Chapter 8
Terrestrial Biological Resources

8.1 Introduction

This chapter describes the environmental setting for terrestrial biological resources and the regulatory background associated with these resources. It also evaluates environmental impacts on terrestrial biological resources that could result from the Lower San Joaquin River (LSJR) alternatives, the significance of any impacts, and, if applicable, offers mitigation measures that would reduce significant impacts. A discussion of aquatic biological species and habitat (e.g., fish and their spawning and rearing areas) is presented in Chapter 7, *Aquatic Biological Resources*.

The Southern Delta Water Quality (SDWQ) alternatives would not affect terrestrial biological resources. As summarized in Section 8.4.2, *Methods and Approach*, the SDWQ alternatives would not result in a change in the water quality at Vernalis and, therefore, would not result in a change from baseline conditions. As discussed in Chapter 5, *Surface Hydrology and Water Quality,* and Appendix F.2, *Evaluation of Historical Flow and Salinity Measurements of the Lower San Joaquin River and Southern Delta,* it is not expected that salinity within the southern Delta would exceed historical monthly salinity levels, which range between 0.2 deciSiemens per meter (dS/m) (0.134 parts per thousand [ppt]) and 1.2 dS/m, (0.768 ppt), which are levels that terrestrial species can tolerate. As such, the SDWQ alternatives are not expected to result in significant adverse modifications to existing terrestrial habitat or result in impacts on plant and animal species and are not analyzed in detail in this chapter. To comply with specific water quality objectives or the program of implementation under SDWQ Alternatives 2 or 3, construction and operation of different facilities in the southern Delta could occur, which could involve impacts on biological resources. These impacts are evaluated in Chapter 16, *Evaluation of Other Indirect and Additional Actions.*

As described in Chapter 1, *Introduction*, the plan area generally includes those portions of the San Joaquin River (SJR) Basin that drain to, divert water from, or otherwise obtain beneficial use (e.g., surface water supplies) from the three eastside tributaries[1] of the LSJR. These include the Stanislaus River from and including New Melones Dam and Reservoir to its confluence with the LSJR; the Tuolumne River from and including New Don Pedro Dam and Reservoir to its confluence with the LSJR; the Merced River from and including New Exchequer Dam and Lake McClure to its confluence with the LSJR; and, the SJR between its confluence with the Merced River and downstream to Vernalis (i.e., LSJR). Within the plan area, there is a designated area of potential effects for terrestrial biological resources (including riparian habitats) for the LSJR alternatives. For the three large reservoirs, this area of potential effects is defined as the *zone of fluctuation*. While the smaller reservoirs that exist downstream of the rim dams[2] also contain habitat for terrestrial biological resources, including wetland and riparian habitat, the LSJR alternatives are not expected to adversely affect those waterbodies as they are used to regulate flows released from the upstream

[1] In this document, the term *three eastside tributaries* refers to the Stanislaus, Tuolumne, and Merced Rivers.

[2] In this document, the term *rim dams* is used when referencing the three major dams and reservoirs on each of the eastside tributaries: New Melones Dam and Reservoir on the Stanislaus River; New Don Pedro Dam and Reservoir on the Tuolumne River; and New Exchequer Dam and Lake McClure on the Merced River.

dams and would release any increased flow downstream. For the three eastside tributaries and the LSJR, the area of potential effects includes the areas adjacent to these channels that are affected by the existing flows or the flows that would result from the LSJR alternatives (e.g., riparian vegetation). This area includes the bankfull channel below the floodplain and the inundated areas adjacent to the main channel. Within the plan area, there is also an area of potential indirect effects for terrestrial biological resources. This area of potential indirect effects includes undeveloped and agricultural areas outside of riparian and reservoir areas since this area could experience potential changes in agricultural uses or land cover as a result of potential reduced irrigation water supply.

The extended plan area, also described in Chapter 1, generally includes the area upstream of the rim dams. The area of potential effects for this area is similar to that of the plan area and includes the zone of fluctuation around the numerous reservoirs that store water on the Stanislaus and Tuolumne Rivers. (The Merced River does not have substantial upstream reservoirs that would be affected.) It also includes the upper reaches of the Stanislaus, Tuolumne, and Merced Rivers. Unless otherwise noted, all discussion in this chapter refers to the plan area. Where appropriate, the extended plan area is specifically identified.

In Appendix B, *State Water Board's Environmental Checklist*, the State Water Resources Control Board (State Water Board) determined whether the plan amendments[3] would cause any adverse impact for each environmental category in the checklist in Appendix B and provided a brief explanation for its determination. Impacts that are listed as "Potentially Significant Impacts" are discussed in detail in this chapter. In addition, as discussed in Appendix B, the State Water Board determined that additional types of potential adverse impacts that are not listed in the checklist should be evaluated. Accordingly, this chapter evaluates potential impacts not initially listed in the checklist, but that have been identified in this chapter as potentially significant. Specifically, whether the LSJR alternatives could have a substantial adverse effect on native terrestrial species by increasing the distribution and abundance of invasive plants and nonnative wildlife species in the plan area. Appendix B identified the LSJR alternatives as having a potentially significant impact on aquatic biological resources and terrestrial biological resources because changes in flow requirements may result in changes in river volume or rates, or reservoir water surface elevation fluctuations and may have indirect effects associated with potential changes in agricultural uses or land cover. The potential impacts on terrestrial biological resources are described in this chapter, whereas the potential impacts on aquatic biological resources are discussed in Chapter 7.

LSJR Alternatives 2, 3, and 4 could affect reservoir operations in the Stanislaus, Tuolumne, and Merced Rivers and, therefore, changes in the flows in each of these tributaries, the LSJR, and Delta, resulting in potential impacts on terrestrial biological resources. The comparison of monthly cumulative distributions of flows, in conjunction with the individual monthly average changes in flow, provides an appropriate measure of hydrologic changes resulting from the LSJR alternatives. For the three large reservoirs, the rates of reservoir fluctuations from month to month are compared between baseline and the LSJR alternatives. This information is then used to evaluate the expected type of terrestrial habitat conditions under baseline and LSJR alternative conditions.

The potential impacts of the LSJR alternatives on terrestrial biological resources are summarized in Table 8-1. As described in Chapter 3, *Alternatives Description*, LSJR Alternatives 2, 3 and 4 each include four methods of adaptive implementation. This recirculated substitute environmental

[3] These plan amendments are the *project* as defined in State CEQA Guidelines, Section 15378.

document (SED) provides an analysis with and without adaptive implementation because the frequency, duration, and extent to which each adaptive implementation method would be used, if at all, within a year or between years under each LSJR alternative is unknown. The analysis, therefore, discloses the full range of impacts that could occur under an LSJR alternative, from no adaptive implementation to full adaptive implementation. As such, Table 8-1 summarizes impact determinations with and without adaptive implementation.

Impacts related to the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1) are presented in Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* and the supporting technical analysis is presented in Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1)*. Chapter 16, *Evaluation of Other Indirect and Additional Actions,* includes discussion of impacts related to actions and methods of compliance.

Table 8-1. Summary of Terrestrial Biological Resources Impact Determinations

Alternative	Summary of Impact(s)	Impact Determination without Adaptive Implementation	Impact Determination with Adaptive Implementation[a]
Impact BIO-1: Have a substantial adverse effect on any riparian habitat or other sensitive natural terrestrial communities identified in local or regional plans, policies, or regulations or by the California Department of Fish and Wildlife (CDFW) or United States Fish and Wildlife Service (USFWS)			
No Project Alternative (LSJR/SDWQ Alternative 1)	See note.[b]	Significant	NA
LSJR Alternatives 2, 3, and 4	The change in median monthly flows or overall cumulative distribution of flows on the Stanislaus, Tuolumne, and Merced Rivers and the LSJR would not substantially effect riparian habitat or other sensitive terrestrial communities because the plants located within the area of potential effects can survive inundation, are resistant to the effects of scouring and deposition, and are limited by water availability. Fluctuations in reservoir elevations would not be substantially different than those that currently occur. Therefore, the LSJR alternatives would not have significant adverse effects on riparian or wetland habitats or other sensitive terrestrial communities around the reservoirs.	Less than significant	Less than significant
Impact BIO-2: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrologic interruption, or other means			
No Project Alternative (LSJR/SDWQ Alternative 1)	See note.[b]	Significant	NA
LSJR Alternatives 2, 3, and 4	Monthly median flows or the cumulative distribution of flows on the Stanislaus, Tuolumne, and Merced Rivers and the LSJR would generally increase. Increased flow would not adversely affect wetland communities because wetland plants can survive inundation, are resistant to the effects of scouring and deposition, and are growth-limited by water availability. Little change is expected in the frequency and range in water level fluctuation in the reservoirs as a result of the LSJR Alternatives 2, 3, and 4, therefore adverse effects are not expected to occur on wetland communities surrounding the reservoirs. Therefore, substantial adverse effects on wetland communities would not occur.	Less than significant	Less than significant

Alternative	Summary of Impact(s)	Impact Determination without Adaptive Implementation	Impact Determination with Adaptive Implementation[a]
Impact BIO-3: Facilitate a substantial increase in distribution and abundance of invasive plants or nonnative wildlife that would have a substantial adverse effect on native terrestrial species			
No Project Alternative (LSJR/SDWQ Alternative 1)	See note. [b]	Less than significant	NA
LSJR Alternatives 2, 3, and 4	Changes in flows in the LSJR and the three eastside tributaries and fluctuations in reservoir elevations may result in alteration of vegetation patterns in specific locations, but there is no basis to suggest increased flows would substantially increase the distribution and abundance of invasive plant species. Little change is expected in the frequency and range in water level fluctuation in the reservoirs as a result of the LSJR Alternatives 2, 3, and 4. In addition, the potential for invasive plants and nonnative wildlife species to increase due to a reduction in irrigation water supply availability or potential fallowing would not be expected to exceed existing levels because some agricultural lands would be farmed less intensively, fallowed lands can retain growth, and existing invasive species programs would continue to be implemented. Therefore, an increase in the distribution and abundance of invasive plants or nonnative wildlife is not expected to result from implementation of the LSJR alternatives.	Less than significant	Less than significant
Impact BIO-4: Have a substantial adverse effect, either directly or through habitat modifications, on any terrestrial animal species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by CDFW or USFWS			
No Project Alternative (LSJR/SDWQ Alternative 1)	See note. [b]	Significant	NA
LSJR Alternatives 2, 3, and 4	Most of the special-status animal species present in the area of potential effects are dependent on riparian habitat. As described above for Impact BIO-1, there would not be a substantial change to available riparian habitat. Similarly, the frequency and range in reservoir elevation fluctuation are not expected to change substantially compared to the baseline conditions, consequently, adverse effects are not expected to occur to special-status species or their habitat at the reservoirs. A potential reduction in irrigation water supply in the area of potential indirect effects would not have a substantial adverse effect on special status species due to indirect habitat	Less than significant	Less than significant

Alternative	Summary of Impact(s)	Impact Determination without Adaptive Implementation	Impact Determination with Adaptive Implementation[a]
	modification because agricultural land cover would not necessarily be fallowed in perpetuity, as lands could be dryland farmed, deficit irrigated, or rotated. This could result in less agricultural intensive practices on some lands. The resulting halt of mechanized agriculture, pesticide and rodenticide application, and anthropogenic disturbance as a result of less agricultural intensive practices is unlikely to result in a substantial adverse effect on sensitive or special-status species. The potential reduction of monocultural irrigated crops is likely to support the species and ecosystem recovery strategy outlined in the USFWS recovery strategy. Therefore, it is not expected that special-status animal species would be adversely affected.		
Impact BIO-5: Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan or conflict with any local policies or ordinances protecting biological resources			
No Project Alternative (LSJR/SDWQ Alternative 1)	See note. [b]	Significant	NA
LSJR Alternatives 2, 3, and 4	The change in median monthly flows or overall cumulative distribution of flows on the Stanislaus, Tuolumne, and Merced Rivers and the LSJR and changes to the range and/or frequency in reservoir fluctuation would not substantially affect riparian habitat or other sensitive terrestrial communities or the special-status animal species dependent on them (Impact BIO-1and Impact BIO-4). In addition, it is expected that wildlife refuges would continue to receive surface water, as needed, and continue to implement existing water management plans. Therefore, impacts on habitat value would not occur and there would not be a potential to conflict with plans protecting biological resources.	Less than significant	Less than significant

NA = not applicable

[a] Four adaptive implementation methods could occur under the LSJR alternatives, as described in Chapter 3, *Alternatives Description*, and summarized in Section 8.4.2, *Methods and Approach*, of this chapter.

[b] The No Project Alternative (LSJR/SDWQ Alternative 1) would result in continued implementation of flow objectives and salinity objectives established in the 2006 Bay–Delta Plan. See Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative impact discussion, and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative technical analysis.

8.2 Environmental Setting

The Upper SJR flows north through the San Joaquin Valley, a geologic trough between the Coast Ranges to the west and the Sierra Nevada to the east. It is joined by the three eastside tributaries, which convey surface runoff (rain and snow melt) from the Sierra Nevada to the LJSR. The freshwater from the LSJR enters the Delta where it eventually joins the Sacramento River, and the combined rivers flow west through the Carquinez Strait into the San Francisco Bay, along the way mixing with ocean saltwater to create unique and diverse semi-aquatic and terrestrial ecosystems.

Together, the LSJR and the Delta serve as an important habitat to more than 750 animal and plant species (CDFW 2014a). Once a vast system of wetlands and uplands, the LSJR and Delta have been transformed by over 100 years of levee building into a maze of interconnected waterways and low, reclaimed islands (CDFW 2014a). Dams and water diversions have impaired river flow and modified inundation regimes. CDFW (2014a) estimates that less than 10 percent of the historical wetland acreage and less than 2 percent of the historical riparian acreage currently remains in the San Joaquin Valley.

The State Water Board performed a literature review to characterize the terrestrial biological resources in and around the area of potential effects for the LSJR and southern Delta. Information was gathered and reviewed to identify and describe special-status plant and wildlife species that are known to exist, could potentially exist, or historically existed in the area of potential effects. For the purpose of this document, special-status species were defined as follows.

- Species listed, species proposed for listing, or candidates for possible future listing as threatened or endangered under the Endangered Species Act (ESA) (16 U.S.C., § 1531 et seq.) or California Endangered Species Act (CESA). (Fish & G. Code, § 2050 et seq.)
- Plant species designated as rare under the California Native Plant Protection Act. (Fish & G. Code, § 1900 et seq.)
- Plant species considered by the California Native Plant Society (CNPS) to be "rare, threatened, or endangered in California" (Rare Plant Rank 1B and 2).
- Wildlife species considered species of special concern by the California Department of Fish and Wildlife (CDFW) (formerly the California Department of Fish and Game).
- Wildlife species designated as "fully protected species" by CDFW. (Fish & G. Code, §§ 3511, 4700, 5050 and 5515.)

Information on special-status plant and wildlife species was compiled through a review of the following sources.

- CNPS Inventory of Rare and Endangered Plants of California, 2012.
- California Natural Diversity Database (CNDDB), 2011–2012.
- U.S. Fish and Wildlife Service (USFWS) Federal Endangered and Threatened Species Lists for the region, 2011.

8.2.1 LSJR and the Three Eastside Tributaries

This section describes the area of potential effects and the area of potential indirect effects of the LSJR alternatives within the LSJR and the three eastside tributaries on terrestrial resources. Flows would affect vegetation within the immediate area of the rivers and are not expected to affect vegetation or habitat outside the riparian corridor. The area of potential effects includes the channels of the three eastside tributaries to the LSJR and the LJSR, including the areas adjacent to these channels that are affected by the existing flows or the LSJR alternative flows (e.g., riparian vegetation). This includes the bankfull channel below the floodplain (Figures 8-1a and 8-1b). The area of potential indirect effects includes undeveloped and agricultural land cover in the plan area which could experience a reduction in irrigation water supply.

Snowmelt runoff and seasonal rainfall from the Sierra Nevada mountain range are the major sources of water to the SJR and the three eastside tributaries. As a result, peak flows historically occurred in May and June. Natural overbank flooding distributed higher flows outside the main river channel(s) into a complex network of sloughs, which supported large patches of riparian forest and tule marshes. This overland flooding resulted in several thousands of acres of permanent tule marsh and more than 1.5 million acres of seasonally flooded wetlands and native grasslands (CALFED 2000). The natural levees and floodplains formed by these processes supported as many as 2 million acres of large, diverse riparian forests (CDFW 2014a). The LSJR and three eastside tributaries are now largely confined within constructed levees in many locations and bounded by agricultural and urban development. Flows are regulated through dams and water diversions, and floodplain habitats have been fragmented and reduced in size and diversity (USBR 2011a).

Federal, state, and local efforts to preserve existing habitat functions have resulted in the establishment of multiple national wildlife refuges and other wildlife areas, which receive water from the LSJR and the three eastside tributaries. Figure 8-2 shows the location of the national wildlife refuges and the other wildlife areas and Table 8-2 summarizes characteristics of these refuges and areas.

Flow and sediment regulation, through the development of the rim dams and increased water diversions, have been implicated as factors in the decline of riparian communities, both in general and specifically on the LSJR and three eastside tributaries (Capon and Dowe 2006; CDFG 2007; TID and MID 2011). Flow regulation has created artificially stable inter- and intra-annual hydrologic conditions, resulting in decreased peak flows, increased summer base flows, and a reduction of physical processes, such as scour and sediment deposition (Stillwater Sciences 2003a). Modified hydrologic and fluvial processes influence riparian vegetation establishment, survival, and succession. The near elimination of large floods and the corresponding scouring flows that remove vegetation have allowed some riparian habitat to mature into dense, even-aged stands, which impoverishes community structure and reduces sapling recruitment (TID and MID 2011; USBR 2011b). Elimination of floods also has allowed riparian scrub and trees to establish themselves in channels and gravel bars, which anchors substrates that typically are rearranged with every high flow event (TID and MID 2011; USBR 2011b). This evolution has contributed to simplification of channel morphology and loss of channel margins (TID and MID 2011).

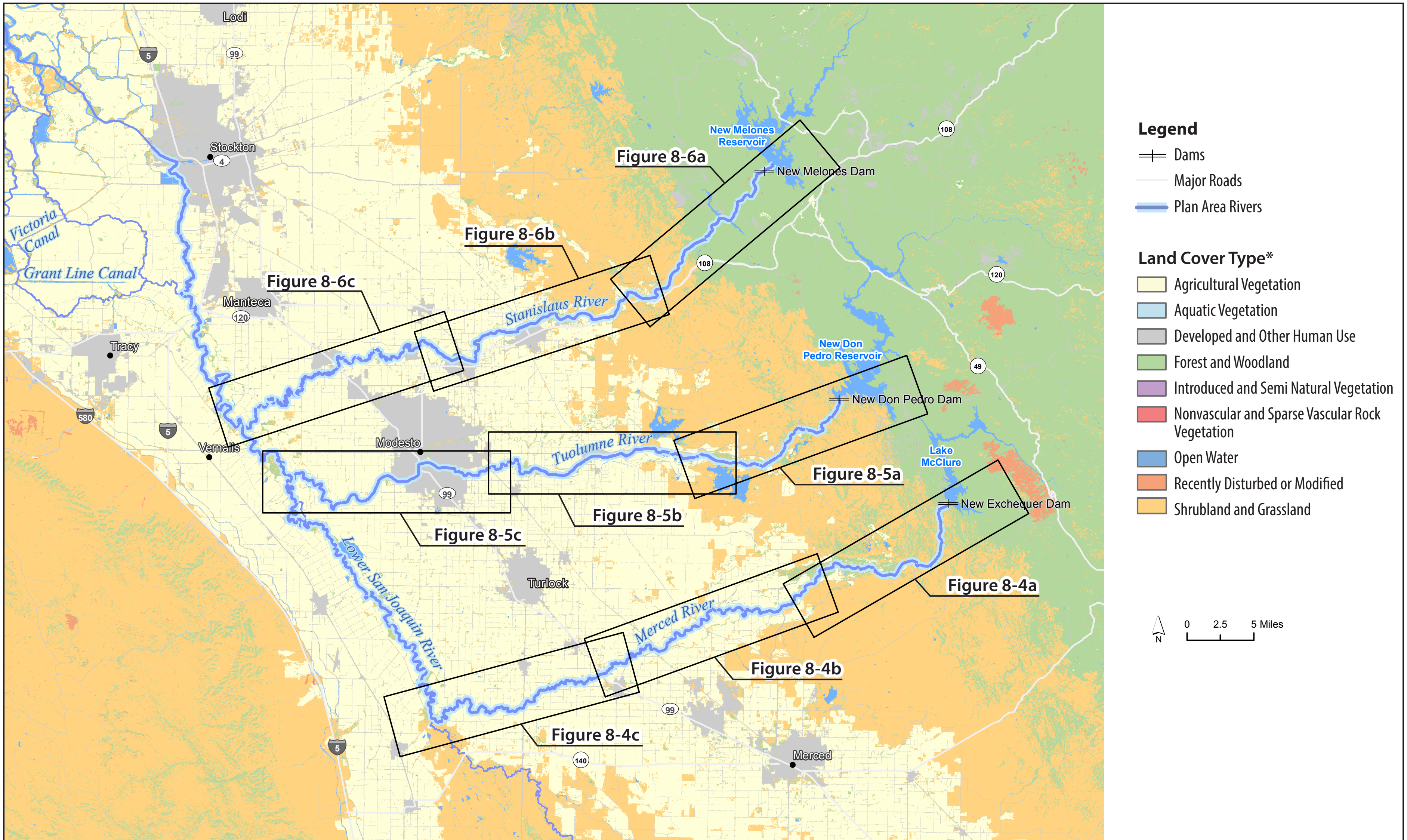
* Land Cover Type Source: USGS Gap Analysis Program: Land Cover, U.S. Department of the Interior U.S. Geological Survey

URL: http://gapanalysis.usgs.gov/index.php

Reservoirs are representative of full-reservoir conditions.

Graphics...00427.11 (3-1-2016)

Figure 8-1a
Lower San Joaquin River Land Cover



* Land Cover Type Source: USGS Gap Analysis Program: Land Cover, U.S. Department of the Interior U.S. Geological Survey

URL: http://gapanalysis.usgs.gov/index.php

Reservoirs are representative of full-reservoir conditions.

Graphics...00427.11 (3-1-2016)

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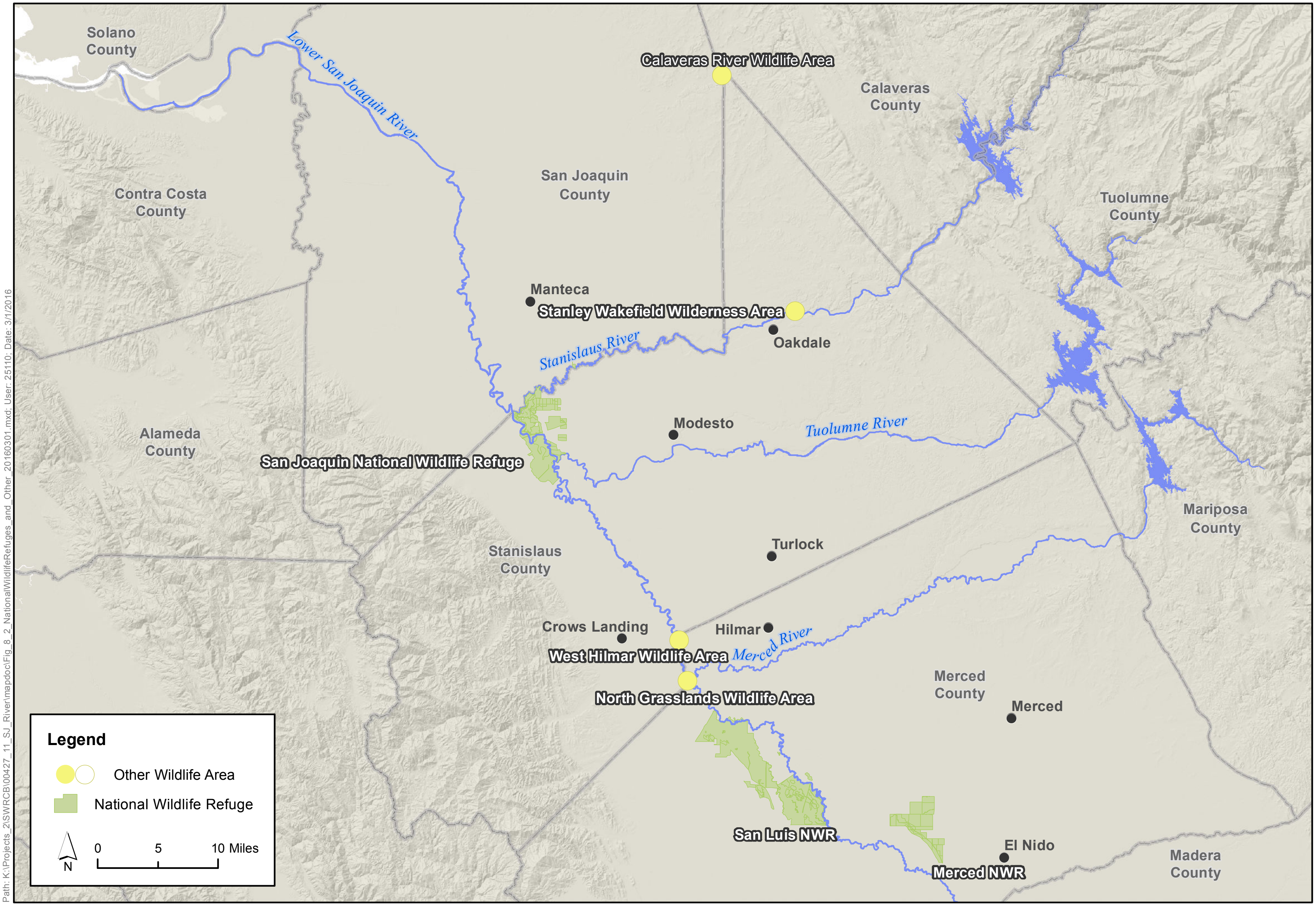
Figure 8-1b
Merced, Tuolumne, and Stanislaus Rivers Land Cover



Path: K:\Projects_2\SWRCB\00427_11_SJ_River\mapdoc\Fig_8_2_NationalWildlifeRefuges_and_Other_20160301.mxd; User: 25110; Date: 3/1/2016

Figure 8-2
National Wildlife Refuges and Other Wildlife Areas

Table 8-2. Summary of National Wildlife Refuges and Other Wildlife Areas

Location/ Size (acres[a])	General Characteristics, Including Habitat Types	Identified Wildlife	Surface Water Source(s)	Other Water Source(s) and Information Regarding Water Supply
North Grasslands Wildlife Area				
Merced County (7,400 acres)	Restored and created wetlands, riparian habitat, and uplands. The wildlife area is comprised of three non-contiguous units: (1) China Island Unit (to the east of Newman and Gustine), (2) Salt Slough Unit (Volta), and (3) Gadwall Unit (Los Baños)	Swainson's hawk, Sandhill crane, duck, pheasant, dove.	The China Island Unit receives the majority of its water from USBR and Central California Irrigation District (CCID) cooperative agreements (CDFG 2011a). Specifically, federal L2 and L4[b] contract for 6,967 and 3,483 acre-feet/year (AF/y), respectively (CDFG 2011b). The Salt Slough Unit receives federal L2 and L4 water (6,680 and 3,340 AF/y, respectively) from Grasslands Water District. The Salt Slough Unit also receives water via the following sources: (1) Appropriative (Contract A0145582), 13,500 AF/y, from Salt Slough; (2) Appropriative (Contract A013508) 3 cubic feet per second (cfs) from Salt Slough; and (3) Other, riparian, (Statement S009611), 30 cfs from Salt Slough (CDFG 2011b). Frequently, federal L2 and L4 contracted water cannot be delivered due to maintenance or other issues such as constraints due to mosquito abatement issues (CDFG 2011a). The Gadwell Unit receives water through the Central Valley Project Improvement Act (CVPIA) (Central Valley Joint Venture 2006).	The China Island and Salt Slough Units have groundwater wells, which provide a valuable source of water during drought periods (CDFG 2011a, 2011b). Although, these wells do not meet all water needs of refuge, policies are in place to support pooling of water supplies,[c] water transfers, water reallocations or exchanges of water to meet the needs of these wildlife areas (CDFG 2011a and 2011b). The Gadwall Unit has a groundwater well (USBR 2014 and USBR 2105a).
Stanley Wakefield Wilderness Area				
Stanislaus County (14 acres)	Kerr Community Park	Unknown recorded wildlife	There is no record of water rights or statements that serve this wildlife area (State Water Board 2016). As such, this refuge is likely served by available water in the Stanislaus River.	Assumed no other water supply besides Stanislaus River.

Location/ Size (acres[a])	General Characteristics, Including Habitat Types	Identified Wildlife	Surface Water Source(s)	Other Water Source(s) and Information Regarding Water Supply
West Hilmar Wildlife Area				
Merced County (340 acres)	Oak and cottonwood woodlands and grasslands	Great blue heron, egret, waterfowl, quail, and pheasant	There is no record of water rights or statements that serve this wildlife area (State Water Board 2016). As such, this refuge is likely served by available water in the LSJR.	Assumed no other water supply besides the LSJR.
Calaveras River Wildlife Area				
San Joaquin County (24 acres)	Lower Calaveras-Mormon Slough Watershed unknown	Unknown recorded wildlife	There is no record of water rights or statements that serve this wildlife area (State Water Board 2016). As such, this refuge is likely served by available water in the river. Conservation easement held by CDFW.	Assumed no other water supply besides river.
San Joaquin River National Wildlife Refuge				
Stanislaus and San Joaquin Counties (7,000 acres)	Riparian woodlands, wetlands, grasslands, cropland, irrigated pasture, fallow, and vernal pools	Swainson's hawk, heron, cormorant, and riparian brush rabbit	San Joaquin River National Wildlife Refuge has two appropriative rights and one riparian right. These rights supplied water to the portion of the refuge purchased from El Soyo Dairy. There are also one appropriative and three riparian rights on lands within the refuge boundary that are not owned by USFWS. Modesto Irrigation District (MID) supplies water to the western portions of the refuge. Water used east of the SJR is provided by the privately owned Mapes Ranch. (USFWS 2006.) A total of 19,440 AF/y is needed for the refuge (USFWS 2006). This refuge does not receive CVPIA/Central Valley Project (CVP) water (USFWS 2006).	Groundwater wells are present on the refuge (USFWS 2006).

Location/ Size (acres[a])	General Characteristics, Including Habitat Types	Identified Wildlife	Surface Water Source(s)	Other Water Source(s) and Information Regarding Water Supply
Merced National Wildlife Refuge				
Merced County (10,000 acres)	Over 150 individual wetland units or ponds are managed and contain wetlands, native grasslands, vernal pools, and riparian areas. The refuge is comprised of the following three units: (1) Merced Unit, (2) Arena Plains Unit, and (3) Snobird Unit	Sandhill crane, migratory waterfowl, Swainson's hawk, tricolored blackbird, burrowing owl, marsh wren, coyote, ground squirrel, desert cottontail rabbit, beaver, long tailed weasel, fairy shrimp, tadpole shrimp, and tiger salamander	The refuge receives approximately 16,000 AF/y of federal L2 water from the Merced Irrigation District (Merced ID) (USFWS 2010a). The refuge has an appropriative right for approximately 3,000 AF/y from Deadman Slough during the winter and spring, and approximately 350 AF/y during the spring and summer from Duck Slough (USFWS 2010a). The refuge receives floodwater/tailwater from Deadman Slough and Mariposa Creek/Eastside Bypass when available (USFWS 2010a). Under the "Exceptional Drought" conditions of 2015, the Merced National Wildlife Refuge received 50% or less of normal water allotments (USFWS 2016).	Groundwater wells are present on the refuge (USFWS 2010a). Drainage water is accepted from Merced ID (USFWS 2010a). The refuge follows the policies and procedures on pooling, transfers, reallocations, and exchanges for those established by the CVPIA and in water supply contracts.
San Luis National Wildlife Refuge				
Merced County (29,000 acres)	Wetlands, riparian forests, native grasslands, vernal pools, and uplands (irrigated pasture, croplands, non-irrigated pasture). The refuge is comprised of the following three areas: (1) East of Highway 165, (2) East Bear Creek, and (3) West of Highway 165	California tiger salamander, long-horned fairy shrimp, San Joaquin kit foxes, Tule Elk, green-winged teals northern shoveler, mallard, gadwall, wigeons cinnamon teal, northern pintail, ring-necked duck, canvasback, ruddy duck, snow goose, Ross' goose, white-fronted goose, coot, grebe, blackbird, bittern, dunlin, long-billed dowitcher, least sandpiper, western	The refuge receives federal L2 and L4 water from the San Luis Canal Company, Stevenson Water District, Merced ID, and Grasslands Water District (USFWS 2010b). The L2 water totals approximately 50,000 AF/y, depending on the water suppliers and contracts. The L4 water totals approximately 8,000 AF/y depending on availability from Grasslands Water District (USFWS 2010b). The refuge also has an appropriative right to approximately 20,000 AF/y from Salt Slough (USFWS 2010b). The refuge has floodwater-passive riparian rights from the SJR, and a riparian diversion from Bear Creek, as available (USFWS 2010b). Under the "Exceptional Drought" conditions of 2015, San Luis National Wildlife Refuge received 50 percent or less of normal water allotments (USFWS 2016).	Appropriative sources, groundwater and drainwater provide most of the water supply used to manage the wetlands before CVPIA (L2 and L4 water) became available (USFWS 2010b). Drainage water is accepted from various sources (USFWS 2010a). The refuge follows the policies and procedures on pooling, transfers, reallocations, and exchanges for those established by the CVPIA and in water

Location/ Size (acres[a])	General Characteristics, Including Habitat Types	Identified Wildlife	Surface Water Source(s)	Other Water Source(s) and Information Regarding Water Supply
		sandpiper, long-billed curlew, heron, white-faced ibis, coyote, desert cottontail rabbit, ground squirrel, western meadowlark, yellow-billed magpie, loggerhead shrike, northern harrier, and white-tailed kite		supply contracts. Groundwater wells are present on the refuge (USFWS 2010b).

Sources: CDFG 2011a; CDFG 2011b; USBR 2014; USBR 2015a; Central Valley Joint Venture 2006; State Water Board 2016;; USFWS 2006; USFWS 2010a; USFWS 2010b; USFWS 2016.

AF/y = acre-feet per year
CCID = Central California Irrigation District
cfs = cubic feet per second
CVP = Central Valley Project
CVPIA = Central Valley Project Improvement Act
Merced ID = Merced Irrigation District
MID = Modesto Irrigation District
USBR = U. S. Bureau of Reclamation
USFWS = U.S. Fish and Wildlife Service

[a] Acreages are approximate.

[b] The CVPIA is described in greater detail in Section 8.3.1 *Federal [Regulatory Background]* and refers to two types of refuge water deliveries, Level 2 (L2) and Level 4 (L4). L2 represents the average annual historical water supplies received by land designated for refuges between 1975 and 1984 and L4 identifies the water supplies needed by refuges for the development of full habitat benefits. L2 water is provided primarily from CVP water supplies (USBR. 2014).

[c] Whenever maximum quantities of L2 Water Supplies and/or the Incremental L4 water supplies in a USBR contract (in the case of China Island Unit Contract #01-WC-20-1756 Exhibit B) are reduced, the remaining L2 and/or Incremental L4 Water Supplies may be pooled for use on other refugees following established rules (CDFG 2011a).

Potentially Affected Habitats

Much of the native vegetation in terrestrial habitats along the LSJR and the three eastside tributaries has been replaced by introduced species or is disturbed by cultivation, grazing, and development. The spatial extent of the river floodplains has been reduced by water management (CDFG 2007; USBR 2011b). Despite the loss of habitat associated with these activities, the rivers are generally flanked by a ribbon of riparian and wetland habitats. There is also some riparian habitat and small areas of wetland habitat around the edges of the three large reservoirs on the three eastside tributaries.

A spatial query of the CNDDB reported the following special-status habitats to be within approximately 1,000 feet (ft) of the area of potential effects: coastal and valley freshwater marsh, great valley cottonwood riparian forest, great valley mixed riparian forest, great valley oak riparian forest, and elderberry savanna. Although not reported by the CNDDB within or near the area of potential effects, other sensitive habitats in the vicinity include northern claypan and other vernal pool types, valley needlegrass grassland, serpentine bunchgrass, valley sacaton grassland, alkali flats and playas, and chenopod scrub (State Water Board 1999; CDFG 2012).

ESA defines *critical habitat* for threatened or endangered species as specific geographic areas that contain features essential for the conservation of the species and that may require special management and protection. (16 U.S.C., § 1532(5)(A).) No federally designated critical habitat is within the area of potential effects for the LSJR or SDWQ alternatives (i.e., channels). Outside the area of potential effects (areas adjacent to the main channel) on the Stanislaus and Tuolumne Rivers, are critical habitat areas designated for the California tiger salamander (*Ambystoma californiense*). There is also critical habitat designated outside the area of potential effects on the Merced River for San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*) (USFWS 2012).

The following sections describe the major vegetation communities and types of land cover in the area of potential effects. Figures 8-3, 8-4, 8-5 and 8-6 show major vegetation communities in the area of potential effect for each river. Near the water bodies, habitats are dynamic and constantly shifting in response to environmental factors, such as water chemistry and water availability. Riparian plants possess adaptations that reduce physiological stress and damage when submerged or completely exposed, such as during droughts or reservoir drawdown (Braendle and Crawford 1999; Karrenberg et al. 2002). Capon and Dowe (2006) explain:

> Plants persisting in riparian habitats usually exhibit adaptations that allow them to survive through periodic episodes of fluvial disturbance. These can be either physiological or morphological adaptations, through which plants tolerate flooding as mature individuals, or life history adaptations that enable plants to tolerate the stresses associated with flooding in time or space. . . . Furthermore, this vegetation type exists in locations that already experience wide fluctuations in water availability and wave erosion.

Riparian Forest

The term *riparian*, as used herein, applies to the vegetation zone and other biological resources contiguous to, and affected by, surface and subsurface hydrologic features of perennial or ephemeral rivers and streams or artificial drainage ways. Riparian forests depend on a shallow groundwater table and can survive brief periods of flooding. The nature of San Joaquin Valley riparian zones is dynamic and was historically driven by annual flooding and long summer drought. Annual flooding established a frequent disturbance regime via floodplain inundation, scour, and sediment deposition

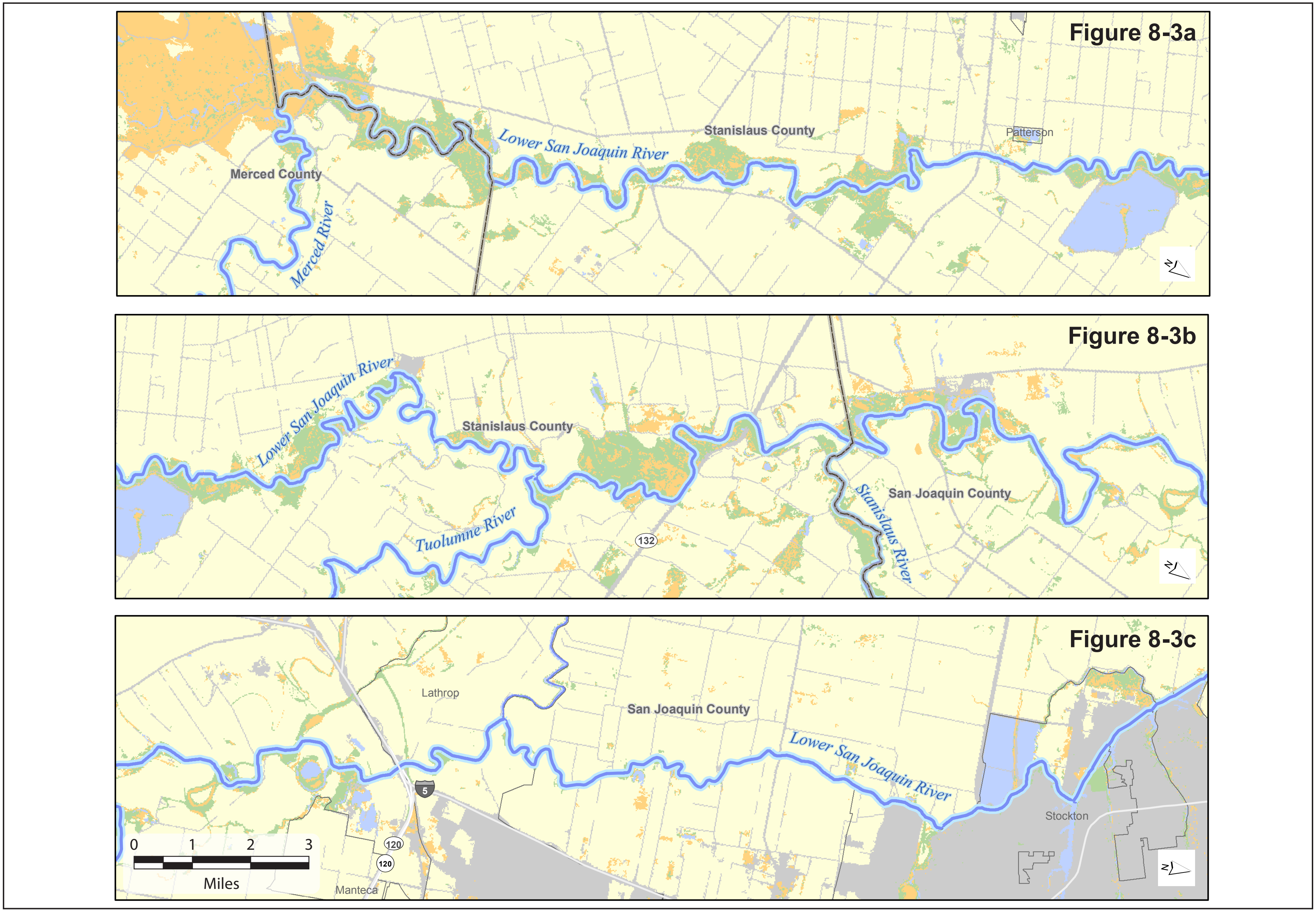
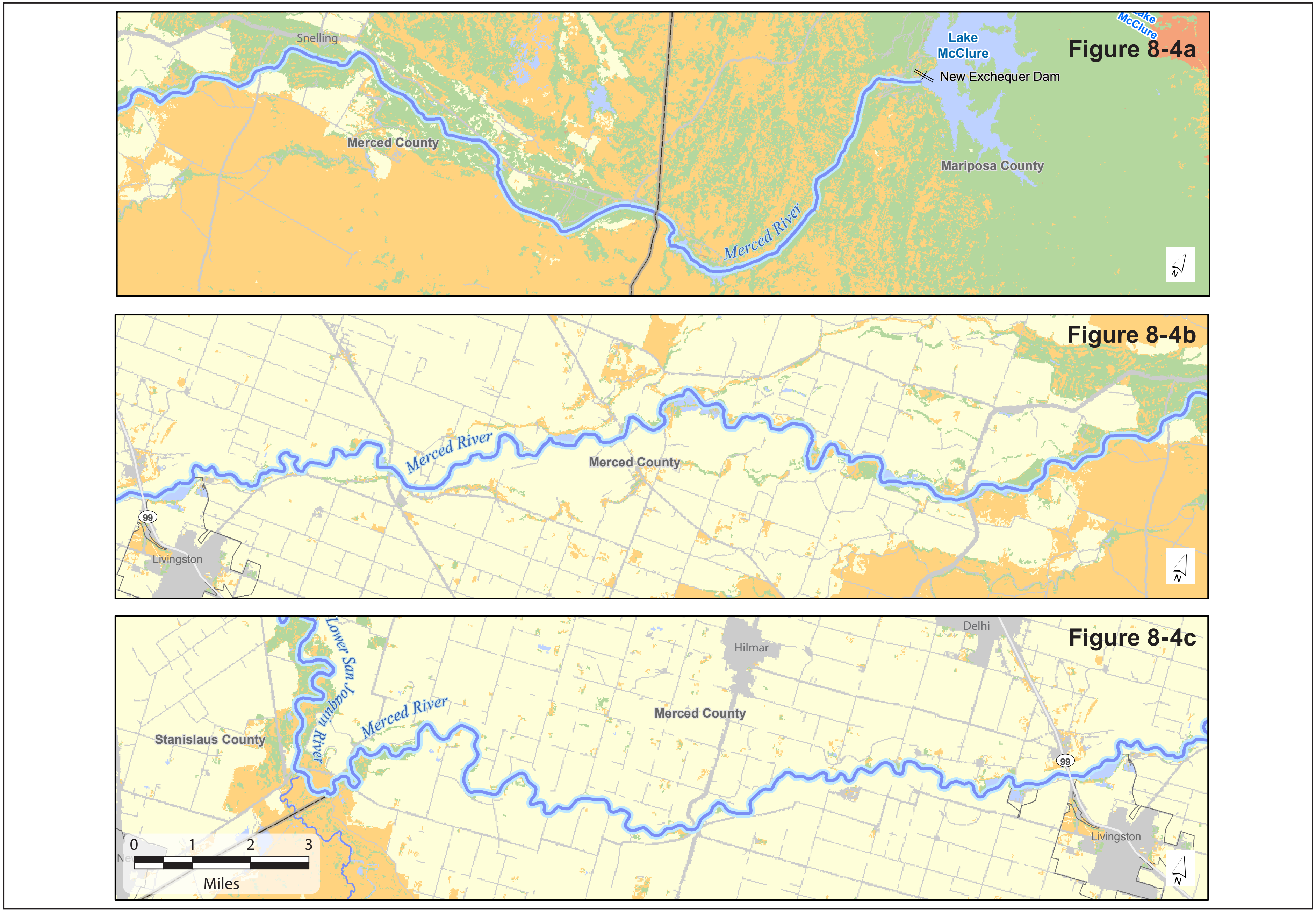


Figure 8-3
Lower San Joaquin River Vegetation Communities



Graphics...00427.11 (3-2-2016)

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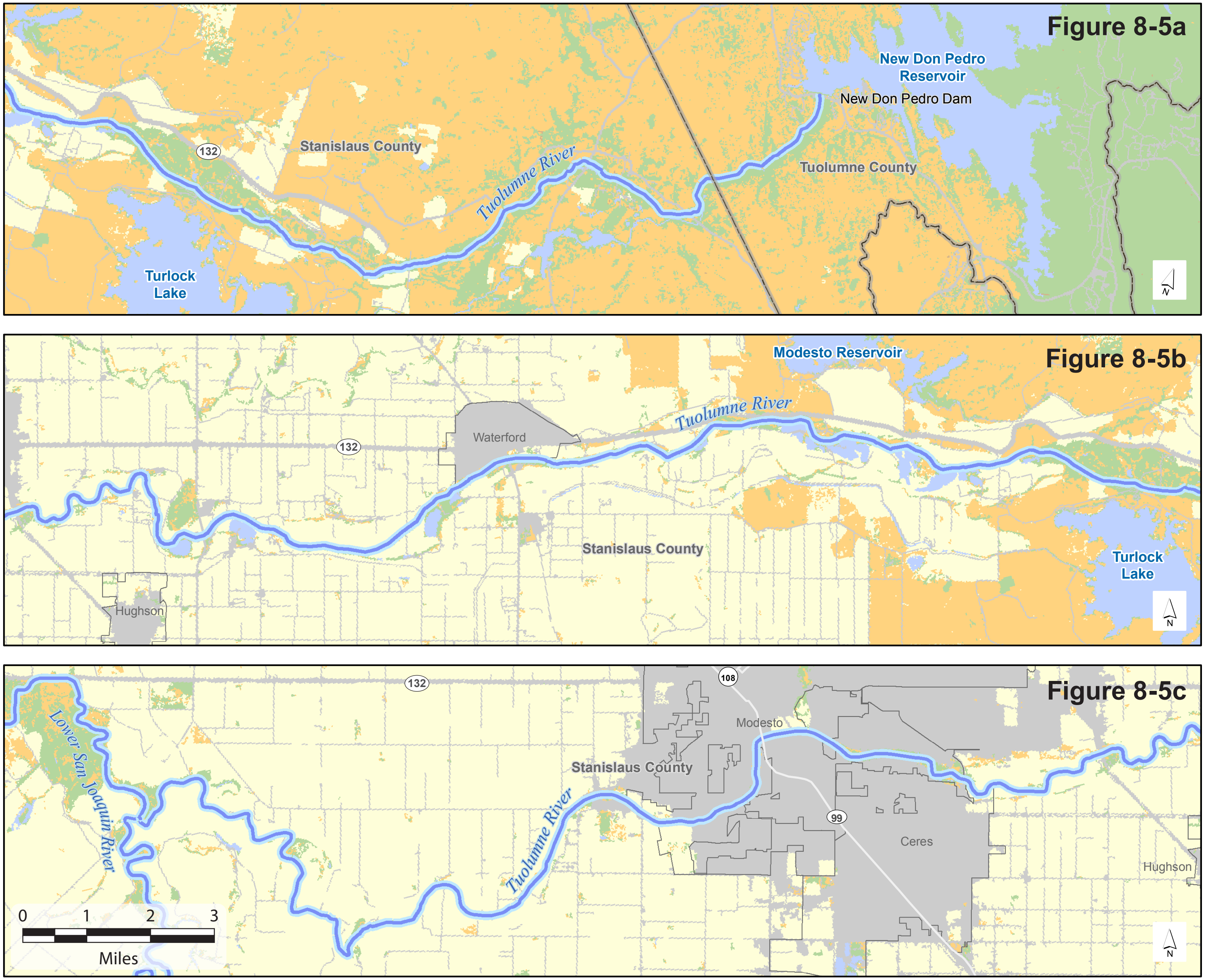
Figure 8-4
Merced River Vegetation Communities



Graphics...00427.11 (3-2-2016)

Figure 8-5
Tuolumne River Vegetation Communities

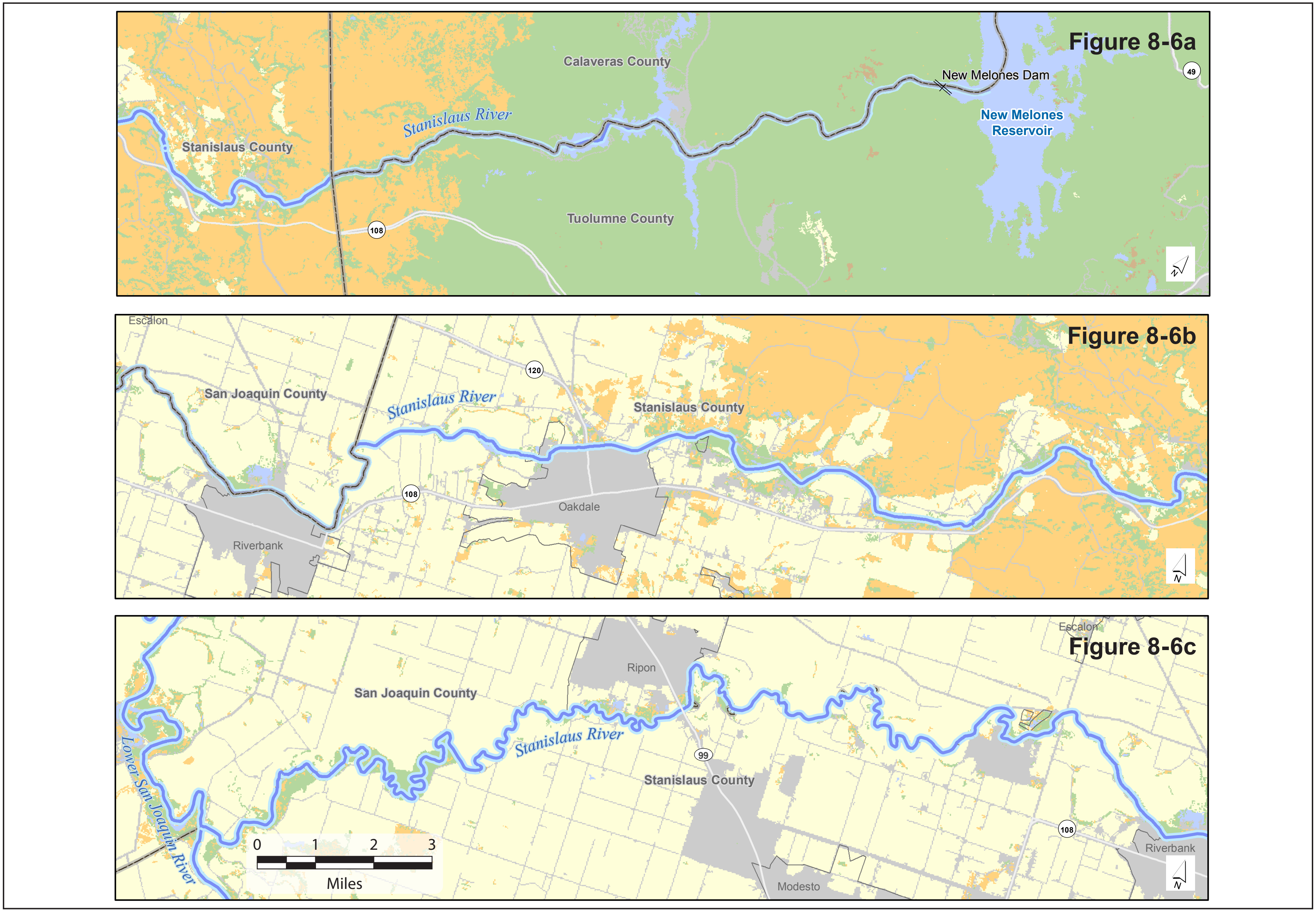


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Figure 8-6
Stanislaus River Vegetation Communities

that maintained vegetation recruitment, survival, and mortality while water availability during summer drought limited riparian species distribution. This cycle of flooding and drought is especially significant to pioneer woody plant species, primarily willows (*Salix* spp.) and cottonwoods (*Populus* spp.), which rely on floods for bare seed beds, water, and nutrients, and which grow roots quickly to reach permanent water tables and a secure bank footing to resist subsequent floods (Stillwater Sciences 2003a).

Regeneration statistics are not available for riparian vegetation in California, but increased spring flows are believed to generally support the growth and dispersal of these species (CDFW 2014a). An analysis of historical data conducted in 2006 suggests that Fremont cottonwood (*Populus fremontii*) seed release coincided with peak runoff in almost all years, whereas Goodding's black willow (*Salix gooddingii*) and narrow-leaf willow (*Salix exigua*) seed dispersals typically took place during the spring flood recession after peak runoff (TID and MID 2011).

Riparian habitat has been significantly reduced by stream channelization, riprapping of stream banks, altered hydraulics, livestock grazing, and direct loss of habitat to agriculture and urban development (Riparian Habitat Joint Venture 2004; Moyle and Bennett 2008). As a result, wildlife corridors are narrow, riparian habitats are fragmented, stream temperatures have increased, channel variability has decreased, and little or no regeneration of riparian vegetation is occurring at many sites (Moyle and Bennett 2008; USBR 2011b).

Riparian forest is a broad vegetation category from which at least four major subtypes can be differentiated in the area of potential effects based on the dominant species: cottonwood riparian forest, willow riparian forest, mixed riparian forest, and valley oak riparian forest (Moise and Hendrickson 2002; Sawyer et al. 2009; USBR 2011b).

Cottonwood riparian forest is a multilayered riparian forest found on active, low floodplains. Common dominant trees in the overstory include Fremont cottonwood and Goodding's black willow (Sawyer et al. 2009). The midstory consists of shade-tolerant shrubs and trees, such as Oregon ash (*Fraxinus latifolia*) and California box elder (*Acer negundo*); California wild grape (*Vitis californica*) is also common. The understory typically is dominated by native grasses and forbs, such as stinging nettle (*Urtica dioica*) and sedges (*Carex* spp.)(Sawyer et al. 2009).

Willow riparian forest is dominated by black willow, but red willow (*Salix laevigata*) and arroyo willow (*S. lasiolepis*) are also common. Occasional scattered cottonwoods, ashes, or white alders (*Alnus rhombifolia*) may be present. Cover is generally dense. California buttonbush (*Cephalanthus occidentalis*) is often present (Sawyer et al. 2009).

Mixed riparian forest is a multilayered, winter-deciduous forest generally found on the intermediate terrace of the floodplain of the LSJR and the three eastside tributaries. Species dominance varies by environmental conditions, but typical dominants include Fremont cottonwood, box elder, Goodding's black willow, Oregon ash, and western sycamore (*Platanus racemosa*). Immediately along the water's edge, white alder may be found. The understory of mixed riparian forest is similar to that of cottonwood riparian forest (Sawyer et al. 2009).

Valley oak riparian forest varies from an open- to a closed-canopy habitat. This forest type is found on the higher portions of the floodplain. Besides valley oak (*Quercus lobata*), California sycamore, Oregon ash, and Fremont cottonwood are present. Common understory species are the California wild rose (*Rosa californica*), blackberry (*Rubus armeniacus* and *R. ursinus*), and California wild grape (Sawyer et al. 2009; USBR 2011b).

Riparian forests provide high-quality nesting habitat for raptors, such as red-tailed hawk (*Buteo jamaicenesis*), red-shouldered hawk (*B. lineatus*), Swainson's hawk (*B. swainsoni*), and white-tailed kite (*Elanus leucurus*). Riparian forest trees also provide nesting habitat for cavity-nesting species, such as downy woodpecker (*Picoides pubescens*), wood duck (*Aix sponsa*), northern flicker (*Colaptes auratus*), ash-throated flycatcher (*Myiarchus cinerascens*), oak titmouse (*Baeolophus inornatus*), tree swallow (*Tachycineta bicolor*), and white-breasted nuthatch (*Sitta carolinensis*). Riparian forests support large populations of insects that are prey for migratory and resident birds, including Pacific-slope flycatcher (*Empidonax difficilis*), western wood-pewee (*Contopus sordidulus*), olive-sided flycatcher (*C. cooperi*), warbling vireo (*Vireo gilvus*), orange-crowned warbler (*Vermivora celata*), yellow warbler (*Dendroica petechia*), Bullock's oriole (*Icterus bullockii*), and spotted towhee (*Pipilo maculatus*). Mammal species using riparian forests include coyote (*Canis latrans*), beaver (*Castor canadensis*), river otter (*Lontra canadensis*), raccoon (*Procyon lotor*), desert cottontail (*Sylvilagus audobonii*), and striped skunk (*Mephitis mephitis*) (USBR 2011b).

Scrub

Scrub habitat present in the area of potential effects includes willow scrub, riparian scrub, and elderberry savanna (Moise and Hendrickson 2002).

Willow scrub is a dense assemblage of shrubs found on riverbanks, in active channels subject to scouring flows, and especially on sand and gravel point bars immediately above the active river channels. Willows may survive three consecutive months of inundation (USBR 2011b). Dominant shrubs in willow scrub include sandbar willow (*Salix exigua*), arroyo willow, and red willow, although riparian trees such as Fremont cottonwood may also be present (Sawyer et al. 2009; USBR 2011b).

Riparian scrub consists of woody shrubs and herbaceous species. Depending on site conditions, some areas are dominated by mugwort (*Artemisia douglasiana*) and stinging nettle and various tall weedy herbs; others are dominated by blackberry or wild rose in dense thickets, sometimes with emergent willows. Such scrub associations may be maintained by periodic disturbance from fire or flood.

Elderberry savanna is typically found on floodplains (outside active channels), and is characterized by widely spaced blue elderberry shrubs (*Sambucus mexicana*) interspersed among nonnative grasses and forbs (Sawyer et al. 2009; USBR 2011b).

Bird species common to scrub habitat include various wrens (*Troglodytes* and *Thryomanes*), western wood-pewee, black phoebe (*Sayornis nigricans*), yellow-billed magpie (*Pica nuttalli*), bushtit (*Psaltriparus minimus*), buntings (*Passerina* spp.), tanagers (*Piranga* spp.), and American goldfinch (*Carduelis tristis*) (Sibley 2003; USBR 2011b). Animal species using scrub habitats are similar to those described for riparian forest habitats above, but may contain a wider variety of species, such as reptiles, because there is greater habitat diversity (USBR 2011b).

Emergent Wetlands

Emergent wetlands typically occur in the river bed adjacent to the low-flow river channels (Sawyer et al. 2009; USBR 2011b). Backwaters and sloughs support emergent marsh vegetation such as common tule (*Schoenoplectus acutus*), sedges (*Carex* spp.) and cattails (*Typha* spp.). Marsh species require shallow, periodic flooding of muddy benches and backwater areas. More ephemeral wetlands support an array of native and nonnative herbaceous species, including western goldenrod (*Euthamia occidentalis*), smartweed (*Polygonum* spp.), rushes (*Juncus* spp.), and dock (*Rumex* spp.).

Emergent wetlands support a wide variety of wildlife, including sparrows (*Melospiza* spp.), common yellowthroat (*Geothlypis trichas*), wrens (*Cistothorus*, *Troglodytes*, and *Thryomanes*), and red-winged blackbird (*Agelaius phoeniceus*) (Sibley 2003; USBR 2011b). Mammal species that use this habitat include beaver, voles (*Microtus* spp.), common muskrat (*Ondatra zibethicus*), and Norway rat (*Rattus norvegicus*). Emergent wetlands also sustain a variety of amphibians, especially Pacific chorus frog (*Pseudacris regilla*), American bullfrog (*Rana catesbeiana*) and garter snake (*Thamnophis elegans*) (CDFG 2007; USBR 2011b).

Grassland and Pasture

Grassland and pasture vegetation can exist adjacent to river channels on floodplains or where riparian habitat has been disturbed or converted. These locations are well drained and flood only occasionally. They are typically not connected hydrologically to the LSJR and the three eastside tributaries; therefore, grasslands and pastures are typically outside the area of potential effects affected by flow.

Various assemblages of nonnative annual and perennial grasses are predominating, as well as occasional nonnative and native forbs (Sawyer et al. 2009; USBR 2011b). Native grassland and bunchgrass populations may exist as well but are limited in distribution. Grasslands support a wide variety of bird species, including raptors such as northern harrier (*Circus cyaneus*) and white-tailed kite (*Elanus leucurus*), ring-necked pheasant (*Phasianus colchicus*), mourning dove (*Zenaida macroura*), burrowing owl (*Athene cunicularia*), horned lark (*Eremophila alpestris*), loggerhead shrike (*Lanius ludovicianus*), and sparrows (*Passerculus*, *Spizella*, and *Aimophila*) (Sibley 2003; USBR 2011b). Mammal species that use grasslands include California vole, deer mice (*Peromyscus* spp.), California ground squirrel (*Spermophilus beecheyi*), Botta's pocket gopher (*Thomomys bottae*), desert cottontail (*Sylvilagus audobonii*), striped skunk (*Mephitis mephitis*), American badger (*Taxidea taxus*), fox, and coyote. Common amphibian and reptile species associated with grasslands in the San Joaquin Valley include western toad (*Bufo boreas*), alligator lizard (*Elgaria coerulea*), western fence lizard (*Sceloporus occidentalis*), western racer (*Coluber constrictor*), and gopher snake (*Pituophis catenifer*) (USBR 2011b). There is a very low potential for the LSJR alternatives to affect this type of habitat because it is outside of the river channels and not hydrologically connected.

Agriculture and Other Disturbed Areas

Agricultural lands consist primarily of orchards (citrus, stone fruits), vineyards, and annual crops (cotton, corn, lettuce, strawberries, rice, etc.), and occasionally cattle pasture. Although some land adjacent to the river channels has been developed for agriculture, these locations are typically well drained and flood only occasionally. Cropland can provide food and cover for wildlife species, but the value of the habitat varies greatly with crop type and agricultural practices. Typically, agricultural lands provide low-value habitat for wildlife (CDFG 2007).

Disturbed (ruderal) areas include roads, canals, and levees. As with agricultural habitats, low vegetation cover and low species diversity in disturbed habitats limit their value to wildlife. There is a low potential for the LSJR alternatives to directly affect agriculture and disturbed habitats because they are typically located in upland areas outside of the river channel.

Agricultural lands within the plan area, but outside of areas directly affected by flows or reservoir changes, are considered an area of potential indirect effect. Agricultural practices in this area vary due to numerous considerations including irrigation water availability. Changes could occur to agricultural lands in upland areas throughout the plan area as a result of changes to irrigation water availability. These changes could have potential indirect effects on sensitive species. Currently there are over 600,000 acres of agricultural lands[4] in the plan area (Table 11-2). This land is a mix of various crops and, as such, provides different habitat types and values to wildlife depending on the land cover. Habitat values within this area of potential indirect effects currently fluctuate in response to a number of variables including the type of crop grown on a particular property and different crop mixes on a property and in the area, all of which are influenced by the market and discrete farming decisions and practices. Habitat values are also influenced by common agricultural practices, such as harvesting, spraying, tilling, crop rotation, and fallowing. These activities typically vary within an agricultural season and between years.

Potentially Affected Vegetation

A spatial query of the CNDDB revealed multiple special-status plant species that could occur within potentially affected habitats (CDFG 2012). Most of these species (e.g., *Atriplex* spp.) are associated with habitats such as chenopod scrub, alkali sinks, and vernal pools that by their very nature are isolated from flowing waters. These habitats, although sometimes near active channels, are not hydrologically linked to the channels, and thus the special-status plants that require these habitats would not be affected by the LSJR alternatives. In addition, species associated with grasslands (e.g., big tar plant [*Blepharizonia plumose*]) would generally be located outside of river channels and thus have a very low potential to occur in river channels. Additionally, several species of special-status plants may potentially be found within the area of potential effects (zone of fluctuation) near the edges of the large reservoirs. Table 8-3a shows those vegetation species that could be located within the area of potential effects. Table 8-3b shows those vegetation species that could be located in the area of potential indirect effects.

[4] Includes lands identified as Prime, Unique, Farmland of Statewide Importance, Farmland of Local Importance, and grazing lands.

Table 8-3a. Special-Status Plants with Potential to Occur or Known to Occur within the Area of Potential Effects – LSJR and the Three Eastside Tributaries

Scientific Name	Common Name	Status	Habitat Notes
Eryngium racemosum	Delta button-celery	CE, CNPS 1B.1	Associated with riparian scrub
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	FT, CE	Grows on alluvial fans and stream terraces
Packera layneae	Layne's ragwort	FT, CNPS 1B	Associated with chaparral, cismontane woodland, and serpentine or gabbroic habitat
Clarkia biloba ssp. australis	Mariposa clarkia	CNPS 1B.2	Associated with chaparral and cismontane woodland habitat
Clarkia rostrata	Beaked clcarkia	CNPS 1B.3	Associated with cismontane woodland and valley/ foothill grassland
Lupinus spectabilis	Shaggyhair lupine	CNPS 1B.2	Associated with chaparral, cismontane woodland and serpentine habitat
Githopsis pulchella ssp. *serpentinicola*	Serpentine bluecup	CNPS 4.3	Associated with serpentine or Ione soils in oak woodlands
Eriophyllum confertiflorum var. *tanacetiflorum*	Golden yarrow	CNPS 4.3	Associated with oak woodland habitat
Helianthemum scoparium	Bisbee peak rush rose	CNPS 3.2	Associated with oak woodland habitat
Jepsonia heterondra	Foothill jepsonia	CNPS 4.3	Associated with chaparral habitat
Cryptantha mariposae	Mariposa cryptantha	CNPS 1B.3	Associated with chaparral and serpentine habitat
Verbena californica	California vervain	CNPS 1B FT, ST	Cismontane woodland, valley and foothill grassland, usually serpentine seeps and creeks
Allium tuolumnense	Red Hills onion	CNPS 1B	Associated with serpentine soils and found to occur around New Don Pedro Reservoir

Source: CDFG 2012.
CE = California listed as endangered
CNPS = California Native Plant Society rarity rank
FT = Federally listed as threatened

Table 8-3b. Special-Status Plant Species with Potential to Occur or Known to Occur within the Area of Potential Indirect Effects

Scientific Name	Common Name	Status	Presence in area of potential indirect effects
Brodiaea pallida	Chinese Camp brodiaea	FT, CE	Presumed surviving or in existence
Castilleja campestris var. succulenta	Succulent owl's-clover	FT, CE	Presumed surviving or in existence
Chloropyron palmatum	Palmate-bracted salty bird's-beak	FE, CE	Possibly removed
Eryngium racemosum	Delta button-celery	CE	Presumed surviving or in existence
Euphorbia hooveri	Hoover's spurge	FT	Presumed surviving or in existence
Lilaeopsis masonii	Mason's lilaeopsis	CR	Presumed surviving or in existence
Neostapfia colusana	Colusa grass	FT, CE	Presumed surviving or in existence
Orcuttia inaequalis	San Joaquin Valley Orcutt grass	FT, CE	Removed
Orcuttia pilosa	Hairy Orcutt grass	FE, CE	Removed
Packera layneae	Layne's ragwort	FT, CR	Presumed surviving or in existence
Pseudobahia bahiifolia	Hartweg's golden sunburst	FE, CE	Presumed surviving or in existence
Tuctoria greenei	Greene's tuctoria	FE, CR	Presumed surviving or in existence
Verbena californica	Red Hills vervain	FT, CT	Presumed surviving or in existence

Source: CDFW 2016.
CT = California Listed as Threatened
FT = Federally Listed as Threatened
CE = California Listed as Endangered
FE = Federally Listed as Endangered
CR = California Listed as Rare

Invasive Plants within Potentially Affected Habitats

Invasive plants are species that are not native to the area, generally persist without human assistance, and impact the environment to which they are introduced (Simberloff et al. 1997; USBR 2011b). There are a number of governmental agencies and nongovernmental organizations that have goals to limit or remove invasive species (see Section 8.3.1, *Federal [Regulatory Background]*, and Section 8.3.2, *State [Regulatory Background]*). The term *invasive plant* differs from the classification terms *nonnative*, *exotic*, or *introduced plant* because it describes those nonnative plant species that displace native species on a large enough scale to alter habitat functions and values.

The term *noxious weed* is used by government agencies for invasive nonnative plants that have been defined as pests by law or regulation (CDFG 2007).

Invasive riparian plants, especially giant reed (*Arundo donax*) and salt cedar (*Tamarix* spp.), displace native riparian vegetation and provide lower-quality habitat for native wildlife (CDFG 2007). Invasive plants may not sustain the rich invertebrate communities or provide forage for terrestrial wildlife as effectively as do native riparian plants (CDFG 2007; USBR 2010a). Invasive riparian plants also colonize channel and floodplain surfaces that can alter hydrologic processes and interfere with flood control (Moyle and Bennett 2008; USBR 2010a, 2011b). Removal or control of invasive riparian plants constitutes a substantial investment of capital resources (CDFG 2007; USBR 2010a).

Some of the most prevalent invasive plants in the area of potential effects are: red sesbania (*Sesbania punicea*); salt cedar; giant reed; purple loosestrife (*Lythrum salicaria*); Chinese tallow (*Sapium sebiferum*); tree-of-heaven (*Ailanthus altissima*); Eucalyptus (*Eucalyptus* spp.); pampas grass (*Cortaderia selloana*); fig (*Ficus* spp.); Himalayan blackberry (*Rubus armeniacus*); white mulberry (*Morus alba*); castor bean (*Ricinus communis*); Lombardy poplar (*Populus nigra*); and tree tobacco (*Nicotiana glauca*) (CDFG 2007; USBR 2010a, 2011). Also prevalent in the area of potential effects are emergent and submergent invasive aquatic plants, such as parrot feather, milfoils (*Myriophyllum* spp.), and water primrose (*Ludwigia* spp.); herbaceous weeds, such as thistles (*Centaurea* spp., *Cirsium* spp., *Carduus* spp., etc.); European annual grasses (*Avena* spp., *Cynodon* spp., *Echinochloa* spp., etc.); and numerous forbs that compete with native riparian species for shoreline and low floodplain establishment and growth sites.

Reduction of habitat quality in riparian ecosystems has contributed to the decline of native tree species and opened a niche for invasion by salt cedar in the western United States (Shafroth et al. 1995; Carter and Nippert 2012). In many riparian areas, salt cedar has replaced stands dominated by native Fremont cottonwood, decreasing habitat quality for native species and altering fluvial processes (Shafroth et al. 1995). Smaller peak flows in the river channels as a result of managed flow releases have also reduced leaching of salts from floodplain soils, perhaps favoring the salt-tolerant plants such as salt cedar (Shafroth et al. 1995).

Invasive Plants within Area of Potential Indirect Effects

Invasive plant species occurring within the area of potential indirect effects (all upland agricultural lands outside of river channels and reservoirs) include common herbaceous weeds such as thistles (*Onopordum* spp, *Cirsium spp*, *Carduus* spp, etc.) and knapweed (*Centaurea* spp.). These examples of invasive plant species are typical of those types of species found in and around agricultural lands in the area of potential indirect effects. The California Invasive Plant Council (Cal-IPC) has identified 9 invasive plant species within the South Central Valley region (San Joaquin, Stanislaus, and Merced Counties) for eradication, with an additional 31 species identified for active management (Cal-IPC 2012b). Containment and eradication of invasive plant species on agricultural lands often requires the use of herbicides or mechanical removal

Potentially Affected Wildlife

Historically, the San Joaquin Valley was composed of wetlands, grasslands, broad riparian corridors, scrub, and bunchgrass habitats. The valley supported a diverse assemblage of wildlife species, such as bison, elk, and grizzly bears. However, agricultural, urban, and commercial development have reduced, fragmented, and heavily modified natural habitat on the valley floor. Although few large mammals remain in the San Joaquin Valley, the remnant habitat continues to support a diverse group of vertebrate and invertebrate species (CDFG 2003). Table 8-4a lists the special-status animal species identified by a spatial query of the CNDDB within the area of potential effects (CDFG 2012). Table 8-4b shows those wildlife species that could be located in the area of potential indirect effects, many of which occur adjacent to the river channels.

Table 8-4a. Special-Status Animal Species with Potential to Occur or Known to Occur within the Area of Potential Effects– LSJR and the Three Eastside Tributaries

Scientific Name	Common Name	Status	Habitat Notes
Actinemys marmorata	western pond turtle	CSC	Slack- or slow-water aquatic habitat. Tulloch Reservoir implements a special-species plan. Present around reservoir shoreline at New Don Pedro Reservoir and Lake McClure.
Agelaius tricolor	tricolored blackbird	CSC, MB	Marsh and scrub habitats used for nesting.
Antrozous pallidus	pallid bat	CSC	Grassland, scrub, and forest.
Ardea herodias	great blue heron	CSC, MB	Saltwater and freshwater marshes, sloughs, riverbanks, and reservoirs (lakes). Forages in grasslands and agricultural fields.
Branta hutchinsii leucopareia	Aleutian Canada goose	Delisted, MB	Forages on pastures, harvested fields, and wetlands; roosts on flooded fields and ponds at night.
Buteo swainsoni	Swainson's hawk	CT, MB	Nests in riparian areas.
Calicina breva	Stanislaus harvestman	CSC	Various habitats.
Coccyzus americanus occidentalis	western yellow-billed cuckoo	CE, MB	Uses riparian areas for cover, foraging, and breeding.
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	FT	Dependent on the elderberry shrub, a riparian species.
Egretta thula	snowy egret	CSC, MB	Marshes, swamps, shorelines, mudflats, and ponds.
Haliaeetus leucocephalus	bald eagle	CE, MB	Requires large, old-growth trees or snags in mixed stands near large bodies of water or free-flowing rivers with abundant fish.
Lasiurus blossevillii	western red bat	CSC	Associated with riparian habitat.
Myotis yumanensis	Yuma myotis	CSC	Optimal habitats are open forests and woodlands with sources of water over which to feed.
Neotoma fuscipes riparia	San Joaquin Valley woodrat	FE	Restricted primarily to riparian areas where trees and brush are found.
Pandion haliaetus	Osprey	CSC, MB	Wide range of habitats near water, primarily reservoirs (lakes), rivers, and coastal waters with adequate supplies of fish.
Perognathus inornatus	San Joaquin pocket mouse	CSC	Dependent on riparian forests with dense understory. Present in Caswell Memorial State Park on the Stanislaus River.

Scientific Name	Common Name	Status	Habitat Notes
Rana aurora draytonii	California red-legged frog	FT, CSC	Permanent and semi-permanent aquatic habitats such as creeks and coldwater ponds with emergent and submergent vegetation and riparian species along the edges.
Sylvilagus bachmani riparius	riparian brush rabbit	FE, CE	Dependent on riparian forests with dense understory that include floodplains with upland area for retreat from high waters. Present in Caswell Memorial State Park on the Stanislaus River.

Source: CDFG 2012.
FE = Federally listed as endangered
FT = Federally listed as threatened
MB = Migratory Bird Act
CE = California listed as endangered
CT = California listed as threatened
CSC = California species of special concern
CFP = California fully protected species

Table 8-4b. Special-Status Animal Species with Potential to Occur or Known to Occur within the Area of Potential Indirect Effects

Scientific Name	Common Name	Status	Presence in area of potential indirect effects
Ambystoma californiense	California tiger salamander	FT, CT	Presumed surviving or in existence
Branchinecta conservatio	Conservancy fairy shrimp	FE	Presumed surviving or in existence
Branchinecta longiantenna	Longhorn fairy shrimp	FE	Presumed surviving or in existence
Branchinecta lynchi	Vernal pool fairy shrimp	FT	Presumed surviving or in existence
Branta hutchinsii leucopareia	Cackling goose/Aleutian Canada goose	Delisted	Presumed surviving or in existence
Buteo swainsoni	Swainson's hawk	CT	Presumed surviving or in existence
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	FT, CE	Possibly removed
Corynorhinus townsendii	Townsend's big-eared bat	CA candidate Threatened	Presumed surviving or in existence
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	FT	Presumed surviving or in existence
Gambelia sila	Blunt nosed leopard lizard	FT	Presumed surviving or in existence
Haliaeetus leucocephalus	Bald eagle	Federal Delisted, CE	Presumed surviving or in existence
Hydromantes brunus	Limestone salamander	CT	Presumed surviving and in existence
Lepidurus packardi	Vernal pool tadpole shrimp	FE	Presumed surviving or in existence

Scientific Name	Common Name	Status	Presence in area of potential indirect effects
Masticophis lateralis euryxanthus	Alameda whipsnake	FT, CT	Presumed surviving or in existence
Neotoma fuscipes riparia	Riparian woodrat/San Joaquin Valley woodrat	FE	Presumed surviving or in existence
Rana draytonii	California red-legged frog	FT	Presumed surviving and in existence
Sylvilagus bachmani riparius	Riparian brush rabbit	FE, CE	Presumed surviving or in existence
Thamnophis gigas	Giant gartersnake	FT, CT	Presumed surviving or in existence
Vireo bellii pusillus	Least Bell's vireo	FE, CE	Possibly removed
Vulpes macrotis mutica	San Joaquin kit fox	FE, CT	Presumed surviving or in existence

Source: CDFW 2016.
CT = California Listed as Threatened
FT = Federally Listed as Threatened
CE = California Listed as Endangered
FE = Federally Listed as Endangered
CR = California Listed as Rare

Nonnative Wildlife

The introduction of nonnative wildlife species can be detrimental to native species assemblages. The distribution and abundance of nonnative wildlife species in the area of potential effects are not fully documented, but species include American bullfrog (*Lithobates catesbeiana*), red swamp crayfish (*Procambarus clarkii*), red-eared slider (*Trachemys scripta*), European snails (e.g., *Helix* spp.), and Chinese mitten crab (*Eriocheir sinensis*) (USBR 2010a).

8.2.2 Reservoirs

This section describes the area of potential effects at the three rim dams (New Melones, New Don Pedro, and New Exchequer) and their respective reservoirs (New Melones Reservoir, New Don Pedro Reservoir, and Lake McClure). As a result of the LSJR alternatives, water surface elevations are expected to change, but generally this change would be within the current zone of fluctuation at the three rim dams and reservoirs (Tables 8-7a, 8-7b, and 8-7c and Section 8.4.2, *Methods and Approach*). Therefore, the area of potential effects at the three rim dams and reservoirs is limited to the area along their banks that would experience this change in water level.

Water surface elevations in smaller downstream reservoirs on the three eastside tributaries are maintained through water releases from the rim dams upstream. These downstream reservoirs are used to regulate the flow released by the upstream rim dams. Although more flow might go through these smaller downstream reservoirs as a result of the LSJR alternatives, the reservoirs would simply release the flow downstream, so surface elevations of the smaller downstream reservoirs are not expected to change under the LSJR alternatives.

Potentially Affected Habitats

While there are a multitude of different habitat types within the vicinity of the reservoirs, annual grasses and disturbed/barren habitats make up the majority of the habitat types found within the area of potential effects around the reservoirs. Small segments of riparian and wetland habitat exist around the reservoirs at some locations where tributaries meet the reservoir within the zone of water level fluctuation. Information from the Don Pedro Hydroelectric Project (TID and MID 2014), the Merced River Hydroelectric Project (Merced ID 2010; Merced ID 2011a), and the New Melones Lake Resource Management Plan (USBR 2010b) documents and technical studies (herein after referred to collectively as the reservoir studies) were reviewed to determine whether the presence of special-status habitat types existed in the area of potential effects. There were no special-status habitat types located within the vicinity of New Melones and New Don Pedro reservoirs due to the reservoirs' steep-sided banks and regular water level fluctuations. Investigations done as part of the Merced River relicensing proceeding revealed the presence of limestone salamander, a California fully protected species that inhabits steep-sided talus slopes and rocky habitat around Lake McClure (Merced ID 2011b). Additionally, BLM has established the Bagby Serpentine Area of Critical Environmental Concern in the vicinity of the upstream end of Lake McClure near Bagby. The Bagby Serpentine Area of Critical Environmental Concern also includes land bordering the Lake McClure and the Red Hills Area of Critical Environmental Concern, which is located near New Don Pedro Reservoir and may overlap portions of the area of potential effects at that reservoir.

Annual Grassland

Annual grassland is typically found at the higher elevations of the area of potential effects of the reservoirs where water inundation occurs least frequently. Studies of the vegetation around the reservoirs found annual grasses were present along the reservoir shores just below the high water line creating a "bathtub ring" effect. Many of the vegetative species within this classification are nonnative and invasive. Dominant species include the following: ripgut brome (*Bromus diandrus*), Italian ryegrass (*Lolium multiflorum*), soft chess (*Bromus hordeaceus*), wild oats (*Avena barbata*), silver hairgrass (*Aira carophyllea*), and the highly invasive Bermudagrass (*Cynodon dactylon*) which was found to be very common along the reservoirs.

Terrestrial wildlife species associated with this vegetation type closely follow that of the grassland and pasture vegetation classification as discussed in Section 8.2.1, *LSJR and the Three Eastside Tributaries*.

Disturbed/Barren

The reservoir studies found the areas below the normal maximum surface elevations, which are periodically exposed, were sparsely vegetated and/or bare. As such, the disturbed/barren vegetation classification is similar to the disturbed/barren habitat classification discussed previously in Section 8.2.1, *LSJR and the Three Eastside Tributaries*. Typically, this habitat classification includes areas such as roads, canals, levees, and the area of potential effects below the annual grassland vegetation community. Areas that are not found barren within this classification are sparsely inhabited by the annual grassland species discussed above.

While several terrestrial/semi-aquatic wildlife species (i.e., Western pond turtle) maybe found within the disturbed/barren habitat classification, these areas generally have relatively low habitat value due to steep slopes and reduced vegetation, as they afford few opportunities for native wildlife populations, and support little wildlife biodiversity overall (TID and MID 2014). There is a special-status amphibian species, Limestone salamander, which is present around Lake McClure. It is found mainly on the surface in mixed chaparral habitats during moist periods. During the remainder of the year, they can be found below the surface in habitat that includes limestone caverns, deep talus formations, and massive rock fissures (Merced ID 2011b).

Wetland and Riparian

Studies on riparian and wetland habitat around Lake McClure identified the presence of small, ephemeral wetlands at the mouth of drainages where flows from the drainages and the reservoir water level inundate the finger-like drainage beds (Merced ID 2011a). As snowmelt raises the water level of Lake McClure, these wetlands become fully submerged until reservoir levels drop again during fall months. Dominant species in these wetland areas include broadleaf cattails, various species of rush, leather root (*Hoita macrostachya* [*Psoralea macrostacha*]), and California loosestrife (*Lythrum californicum)*. Where soil conditions are saturated but not inundated, Italian thistle (*Carduus pycnocephalus)* is often the dominant species, providing full ground cover. Where soils are slightly less wet, along shallow drainages, seeps, or directly adjacent to inundated temporary wetlands, Italian ryegrass (*Lolium multiflorum)* is dominant; it often occurs in conjunction with Italian thistle. At most drainages, the riparian vegetation community becomes well-developed and vigorous at the high water line, remaining healthy until the natural landscape no longer supports hydric conditions necessary for riparian vegetation. Button willow also occurs intermittently below the high-water line of Lake McClure.

Areas at the mouth of the drainages that enter Lake McClure are inundated for longer durations than other locations around the reservoir and frequently support wetland vegetative species. Riparian vegetation tends to increase in abundance farther up the drainage, where inundation occurs for a shorter duration during the year, with full expression of riparian vegetation occurring near the high water line of the lake, where inundation occurs less frequently and for shorter durations. Various special-status plant species were found around New Don Pedro Reservoir and Lake McClure as a result of studies that were completed for the FERC relicensing on the Tuolumne and Merced Rivers (Merced ID 2011a; TID and MID 2013b).

BLM Areas of Critical Environmental Concern

The Bureau of Land Management (BLM) is a federal land management agency that is responsible for the management of some of the public lands located around the reservoirs. To better protect certain rare or otherwise valuable habitat, BLM establishes Areas of Critical Environmental Concern (ACECs), which are areas of public land where special management attention is required to protect relevant and important natural or cultural resource values. The current Sierra Resource Management Record of Decision (Sierra ROD), completed in 2008, describes the special resource values present in the two ACECs located near the reservoirs, the Red Hills ACEC in the vicinity of New Don Pedro Reservoir and the Bagby Serpentine ACEC located near the upper portions of Lake McClure. These two ACECs, described in more detail below, were designated due to the presence of rare plant communities that are associated with unique soil characteristics at these two locations.

The Red Hills ACEC includes: Delpiedra soils derived from dunite and serpentine, two federally listed species (*Verbena californica* and *Packera layneae*), four BLM sensitive species (*Allium tuolumnense, Chlorogalum grandiflorum, Lomatium congdonii,* and *Senecio clevelandii heterophyllus*), and the serpentine buckbrush chaparral plant community.

The Bagby Serpentine ACEC, which overlaps a portion of the area of potential effects around Lake McClure, was designated to protect a rare plant community characterized by the presence of serpentine soils. As described in the Sierra ROD, relevant and important values at this location are the Henneke soil series soils developed on a serpentine substrate supporting at least two BLM sensitive serpentine endemic species (*Lupinus spectabilis* and *Cryptantha mariposae*), other serpentine endemics, and the serpentine buckbrush chaparral community.

Both of these ACECs contain portions of the designated area that border the shorelines at New Don Pedro Reservoir and Lake McClure. Special-status plants associated with these ACECs were found to exist in the area of potential effects at these two reservoirs.

Potentially Affected Vegetation

The vegetative species found within the area of potential effects are accustomed and acclimatized to large interannual and annual variations in the reservoirs' water surface elevations that occur as part of reservoir operations. Nonnative plants dominate much of the potential area of effects along the reservoirs' banks and limit the potential for native plant species to grow, however observations have been made during studies around New Don Pedro Reservoir and Lake McClure of several special-status plant species around the edge of the reservoir. Since the range in water level fluctuation is not expected to substantially change compared to baseline conditions, the potentially affected vegetation around reservoirs is confined to the area immediately around the reservoir.

Invasive Plants Within Potentially Affected Habitats

As discussed in Section 8.2.1, *LSJR and the Three Eastside Tributaries*, a number of invasive plants are present within the potentially affected habitat. The reservoir studies documented the dominance of European annual grasses and forbs in the annual grassland habitat found along the reservoirs' banks.

Potentially Affected Wildlife

Those special-status wildlife species with the potential to occur within the area of potential effects around the reservoirs are the same as those listed in Table 8-4. However, the reservoir studies did note the lack of abundance of special-status species within the area of potential effects as a result of the limited amount of appropriate habitat and the overall number of invasive species. An exception was the limestone salamander (*Hydromantus brunus),* which has a designation of California listed as threatened, California fully protected species. This species has a range restricted Lake McClure and its tributaries on steep north and east-facing slopes in chaparral habitats during moist periods and in limestone caverns, deep talus, and rock fissures during the remainder of the year. This species spends much of the time below the surface during the dry season and is generally only found above ground during the rainy season when it emerges. Western pond turtles (*Actinemys marmorata*) were also observed around the shore of New Don Pedro Reservoir. These species are accustomed to the frequent changes in water level elevations.

Nonnative Wildlife

The nonnative wildlife species found within the areas of effects along the reservoirs' banks are the same as those described in Section 8.2.1, *LSJR and the Three Eastside Tributaries*. The reservoir studies identify the abundance of American bullfrogs and red swamp crayfish.

8.2.3 Extended Plan Area

Unlike the plan area, where the elevation primarily decreases from the rim dams and becomes flat in the valley, the extended plan area dramatically increases in elevation to the top of the three eastside tributary watersheds. This elevation change influences the types of habitat and vegetation that are found in the area. The vegetation zonation reflects the increase in elevation with associated declines in temperature, increased precipitation, and winter snow at higher elevations. At the uppermost reaches of the Stanislaus, Tuolumne, and Merced Rivers, alpine vegetation or bare bedrock is dominant. Below the alpine zone are subalpine forest, lodgepole-red fir forest, yellow pine forest, foothill woodlands, and chaparral (Schoenherr 1992:92).

There are several special-status animal species in the extended plan area located within the area of potential effects of the rivers and reservoirs. These include valley elderberry longhorn beetle, willow flycatcher (*Empidonax trailii,* CE), and the harlequin duck (*Histrionicus*, CSC). There are two special-status amphibians in the upper watersheds of the extended plan area. These are the Sierra Nevada yellow-legged frog (*Rana sierrae,* FT, CT) and the Yosemite toad (*Bufos canorus,* FT, CSC) (CDFG 2012).

There are no federal or state endangered or threatened plant species associated with reservoirs in the extended plan area. There are several rare plant species associated with reservoir wetland habitats. These include yellow-lipped pansy monkeyflower *(Mimulus pulchellus),* three-bracted onion *(Allium tribracteatum)* and a moonwort *(Botrychium crenulatum)* (CDFG 2012).

Within the Stanislaus National Forest the following acreages have been identified as wildlife habitat: big game (804,700); small game (112,800); bald eagle (3,000); peregrine falcon (15,000); Sierra red fox (100,000); fisher (220,000); pine marten (245,000); spotted owl (120,000); goshawk (104,000); great grey owl (10,000) (USFS 2016).

8.2.4 Southern Delta

The southern Delta once consisted of tidal marshlands, numerous islands, and hundreds of miles of waterways. Upland islands, meandering natural levees, and terraces supported woody riparian vegetation, grassland, and shrubs. Marshlands were drained and reclaimed for irrigated agriculture (CDFG 2007). Today, agricultural land dominates the southern Delta. Levees typically have waterside slopes that are covered with riprap and actively maintained with regular herbicide application to control vegetation. Interior areas of most islands are actively farmed and contain little or no natural vegetation. Consequently, most remaining undisturbed plant communities and most special-status species occur on in-channel islands with no levees (CDFG 2007).

The vegetation, wildlife, and special-status species of the area of potential effects for the SDWQ alternatives are similar to that of the area of potential effects for the LSJR alternatives. The following is a discussion of vegetation, wildlife, and special-status species that are specific to the area of potential effects for the SDWQ alternatives.

Potentially Affected Habitats

The southern Delta contains numerous and varied vegetation communities and land cover types. The majority of the area of potential effects is nonflooded agriculture, followed by grassland, orchards, and vineyards (particularly in the southwestern portion of the southern Delta) (CDFG 2005). A spatial query of the CNDDB revealed the following special-status habitats reported within the area of potential effects: great valley cottonwood riparian forest, great valley mixed riparian forest, great valley oak riparian forest, and northern claypan vernal pool (CDFG 2012). With the exception of northern claypan vernal pools, these habitats are discussed above. Vernal pool habitats are not discussed further because they are isolated from the waterways that could be modified by the plan amendments. There is no critical habitat designated for terrestrial species in the southern Delta. Near the waterways and within the area of potential effects, the dominant habitat types are aquatic. These habitat types are discussed below.

Tidal Freshwater Emergent Wetland

Tidal freshwater emergent wetland habitat is typically a transitional community between tidal perennial aquatic, riparian, and various terrestrial upland communities. It often occurs at the shallow, slow-moving, or stagnant edges of fresh waterways in the intertidal zone and is subject to frequent, long duration flooding. Tidal freshwater emergent wetland habitat is distributed in narrow, fragmented bands along island levees, in-channel islands, shorelines, sloughs, and shoals. In the southern Delta, bulrushes (*Scirpus* spp.), tules, and common reed (*Phragmites australis*) are often the dominant plant species within this community type.

Tidal Mudflat

Tidal mudflat habitat typically occurs as sparsely vegetated sediment deposits in the intertidal zone between the mean higher high tide and the mean lower low water level. It is typically associated with the tidal freshwater wetland community at its upper edge and the tidal perennial aquatic community at its lower edge. The tidal mudflat natural community is ephemeral and owes its physical existence to sediment erosion and deposition processes that vary throughout the Delta. At least two special-status plant species, Mason's lilaeopsis (*Lilaeopsis masonii*) and Delta mudwort (*Limosella subulata*), are found in this community type (Fiedler et al. 2007).

Nontidal Perennial Aquatic

Nontidal perennial aquatic habitat can be found in association with any terrestrial habitat and often transitions into nontidal freshwater perennial emergent wetland and riparian habitats. Specific plant species vary with water depth and distance from shore and include submerged aquatic species (e.g., pondweed [*Potamogeton* spp.] and Brazilian waterweed [*Egeria densa*]) and floating aquatic vegetation (e.g., duckweed [*Lemna* spp.]) and water hyacinth [*Eichhornia crassipes*]). This community is often dominated by nonnative species and may alter the environment by increasing rates of sediment and organic matter accumulation (BDCP 2010).

Nontidal Freshwater Perennial Emergent Wetland

These perennially-saturated wetlands are composed of emergent vegetation that cannot tolerate perpetual exposure to saline or brackish conditions. Nontidal freshwater perennial emergent wetland habitat occurs adjacent to nontidal perennial aquatic and riparian natural communities, typically occurring as associated pockets of habitat (BDCP 2010).

Potentially Affected Vegetation

A spatial query of the CNDDB revealed special-status plant species with potential to occur within the area of potential effects (Table 8-5) (CDFG 2012). The species associated with riparian forests are discussed above for the LSJR alternatives. Vegetation unique to the southern Delta area of potential effects is discussed below.

Table 8-5. Special-Status Plants with Potential to Occur or Known to Occur within the Area of Potential Effects – Southern Delta

Scientific Name	Common Name	Status	Habitat Notes
Cirsium crassicaule	slough thistle	CNPS 1B.1	Chenopod scrub, marshes and swamps, sloughs, and riparian scrub.
Eryngium racemosum	Delta button-celery	CE	Riparian scrub.
Hibiscus lasiocarpos	woolly rose-mallow	CNPS 2.2	Freshwater marsh.
Lathyrus jepsonii var. jepsonii	Delta tule pea	CNPS 1B.2	Freshwater and brackish marshes.
Lilaeopsis masonii	Mason's lilaeopsis	CNPS 1B.1	Intertidal brackish and freshwater marshes along streambanks.
Limosella subulata	Delta mudwort	CNPS 2.1	Marshes and swamps, muddy or sandy intertidal flats.
Symphyotrichum lentum	Suisun Marsh aster	CNPS 1B.2	Freshwater and brackish marshes.
Trichocoronis wrightii var. *wrightii*	Wright's trichocoronis	CNPS 2.1	Meadows, marshes and swamps, riparian forest, and alkaline vernal pools.

Source: CDFG 2012.
CE = California listed as endangered
CNPS = California Native Plant Society rarity rank

Invasive Plants within Potentially Affected Habitats

Some of the most prevalent invasive plants in the area of potential effects are thistles, European annual grasses, salt cedar, giant reed, Chinese tallow, tree-of-heaven, Eucalyptus, pampas grass, edible fig, Himalayan blackberry, white mulberry, castor bean, Lombardy poplar, tree tobacco, and emergent and submergent invasive aquatic plants (CDFG 2007; USBR 2010a, 2011). Invasive plants displace native vegetation and provide lower-quality habitat for native wildlife (CDFG 2007). Invasive plant stands may not sustain rich invertebrate communities or provide forage for terrestrial wildlife as effectively as do native communities (CDFG 2007; USBR 2010a). Invasive riparian plants also colonize channel and floodplain surfaces that can alter hydrologic processes and interfere with flood control (Moyle and Bennett 2008; USBR 2010a, 2011).

Potentially Affected Wildlife

More than 200 species of wildlife utilize the terrestrial habitats of the Delta (CDFG 2003). Wildlife habitats in the area of potential effects include agricultural land, riparian forest, riparian scrub, emergent freshwater marsh, mudflats, grassland, and rangeland. The Delta is particularly important to waterfowl migrating via the Pacific Flyway. The principal attraction for waterfowl is winter-flooded fields, mainly cereal crops, which provide food and extensive seasonal wetlands. The Delta and other Central Valley wetlands provide winter habitat for 60 percent of the 5 million waterfowl on the Pacific Flyway and 90 percent of all waterfowl that winter in California (CDFG 2003). Approximately 27 species of waterfowl are found in the Delta and LSJR (CDFG 2003). Raptor species, including bald eagle, prairie falcon (*Falco mexicanus*), and great-horned owl (*Bubo virginianus)*, hunt in the wetlands, grasslands, and riparian habitats. Many passerines, including species of flycatchers, swallows, warblers, blackbirds, and sparrows, nest, forage, or overwinter in the variety of habitats associated with the Delta. Upland game birds include dove, pheasant, chukar, and quail. Shorebirds include gulls, terns, plovers, sandpipers, herons, and egrets (CDFG 2003).

Small mammals find suitable habitat in the Delta and upland areas. Vegetated levees, remnants of riparian forest, and undeveloped islands still sustain approximately 40 species of mammals (CDFG 2003). Species include muskrat, mink, river otter, beaver, raccoon, gray fox, California ground squirrel, antelope ground squirrel, and skunk.

Herpetofauna of the area include garter, gopher, night, and king snakes; western pond turtle; leopard, fence, alligator, and side-blotched lizards; skinks and whiptails; red-legged frogs, yellow-legged frogs, tree frogs, and bullfrogs; and tiger and slender salamanders. The southern Delta is also home to thousands of insect and other invertebrate species, such as over a hundred beetle species and many rare native bees (e.g., Adrenidae) (Powell and Hogue 1979).

The loss or alteration of most of the natural habitat in the Delta has resulted in the decline of the Delta's sensitive and rare terrestrial species. A spatial query of the CNDDB revealed multiple special-status animal species within the area of potential effects (Table 8-6) (CDFG 2012). Many of the species are avian and dependent on the availability of riparian habitat.

Nonnative Wildlife

The introduction of nonnative wildlife species can be detrimental to native species assemblages. The distribution and abundance of nonnative wildlife species in the area of potential effects are not fully documented in the southern Delta, but among the species that occur are red fox (*Vulpes vulpes*), common starling (*Sturnus vulgaris*), American bullfrog, brown-headed cowbird (*Molothrus ater*), and feral pig and cat (CDFG 2003).

Table 8-6. Special-Status Animals with Potential to Occur or Known to Occur within the Area of Potential Effects – Southern Delta

Scientific Name	Common Name	Status	Habitat Notes
Actinemys marmorata	western pond turtle	CSC	Uses slack- or slow-water aquatic habitat.
Agelaius tricolor	tricolored blackbird	CSC, MB	Uses marsh and scrub habitats for nesting.
Ambystoma californiense	California tiger salamander	FT, CE	Inhabits grassland and oak woodland habitats below 1,500 feet which have scattered ponds, intermittent streams, or vernal pools.
Anthicus sacramento	Sacramento anthicid beetle	CSC	Inhabits sandy substrate among willows in riparian habitats.
Athene cunicularia	burrowing owl	CSC, MB	Uses open, dry grasslands, deserts, prairies, farmland, and scrublands with abundant active and abandoned mammal burrows inside levees.
Buteo swainsoni	Swainson's hawk	CT, MB	Nests in a variety of tree species often in or near riparian habitat. Forages in grasslands and agricultural fields.
Circus cyaneus	northern harrier	CSC, MB	Nests and forages in grasslands and agricultural fields, often at the edge of marshes.
Coccyzus americanus occidentalis	western yellow-billed cuckoo	CE, MB	Uses riparian areas for cover, foraging, and breeding.
Desmocerus californicus dimorphus	valley elderberry longhorn beetle	FT	Dependent on the elderberry shrub, a riparian species.
Falco columbarius	Merlin	MB	Prefers open habitats such as grasslands, marshlands, deserts, coasts, sand dunes and steppes.
Neotoma fuscipes riparia	San Joaquin Valley woodrat	FE	Restricted primarily to riparian areas where trees and brush are found.
Perognathus inornatus	San Joaquin pocket mouse	CSC	Dependent on riparian forests with dense understory.
Sylvilagus bachmani riparius	riparian brush rabbit	FE, CE	Dependent on riparian forests with dense understory that include floodplains with upland area for retreat from high waters.
Taxidea taxus	American badger	CSC	Uses grasslands and levees.
Xanthocephalus	yellow-headed blackbird	CSC, MB	Uses wetlands.

Source: CDFG 2012.
FE = Federally listed as endangered
FT = Federally listed as threatened
MB = Migratory Bird Act
CE = California listed as endangered
CT = California listed as threatened
CSC = California species of special concern

8.3 Regulatory Background

8.3.1 Federal

Relevant federal programs, policies, plans, or regulations related to terrestrial biological resources are described below.

Clean Water Act

The CWA generally applies to all navigable waters of the United States and is discussed in Chapter 5, *Surface Hydrology and Water Quality*.

Central Valley Project Improvement Act

The Central Valley Project Improvement Act (CVPIA) was enacted in 1992 to balance the needs of fish and wildlife resources with other uses of CVP water. The purposes of the CVPIA are as follows.

- Protect, restore, and enhance fish, wildlife, and associated habitats in the Central Valley and Trinity River Basins of California.
- Address impacts of the CVP on fish, wildlife, and associated habitats.
- Improve the operational flexibility of the CVP.
- Increase water-related benefits provided by CVP to the State of California through expanded use of voluntary water transfers and improved water conservation.
- Contribute to California's interim and long-term efforts to protect the Bay-Delta Estuary.
- Achieve a reasonable balance among competing demands for use of CVP water, including the requirements of fish and wildlife, agricultural, municipal and industrial, and power contractors.

The CVPIA added mitigation, protection, and restoration of fish and wildlife to the purposes of the CVP, dedicated 800,000 AF of CVP yield for the primary purpose of implementing fish, wildlife, and habitat restoration, and created a Central Valley Project Restoration Fund to carry out CVPIA programs, projects, plans, and habitat restoration, improvement, and acquisition provisions.

Section 3406(d) of the act requires the Secretary of the Interior to

> provide, either directly or through contractual agreements with other appropriate parties, firm water supplies of suitable quality to maintain and improve wetland habitat areas on units of the National Wildlife Refuge System in the Central Valley; on Gray Lodge, Los Baños, Volta, North Grasslands, and Mendota state wildlife management areas; and on the Grasslands Resources Conservation District in the Central Valley of California.

The volumes of water necessary are divided into Level 2 water supply needs that are to be made immediately available and Level 4 water supply needs, which are to be made available no later than 10 years after CVPIA's enactment.

CVPIA and Section 210(b) of the Reclamation Reform Act of 1982 also require the preparation and submittal of Water Management Plans from certain entities that enter into repayment contracts or water service contracts with the U.S. Bureau of Reclamation (USBR) (USBR 2015b). These plans document the use and amount of water under different federal levels. The following national wildlife refuges and other wildlife areas have submitted water management plans because of their use of contracted water: North Grasslands Wildlife Area; SJR National Wildlife Refuge; Merced National Wildlife Refuge; and San Luis National Wildlife Refuge.

Federal Endangered Species Act of 1973

The purpose of the ESA is to protect and recover imperiled species and the ecosystems upon which they depend. (16 U.S.C., § 1531 et seq.) ESA is administered by USFWS and NMFS. In general, NMFS is responsible for protecting ESA-listed threatened or endangered marine species and anadromous fishes, while other listed species (e.g., freshwater and terrestrial species) are under USFWS jurisdiction. An *endangered species* is defined as "… any species which is in danger of extinction throughout all or a significant portion of its range." (16 U.S.C., § 1532, subd. (6).) A *threatened species* is defined as "… any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." (16 U.S.C., § 1532, subd. (20).) ESA Section 9 makes it illegal to *take* (i.e., harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in such conduct) any endangered fish or wildlife species. (16 U.S.C., §§ 1538; 1532, subd. (19).) For threatened fish and wildlife species, ESA Section 4(d) allows for the adoption of protective regulations, including provisions extending the Section 9 take prohibition to that species. (16 U.S.C., § 1538, subd. (d).)

ESA also requires the designation of critical habitat for listed species. *Critical habitat* is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to a species' conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation (NMFS 2011; NMFS 2009a; ICF International 2012).

If a federal agency believes that its action will jeopardize a listed species or destroy or adversely modify critical habitat, the agency must request formal consultation with USFWS or NMFS, as appropriate, under Section 7 of ESA. (16 U.S.C., § 1536.) USFWS or NMFS then issues a biological opinion (BO) as to whether the action is likely to jeopardize a listed species or to destroy or adversely modify its critical habitat. If an action will result in jeopardy, the USFWS or NMFS will provide the consulting federal agency with reasonable and prudent alternative actions to avoid jeopardy. For any non-federal action otherwise prohibited by Section 9, the applicant must apply to the Secretaries for an incidental take permit under ESA Section 10. (16 U.S.C., § 1539.) Species that are candidates for listing are not protected under ESA; however, USFWS advises that a candidate species could be elevated to listed status at any time, and, therefore applicants should regard these species with special consideration.

Recovery Plan for Upland Species of California

The *Recovery Plan for Upland Species of California* (Recovery Plan) was released by USFWS in 1998. This plan addresses 34 species of plants and animals that occur in the San Joaquin Valley that are either federally listed as threatened or endangered, or are candidates for listing or species of concern. The ultimate goal is to delist the 11 endangered and threatened species addressed in the plan and ensure the long-term conservation of the other 23 species (USFWS 1998). The plan provides for both an ecosystem approach and a community-level strategy to conservation planning. USFWS also uses the plan to determine recommendations and requirements during endangered species consultation for these species. The Recovery Plan should be taken into consideration when analyzing potential impacts on upland natural community habitats in the San Joaquin Valley to ensure that projects do not prevent or impair the future long-term implementation success of the Recovery Plan.

National Wildlife Refuge System Improvement Act of 1997

Comprehensive Conservation Plans (CCP) are required under the National Wildlife Refuge System Improvement Act of 1997 and are prepared by USFWS. In 2006 the USFWS prepared a final CCP for the SJR National Wildlife Refuge to guide the management of the refuge for the next fifteen years. The primary goals of the CCP are: conserve and protect the natural diversity of migratory birds, resident wildlife, fish, and plants through restoration and management of riparian, upland, and wetland habitats on refuge lands; contribute to the recovery of threatened/endangered species, as well as the protection of populations of special-status wildlife and plant species and their habitats; provide optimum wintering habitat for Aleutian Canada geese to ensure their continued recovery; coordinate the natural resource management of the SJR National Wildlife Refuge in the context of the larger Central Valley/San Francisco ecoregion; provide the public with opportunities for compatible, wildlife-dependent visitor services to enhance understanding, appreciation, and enjoyment of natural resources at the SJR National Wildlife Refuge. As identified by Table 8-2 there are several national wildlife refuges, with CCPs, that receive surface water from either the three eastside tributaries or the LSJR. They include: SJR National Wildlife Refuge, Merced National Wildlife Refuge, and the San Luis National Wildlife Refuge.

Federal Power Act

Under the Federal Power Act (FPA), the Federal Energy Regulatory Commission (FERC) is responsible for determining under what conditions to issue licenses, or relicense, non-federal hydroelectric projects. Under the provisions of Section 10(j) of the FPA, each hydroelectric license issued by FERC is required to include conditions for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. These required conditions are to be based on recommendations of federal and state fish and wildlife agencies. FERC may reject or alter the recommendations on several grounds, including if FERC determines they are inconsistent with the purposes and requirements of the FPA or other applicable law. The State Water Board exercises authority over hydropower projects through Section 401 of the Clean Water Act, which requires an applicant for a federal license or permit that conducts an activity that results in a discharge into the navigable waters of the United States to apply for a certification from the state that the discharge will comply with state and federal water quality standards. The certification will include conditions requiring compliance with the Bay-Delta Plan's water quality objectives, including the LSJR flow requirements. FERC does not have authority to review or set aside the water quality certification.

Additionally, under FPA Section 4(e), federal land management agencies can also require measures for the protection, mitigation and enhancement of fish and wildlife resources, including for the protection of terrestrial habitat. BLM is the primary federal land management agency with mandatory conditioning authority under the FPA for federal land around Lake McClure and New Don Pedro Reservoir. In many instances, this has resulted in hydropower operators regulated by FERC developing invasive species management plans and other wildlife management plans.

8.3.2 State

Relevant state programs, policies, plans, or regulations related to terrestrial biological resources are described below.

California Endangered Species Act of 1970

CESA (Fish & G. Code, § 2050 et seq.; Cal. Code Regs, tit. 14, § 783 et seq.) expresses state policy to conserve, protect, restore, and enhance any endangered or threatened species or its habitat. Under CESA, the California Fish and Game Commission has the responsibility for maintaining a list of threatened and endangered species. (Fish & G. Code § 2070.) CESA generally prohibits *take* (defined, in part, as hunt, pursue, catch, capture, or kill) of listed species, although it may allow for take incidental to otherwise lawful activities. (Fish & G. Code, § 2080 et seq.) CDFW also maintains lists of species of special concern that are intended to designate species at conservation risk, stimulate research on poorly known species, and achieve conservation and recovery of species before they are listed under CESA.

Protections under Other Provisions of the California Fish and Game Code

California Fish and Game Code Section 1385 et seq. (known as the California Riparian Habitat Conservation Act) requires that the preservation and enhancement of riparian habitat shall be a primary concern of state agencies whose activities impact riparian habitat. (Fish & G. Code, § 1389.) The California Fish and Game Code also designates certain mammal, amphibian, reptile, fish, and bird species as "fully protected," making it unlawful to take or possess these species except under certain circumstances. Limestone salamander, which is present around Lake McClure, is a fully protected species. (Fish & G. Code, §§ 3511 [birds], 4700 [mammals], 5050 [reptiles and amphibians], 5515 [fish].) According to CDFW, most fully protected species have also been listed as threatened or endangered. California Fish and Game Code Sections 3503, 3503.5, and 3800 prohibit the possession, take, or needless destruction of the nests or eggs of any bird, and the take of any nongame bird.

California Native Plant Protection Act of 1977

The California Native Plant Protection Act of 1977 (Fish & G. Code, § 1900 et seq.) gives the Fish and Game Commission the authority to designate native plants as endangered or rare, and prohibits the take of designated plants with some exceptions.

California Invasive Species Plans

There are several state invasive species plans used to control the infiltration of invasive species and reduce their prevalence. Various state agencies, including CDFW, the California Department of Food and Agriculture (CDFA), California Department of Parks and Recreation, and California State Lands Commission, have oversight over invasive species. Existing state invasive species control programs include the following.

- The California State Parks Division of Boating and Waterways (CDBW) is the lead agency for the survey and control of Brazilian waterweed, water hyacinth, and South American spongeplant in the Delta, its tributaries, and the Suisun Marsh.
- The Noxious Weed Information Project (NWIP), a product of CDFA, provides maps and other information for CDFA, biologists, and the general public (CDFA 2016).
- Cal-IPC's mission is to protect California's lands and waters from ecologically-damaging invasive plants through science, education, and policy. Cal-IPC works closely with agencies, industry, and nonprofit organizations to support research, restoration work, and public education (Cal-IPC

2012). It also operates the CalWeedMapper online database that describes, maps, and identifies management opportunities for controlling invasive plants in California.

California Weed Management Areas

California's Weed Management Area (WMA) program was created in 1999 (Food & Agr. Code, § 7270 et seq.) to address the destructive impact of invasive and noxious weeds. CDFA reviews proposals from established weed management areas, which are local stakeholder groups working on weed projects, and awards funding. Weed management areas must have their goals and objectives defined in a strategic plan to receive funding.

The Sierra-San Joaquin Noxious Weed Alliance (Fresno, Madera, and Mariposa Counties) was formed in 1998 and leads programs targeting the early detection and eradication of noxious weeds, as well as specific programs targeting star thistle. The Central Sierra Partnership Against Weeds covers Calaveras and Tuolumne Counties. In Calaveras County, projects have focused specifically on the location and eradication of certain invasive species (Cal-IPC 2012).

8.3.3 Regional or Local

Relevant regional or local programs, policies, plans, or regulations related to terrestrial biological resources are described below. Although local policies, plans, or regulations are not binding on the State of California, below is a description of relevant ones.

San Joaquin County Multi-Species Habitat Conservation Plan

The *San Joaquin County Multi-Species Habitat Conservation and Open Space Plan* was approved in 2001. The geographic scope covers all of San Joaquin County and includes lands within the legal Delta boundary (County of San Joaquin 2000). The habitat conservation plan (HCP) is a 50-year plan and covers a wide variety of federal, state, and other special-status species in San Joaquin County. One of the primary goals of the HCP is to preserve open space, which includes wetland and riparian habitats. Participation in the HCP is voluntary for both local jurisdictions and project applicants. Only agencies adopting the HCP would be covered by the HCP. In addition, the HCP provides for agricultural conservation easements to support species. Approximately 13,000 acres have been entered into a conservation easement (SJCOG n.d). Approximately 64,000 acres is expected to be placed under conservation easements over the life of the permit for the HCP.

General Plans

General plans guide land development within their jurisdictions. Policies and objectives related to natural resources identified in local general plans typically complement state and federal regulations regarding biological resources and protect open space and native biotic communities. General plan policies related to terrestrial biological resources are summarized below.

Calaveras County

The Open Space Element of the *Calaveras County General Plan* addresses the relationship between open space and the protection of rare and endangered species and ecologically sensitive areas (Calaveras County 1996). Policy V-1A and Policy V-2A require review of proposed developments for potential impacts on significant habitats or potential to cause sedimentation of water bodies. Policy V-3A requires review of proposed development for potential impacts on riparian areas.

Tuolumne County

The *Tuolumne County General Plan* (1996) includes policies to maintain biological resource conservation programs (Policy 4.J.2), and support no net loss of wetlands (Policy 4.J.5) and other sensitive habitats (Policy 4.J.6).

Stanislaus County

The Conservation/Open Space Element (Chapter 3) of the *Stanislaus County General Plan* (Stanislaus County 1994) establishes goals and policies for the management of natural resources and the preservation of open space lands. Policy 3 protects sensitive wildlife habitat and plant life identified by the county or by state or federal agencies, Policy 4 protects woodlands and other native hardwood habitat, and Policy 30 protects the habitats of rare and endangered fish and wildlife species.

Merced County

Policies in the Open Space/Conservation chapter of the *Merced County General Plan* (1990) are primarily focused on development and land use. Specific policies ensure adequate protection and monitoring of development projects near rare and endangered species habitats and protect significant aquatic and waterfowl habitats from excessive water withdraws.

Mariposa County

The *Mariposa County General Plan* (2006) outlines programs for the management and conservation of natural resources, including water conservation to sustain riparian communities (Policy 11-2d). The diversity of native ecosystems and plant and animal species in the county is preserved through the Mariposa County Environmental Conservation Program, standards that reduce or eradicate invasive species, and compliance with state and federal regulations (Policy 11-4a).

San Joaquin County

The *San Joaquin County General Plan* includes open space policies that protect resource areas from adverse impacts of development, including protection of habitat for threatened, rare, and endangered species. The County requires that water projects incorporate safeguards for fish and wildlife, and stipulates that no public action shall significantly diminish the county's wildlife and vegetative resources. The plan protects strips of habitat along waterways and encourages the restoration and enhancement of degraded ecosystems (County of San Joaquin 1992).

8.4 Impact Analysis

This section identifies the thresholds of significance criteria used to evaluate the potential impacts on terrestrial biological resources. It further describes the methods of analysis used to evaluate the potential impacts and to determine the significance of those impacts. Measures to mitigate (i.e., avoid, minimize, rectify, reduce, eliminate, or compensate for) significant impacts accompany the impact discussion, if any significant impacts are identified.

8.4.1 Thresholds of Significance

The thresholds for determining the significance of impacts for this analysis are based on the State Water Board's Environmental Checklist in Appendix A of the Board's CEQA regulations. (Cal. Code Regs., tit. 23, §§ 3720–3781.) Terrestrial biological impacts were determined to be potentially significant in the State Water Board's Environmental Checklist (see Appendix B, *State Water Board's Environmental Checklist*) and therefore are discussed in this analysis. The thresholds derived from the checklist have been modified, as appropriate, to meet the circumstances of the alternatives. (Cal. Code Regs., tit. 23, § 3777, subd. (a)(2).) In this chapter, Impact BIO-3, involving invasive plants and nonnative wildlife, is an additional potential impact meriting analysis as to whether the alternatives could result in the following.

- Have a substantial adverse effect on any riparian habitat or other sensitive natural terrestrial communities identified in local or regional plans, policies, or regulations or by CDFW or USFWS.
- Have a substantial effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Facilitate a substantial increase in distribution and abundance of invasive plants or nonnative wildlife that would have a substantial adverse effect on native terrestrial species.
- Have a substantial adverse effect, either directly or through habitat modifications, on any terrestrial animal species identified as a candidate, sensitive, or special-status in local or regional plans, policies, or regulations or by CDFW or USFWS.
- Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan or conflict with any local policies or ordinances protecting biological resources.

Where appropriate specific quantitative or qualitative criteria are described in Section 8.4.2, *Methods and Approach,* for evaluating these thresholds.

As discussed in Appendix B, the LSJR and SDWQ alternatives would result in either no impact or less-than-significant impacts on the following related to terrestrial biological resources and, therefore, are not discussed within this chapter.

- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

8.4.2 Methods and Approach

This section describes the methods and approach for analyzing the LSJR and SDWQ alternatives.

LSJR Alternatives

This chapter evaluates the potential biological terrestrial impacts associated with the LSJR alternatives. Each LSJR alternative includes a February–June unimpaired flow[5] requirement (i.e., 20, 40, or 60 percent) and methods for adaptive implementation to reasonably protect fish and wildlife beneficial uses, as described in Chapter 3, *Alternatives Description*. In addition, a minimum base flow is required at Vernalis at all times during this period. The base flow may be adaptively implemented as described below and in Chapter 3. State Water Board approval is required before any method can be implemented, as described in Appendix K, *Revised Water Quality Control Plan*. All methods may be implemented individually or in combination with other methods, may be applied differently to each tributary, and could be in effect for varying lengths of time, so long as the flows are coordinated to achieve beneficial results in the LSJR related to the protection of fish and wildlife beneficial uses.

The Stanislaus, Tuolumne, and Merced Working Group (STM Working Group) will assist with implementation, monitoring, and assessment activities for the flow objectives and with developing biological goals to help evaluate the effectiveness of the flow requirements and adaptive implementation actions. Further details describing the methods, the STM Working Group, and the approval process are included in Chapter 3 and Appendix K. Without adaptive implementation, flow must be managed such that it tracks the daily unimpaired flow percentage based on a running average of no more than 7 days. The four methods of adaptive implementation are described briefly below.

1. Based on best available scientific information indicating that more flow is needed or less flow is adequate to reasonably protect fish and wildlife beneficial uses, the specified annual February–June minimum unimpaired flow requirement may be increased or decreased to a percentage within the ranges listed below. For LSJR Alternative 2 (20 percent unimpaired flow), the percent of unimpaired flow may be increased to a maximum of 30 percent. For LSJR Alternative 3 (40 percent unimpaired flow), the percent of unimpaired flow may be decreased to a minimum of 30 percent or increased to a maximum of 50 percent. For LSJR Alternative 4 (60 percent unimpaired flow), the percent of unimpaired flow may be decreased to a minimum of 50 percent.
2. Based on best available scientific information indicating a flow pattern different from that which would occur by tracking the unimpaired flow percentage would better protect fish and wildlife beneficial uses, water may be released at varying rates during February–June. The total volume of water released under this adaptive method must be at least equal to the volume of water that would be released by tracking the unimpaired flow percentage from February–June.
3. Based on best available scientific information, release of a portion of the February–June unimpaired flow may be delayed until after June to prevent adverse effects to fisheries, including temperature, that would otherwise result from implementation of the February–June flow requirements. The ability to delay release of flow until after June is only allowed when the unimpaired flow requirement is greater than 30 percent. If the requirement is greater than 30 percent but less than 40 percent, the amount of flow that may be released after June is

[5] *Unimpaired flow* represents the water production of a river basin, unaltered by upstream diversions, storage, or by export or import of water to or from other watersheds. It differs from natural flow because unimpaired flow is the flow that occurs at a specific location under the current configuration of channels, levees, floodplain, wetlands, deforestation and urbanization.

limited to the portion of the unimpaired flow requirement over 30 percent. For example, if the flow requirement is 35 percent, 5 percent may be released after June. If the requirement is 40 percent or greater, then 25 percent of the total volume of the flow requirement may be released after June. As an example, if the requirement is 50 percent, at least 37.5 percent unimpaired flow must be released in February–June and up to 12.5 percent unimpaired flow may be released after June. If after June the STM Working Group determines that conditions have changed such that water held for release after June should not be released by the fall of that year, the water may be held until the following year. See Chapter 3 and Appendix K for further details.

4. Based on best available scientific information indicating that more flow is needed or less flow is adequate to reasonably protect fish and wildlife beneficial uses, the February–June Vernalis base flow requirement of 1,000 cubic feet per second (cfs) may be modified to a rate between 800 and 1,200 cfs.

The operational changes made using the adaptive implementation methods above may be approved if the best available scientific information indicates that the changes will be sufficient to support and maintain the natural production of viable native SJR Watershed fish populations migrating through the Delta and meet any biological goals. The changes may take place on either a short-term (e.g., monthly or annually) or longer-term basis. Adaptive implementation is intended to foster coordinated and adaptive management of flows based on best available scientific information in order to protect fish and wildlife beneficial uses. Adaptive implementation could also optimize flows to achieve the objective, while allowing for consideration of other beneficial uses, provided that these other considerations do not reduce intended benefits to fish and wildlife. While the measures and processes used to decide upon adaptive implementation actions must achieve the narrative objective for the reasonable protection of fish and wildlife beneficial uses, adaptive implementation could result in flows that would benefit or reduce impacts on other beneficial uses that rely on water. For example, terrestrial riparian species could benefit by receiving additional flows during key germination times in the late spring.

Information from Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, and results from the State Water Board's Water Supply Effects (WSE) model presented in Chapter 5, *Surface Hydrology and Water Quality,* and Appendix F.1, *Hydrologic and Water Quality Modeling,* was reviewed. The quantitative results included in the figures, tables, and text of this chapter present WSE modeling of the specified unimpaired flow requirement for each LSJR alternative (i.e., 20, 40, or 60 percent). This chapter also incorporates a qualitative discussion of adaptive implementation under each of the LSJR alternatives that includes the potential environmental effects associated with adaptive implementation.
To inform the qualitative discussion and account for the variability allowed by adaptive implementation, modeling was performed to predict conditions at 30 percent and 50 percent of unimpaired flow (as reported in Appendix F.1). The modeling also allows some inflows to be retained in the reservoirs until after June, as could occur under method 3, to prevent adverse temperature effects. This variety of modeling scenarios provides information to support the analysis and evaluation of the effects of the alternatives and adaptive implementation. This chapter incorporates a qualitative discussion of the potential terrestrial biological resource impacts of adaptive implementation under each of the LSJR alternatives. For more information regarding the modeling methodology and quantitative flow and temperature modeling results, see Appendix F.1.

Rivers

Plans, policies, and regulations reviewed in the preparation of this analysis have indicated that the area of potential effects includes a variety of riparian communities, freshwater marsh, and elderberry savanna (See Section 8.2.1, *LSJR and the Three Eastside Tributaries*; State Water Board 1999; USFWS 2012; Riparian Habitat Joint Venture 2004; Moyle and Bennett 2008; Moise and Hendrickson 2002; Sawyer et al. 2009; CDFG 2012, 2003). Impact BIO-1 focuses on potential impacts on riparian habitats in the context of the California Riparian Habitat Conservation Act. Impacts on freshwater marsh are discussed in Impact BIO-2. Impacts on the elderberry savanna are not further considered because this community occurs on floodplains (USBR 2010a), and some increased inundation as a result of the LSJR alternatives (Chapter 6, *Flooding, Sediment, and Erosion,* Impact FLO-2) would be beneficial overall (as discussed under Impact BIO-4). However, individual elderberry shrubs are found in riparian vegetation and habitat within or near river channels that may be frequently inundated; as such, the effects on species relying on elderberry shrubs are included in Impact BIO-4.

General trends identified in the WSE for the LSJR alternatives are used in the analysis to qualitatively evaluate impacts on terrestrial biological resources. Annual averages or monthly averages for flow in each river are used where appropriate. In addition, as described in Chapter 5, *Surface Hydrology and Water Quality,* Section 5.4.3, the cumulative distribution[6] of flows for February–June are also used to compare baseline conditions to LSJR alternative conditions. The cumulative distribution of flows is used because they provide an accurate summary of the range of flows expected over a number of years. The comparison of monthly cumulative distributions of flows, in conjunction with the individual monthly average changes in flow, provides an appropriate measure of hydrologic changes resulting from the LSJR alternatives. Therefore, this information is used to evaluate the expected type of terrestrial habitat conditions under baseline and LSJR alternative conditions (see Appendix F.1, *Hydrologic and Water Quality Modeling*, Sections F.1.3 and F.1.4, for additional information and summary data regarding cumulative distributions). These trends are summarized below.

- For LSJR Alternative 2, modeled monthly flows on the Stanislaus River were generally similar to baseline flows, although with some small shifting of flows from March to June. Flows for the Merced and Tuolumne Rivers and the LSJR were generally similar to or greater than baseline flows, depending on the month (Tables 5-16 and 5-17a, 5-17b, 5-17c, and 5-17d).
- For LSJR Alternatives 3 and 4, modeled monthly flows would generally increase relative to baseline flows on the Merced, Tuolumne, and Stanislaus Rivers and the LSJR (Tables 5-16 and 5-17a, 5-17b, 5-17c, and 5-17d). In most cases, these rivers would experience substantial increases in median flows from February–June relative to baseline.
- For LSJR alternatives 3 and 4, modeled results indicated occasional reductions in the highest flows caused by a reduced need for flood control releases when compared to baseline conditions. Flood control releases were most likely to occur when the reservoirs were filling

[6] The cumulative distribution of a particular variable (i.e., reservoir elevations) provides a basic summary of the distribution of values. This term is not referring to, and should not be confused with, the term cumulative impacts, which is a specific CEQA term. A discussion of cumulative impacts for CEQA purposes is provided Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1)*; Chapter 16, *Evaluation of Other Indirect and Additional Actions;* and Chapter 17, *Cumulative Impacts, Growth-Inducing Effects, and Irreversible Commitment of Resources.*

with storm flows or when the reservoirs had to be emptied in the fall in preparation for storms in winter and spring. Flood control releases occurred more often in wet years and were more common at Don Pedro Reservoir and Lake McClure (i.e., the two smaller reservoirs). During wet years, reservoir releases were greater under LSJR Alternatives 3 and 4, so reservoir storage would reach the maximum allowed limit less often and flood control releases would not be needed as much.

- The largest changes in flow associated with the LSJR alternatives occurred from February–June, but there were some smaller effects outside of this period. Changes from July–January were primarily related to changes in flood control releases, retention of unimpaired flow for later release in the fall as part of adaptive implementation described under the LSJR alternatives in Section 8.4.3, *Impacts and Mitigation Measures*, during wet conditions, and retention of water in the reservoirs to maintain carryover storage (by reducing diversions in dry years).
- Actions required by the NMFS BO (Stanislaus River reasonable and prudent alternative, including Action 3.1.3), are included in the baseline for modeling purposes. Under the modeled conditions of the LSJR alternatives, these flows would be met or exceeded. The WSE modeling of the LSJR alternatives assumes that a certain percent of unimpaired flow would be met. However, if the NMFS BO flows are higher than the percent unimpaired flow, then the NMFS BO flow becomes the target flow.

Modeling results predict that LSJR Alternatives 3 and 4 would increase flows on the LSJR February–June. These flows would be distributed between Old River, Middle River, and the SJR downstream of Vernalis and would contribute to an environment that is also affected by water diversions, tidal action, and Sacramento River inflow. Flows caused by the LSJR alternatives would largely be confined within existing channels. Therefore, as described in Chapter 6, there would not be a significantly increased risk of flooding. Also, the effects of Alternatives 3 and 4 on water surface elevation in the southern Delta would be relatively small because water surface elevation in much of the region is dominated by tidal effects. Any increase in elevation of the groundwater table or seepage that may result from higher water levels would be small and would tend to benefit native terrestrial Delta species. Therefore, this analysis does not consider potential impacts of the LSJR alternatives below Vernalis.

Reservoirs

Baseline conditions and LSJR alternative water surface elevations for the three reservoirs (New Melones, Don Pedro, and Lake McClure), are presented in Appendix F.1, *Hydrologic and Water Quality Modeling* (Tables F.1.3-5c, F.1.3-5i, F.1.3-5m, F.1.3-6b, F.1.3-6f, F.1.3-6j, F.1.3-7b, F.1.3-7f, F.1.3-7j, F.1.3-8b, F.1.3-8f, F.1.3-8j). Vegetation along the shores of New Melones Reservoir, New Don Pedro Reservoir, and Lake McClure, as well as birds and other wildlife that may use the reservoirs, are accustomed to fluctuations in reservoir elevation that occur under baseline conditions. WSE results for baseline conditions indicate that for most years there are large fluctuations in water surface elevations in the three reservoirs. The median range between the yearly minimum and maximum elevations over the 82-year baseline simulation was 63 ft for New Melones Reservoir, 54 ft for New Don Pedro Reservoir, and 88 ft for Lake McClure. New Melones Reservoir minimum fluctuation range is 24 ft and its maximum fluctuation range is 232 ft ; New Don Pedro Reservoir minimum fluctuation range is 25 ft and maximum fluctuation range is 151 ft ; and Lake McClure's minimum fluctuation range is 29 ft and maximum fluctuation range is 320 ft . Because terrestrial biological resources that use the reservoirs are accustomed to large interannual and annual variations in the reservoirs' water surface elevation that occur as part of normal reservoir operations, small changes in reservoir elevations are unlikely to affect terrestrial biological resources. Tables 8-7a, 8-7b, and 8-7c characterize the potential water surface fluctuations under the LSJR alternatives. For the purpose of comparison, the tables summarize the percent of time the reservoirs would fluctuate more than 10 ft from one month to the next. The results show that the fluctuation of water surface elevations under the LSJR alternatives is expected to be similar to baseline conditions.

This information was presented to qualitatively evaluate direct and indirect impacts on terrestrial biological resources as a result of the implementation of the LSJR alternatives in Impacts BIO-1 through BIO-5. Direct impacts were defined as actions that were likely to result in immediate plant or animal mortality or complete habitat loss. Indirect impacts were defined as delayed effects, nonfatal stresses upon plants and animals, and/or habitat degradation.

LSJR Alternatives and the Southern Delta

Habitats and the dominant terrestrial wildlife and plant species in the southern Delta tolerate fluctuations in salinity and regularly experience tidal influences and salinity inputs from other sources (e.g., upstream sources). Salinity in the southern Delta generally ranges between 0.2 dS/m and 1.2 dS/m during all months of the year, and salinity at Vernalis is almost always below the current objective (maximum 30-day running average of 0.7 from April through August or 1.0 dS/m from September through March). In addition, a strong relationship is observed between salinity at Vernalis and salinity in the southern Delta; the measured EC[7] at Brandt Bridge is increased by a maximum of 0.2 dS/m above the Vernalis salinity (Figure F.1.5-2a) and is increased by a maximum of 0.4 dS/m at Tracy Boulevard (Figure F.1.5-2b). The volume of water needed to meet the Vernalis EC objective is included in the WSE modeling results and, therefore, is in the impact determinations for the LSJR alternatives. This information is used to qualitatively assess the effects of the LSJR alternatives on water quality, specifically salinity, in the southern Delta with respect to terrestrial habitat and species (Impacts BIO-1 and BIO-4).

Area of Potential Indirect Effects

Agricultural practices and land cover depend on a wide variety of factors, including the unique circumstances and decisions made by farmers in the plan area, market conditions, and the location of different agricultural properties and crops; therefore, this chapter provides a qualitative evaluation of potential indirect effects on sensitive wildlife species and habitat resulting from a reduction of irrigation water supply to agricultural fields using information regarding agricultural land cover and practices. Habitat requirements for San Joaquin Valley representative, or keystone species, such as blunt nosed leopard lizard, San Joaquin kit fox, and Swainson's hawk are discussed in the context of potential changes in agricultural land cover that could occur in the area of potential indirect effects. A qualitative discussion of the potential for invasive species to occur as a result of reduced irrigation water supply is also discussed.

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[7] In this document, EC is *electrical conductivity*, which is generally expressed in deciSiemens per meter (dS/m). Measurement of EC is a widely accepted indirect method to determine the salinity of water, which is the concentration of dissolved salts (often expressed in parts per thousand or parts per million). EC and salinity are therefore used interchangeably in this document.

Extended Plan Area

The analysis of the extended plan area generally identifies how the impacts may be similar to or different from the impacts in the plan area (i.e., downstream of the rim dams) depending on the similarity of the impact mechanism (e.g., changes in reservoir levels, reduced water diversions, and additional flow in the rivers) or location of potential impacts in the extended plan area. Where appropriate, the program of implementation is discussed to help contextualize the potential impacts in the extended plan area.

SDWQ Alternatives

The habitats and the dominant terrestrial wildlife and plant species in the southern Delta tolerate fluctuations in salinity and regularly experience tidal influences and salinity inputs from other sources (e.g., upstream sources). Therefore, terrestrial biological resources in the Southern Delta can only be significantly affected if salinity levels change so substantially that existing habitat or plants could not survive. As discussed in Chapter 5, *Surface Hydrology and Water Quality*, the existing water quality in the southern Delta generally ranges between 0.2 dS/m and 1.2 dS/m during all months of the year. In addition, there is a strong relationship between salinity at Vernalis and salinity in the southern Delta, which increases by a maximum of 0.4 dS/m above the Vernalis salinity at locations downstream.

The program of implementation for the SDWQ alternatives would still include the requirement for USBR to maintain salinity at Vernalis in accordance with its water rights. Therefore, the SDWQ alternatives are not expected to affect the overall quantity or quality of the habitats in the southern Delta. Exact data on the salt tolerance of individual plant species present in the Delta is not readily available and depends on a host of interrelated factors. However, native Delta plant species are adapted to brackish waters and salinity levels that have historically existed in the southern Delta. Additionally, periodic salinity intrusion into the Delta may help to reduce the abundance and/or distribution of certain harmful invasive species and give native species a competitive advantage (Carter and Nippert 2012). There is no mechanism for the SDWQ alternatives, which would only modify the salinity objectives, to result in fill or physical modification of wetlands that occur within the southern Delta.

The modeling results indicated that under SDWQ Alternatives 2 or 3, exceedances (described in Section 8.3.2, *State [Regulatory Background]*) would not increase relative to baseline and the salinity in the LSJR and southern Delta would remain similar to baseline or be reduced (Appendix F.1, Section F.1.5.2, *Salinity Modeling Results*). As a result, there is limited potential for the SDWQ alternatives to impact terrestrial species in the southern Delta as salinity in the southern Delta would remain within the historical range, and the terrestrial plant and animal species can adapt to the variable salinity levels that the southern Delta currently experiences. Consequently, there would be little to no change from baseline; therefore, the SDWQ alternatives are not discussed further in this chapter. However, to comply with specific water quality objectives or the program of implementation under SDWQ Alternatives 2 or 3, construction and operation of different facilities in the southern Delta could occur, which could involve impacts on biological resources. These impacts are evaluated in Chapter 16, *Evaluation of Other Indirect and Additional Actions*.

Table 8-7a. Percent of Time Water Surface Elevation Fluctuation Greater than 10 Feet from Month to Month for New Melones Reservoir

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Baseline % Fluctuation	5	1	16	24	34	26	28	52	46	62	68	10
LSJR Alternative 2 Fluctuation	2	1	10	21	29	20	15	38	30	52	60	6
LSJR Alternative 3 Fluctuation	5	1	12	27	24	21	11	27	17	34	34	4
LSJR Alternative 4 Fluctuation	6	2	13	28	15	11	9	21	4	21	23	5

Note: lower percentages indicate less fluctuation greater than 10 feet occurring at a reservoir.

Table 8-7b. Percent of Time Water Surface Elevation Fluctuation Greater than 10 Feet from Month to Month for New Don Pedro Reservoir

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Baseline % Fluctuation	0	2	15	17	28	20	10	32	55	79	96	6
LSJR Alternative 2 Fluctuation	0	2	17	18	29	21	9	27	45	78	91	4
LSJR Alternative 3 Fluctuation	1	4	22	27	34	28	5	22	33	73	78	18
LSJR Alternative 4 Fluctuation	2	4	23	28	28	24	5	28	17	22	48	13

Note: lower percentages indicate less fluctuation greater than 10 feet occurring at a reservoir.

Table 8-7c. Percent of Time Water Surface Elevation Fluctuation Greater than 10 Feet from Month to Month for Lake McClure

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Baseline % Fluctuation	44	10	15	24	33	52	57	80	38	96	98	93
LSJR Alternative 2 Fluctuation	32	1	9	17	27	46	56	74	32	93	95	79
LSJR Alternative 3 Fluctuation	43	4	16	23	29	48	48	71	20	88	91	67
LSJR Alternative 4 Fluctuation	35	10	18	27	28	39	26	48	22	60	90	49

Note: lower percentages indicate less fluctuation greater than 10 feet occurring at a reservoir.

8.4.3 Impacts and Mitigation Measures

Impact BIO-1: Have a substantial adverse effect on any riparian habitat or other sensitive natural terrestrial communities identified in local or regional plans, policies, or regulations or by CDFW or USFWS

No Project Alternative (LSJR/SDWQ Alternative 1)

The No Project Alternative would result in implementation of flow objectives identified in the 2006 *Water Quality Control Plan for the San Francisco/Sacramento–San Joaquin Delta Estuary* (2006 Bay–Delta Plan). See Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative impact discussion and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative technical analysis.

LSJR Alternatives

Riparian habitats are tolerant of seasonal fluctuations in river flows. Adaptations, such as extremely rapid life cycles that maximize opportunities for replenishment of the soil seed bank prior to subsequent inundation flooding or the onset of drought, allow for species to thrive in variable environments (Capon and Dowe 2006). Despite this tolerance of variability, exceptionally low summer stages (drought) or high water stages year-round can lead to desiccation or inundation mortality, respectively, and are two of the major drivers affecting the composition and success of sensitive habitats and plant species along rivers. In general, unimpaired flow regimes are more seasonally variable. The result of flow regulation has, in many cases, been a reduction in vegetation heterogeneity that has led to eventual loss of biodiversity (Capon and Dowe 2006).

Most riparian vegetation within the area of potential effects is riparian forest or willow scrub. The typical dominant species of these habitats (e.g., sandbar willow) are particularly resistant to damage by scour or burial (USBR 2010a). In addition, scour and deposition of sediment can sustain floodplain habitats and create opportunities for plant establishment, thus sustaining the diversity of riparian vegetation.

In many locations and times of year throughout the area of potential effects, the LSJR alternatives could increase surface water or groundwater elevations, potentially resulting in submergence of the root zones and aboveground aspects of vegetation. This condition may cause dieback of nonnative and upland species that are not adapted to periodic inundation, while an increase in water availability during the growth period for riparian vegetation (generally late spring to early fall) could encourage the growth of native species. Additionally, it is expected that the LSJR alternatives could periodically inundate some areas that do not currently support riparian vegetation. This periodic inundation could create conditions suitable for dispersal and establishment of riparian plants through sediment deposition, water transport of plant seeds and fragments to new locations, increased water availability, and reduced competition from upland plant species (e.g., nonnative grasses) that are intolerant of prolonged submergence. Certain plants, such as deep-rooted trees, are more likely to persist in variable environments because they are able to access groundwater (Capon and Dowe 2006). Therefore, manipulation of flow regimes during critical seasons can potentially augment recruitment and survival of riparian tree species, particularly willows and cottonwoods (Moise and Hendrickson 2002). Activities that support the establishment and success of native species are generally consistent with the goals and policies contained in the SJR National Wildlife Refuge CCP, the San Joaquin County Multi-Species HCP, and applicable general plans.

The ability of a reservoir to support riparian vegetation is a function of reservoir size (larger reservoirs generally have a greater circumference and, therefore, more potential for hydrologic connectivity), adjacent land use, and the speed and frequency at which drawdown occurs. Riparian plants are typically resilient to changes in reservoir levels (Waring 1992). Other habitat features like the presence of small tributaries entering the main reservoir can create small areas of wetland and riparian habitats around the reservoir edge. Riparian habitats at the reservoirs in the area of potential effects are currently subject to fluctuating water levels (see Tables 8-7a, 8-7b, and 8-7c for the expected changes in water level fluctuation for each reservoir). Furthermore, in many cases there is a lack of vegetation in the zone of fluctuation created by variations in water surface elevation. Within this zone, it is difficult for plant species (e.g., riparian or other sensitive plant species) to fully establish because of the propensity for flooding and loss of topsoil from wave erosion however some areas of wetland and riparian habitat have been established (Merced ID 2011a). Shore erosion may occur at all water surface elevations but is generally most severe when water surface elevations change rapidly (Baird and Associates 2004). Water surface elevation fluctuations at the major rim reservoirs tend to follow seasonal patterns, with high water levels occurring during the late spring and early summer and progressively lower water levels occurring during the late summer and fall.

Habitats and the dominant terrestrial wildlife and plant species in the southern Delta tolerate fluctuation in salinity and regularly experience tidal influences and salinity inputs from other sources (e.g., upstream sources). Exact data on the salt tolerance of individual plant species present in the Delta are not readily available and depend on a host of interrelated factors. However, native Delta plant species are adapted to brackish waters and salinity levels that have historically existed in the southern Delta as described above in Section 8.4.2, *Methods and Approach*, and in Chapter 5, *Surface Hydrology and Water Quality*. Additionally, periodic salinity intrusion into the Delta may help to reduce the abundance and/or distribution of certain harmful invasive species and give native species a competitive advantage (Carter and Nippert 2012).

LSJR Alternative 2 (Less than significant/Less than significant with adaptive implementation)

Rivers

The modeling results indicate that under LSJR Alternative 2, the Stanislaus River would experience median flows similar to baseline flows (Table 5-16 and 5-17c). The largest changes in median flow associated with LSJR Alternative 2 relative to baseline in the Stanislaus River were a decrease of 15 percent in March and an increase of 24 percent in June. The overall cumulative distribution of the flows (i.e., the range of flows distributed between the minimum flow [thousand acre-feet] and the maximum flow over the entire 82-year historic modeling period) would be similar under LSJR Alternative 2 when compared to baseline conditions (Table 5-16 and 5-17c). This means that the total volume of water available February–June on the Stanislaus River would be similar when compared to baseline conditions. The baseline flows on the Stanislaus are high from February–June as a result of the Vernalis Adaptive Management Program flow requirements and the mandated pulse flows required by the NMFS BO; however, the flow requirements under LSJR 2 (the maximum of the NMFS BO flows or 20 percent of the unimpaired flow) produce river flows that are similar to baseline. Impacts on riparian habitat or other sensitive natural terrestrial communities would be less than significant.

Modeling results indicate that the median monthly flows would generally be very similar to or greater than baseline flows on the Tuolumne and Merced Rivers, and LSJR under LSJR Alternative 2. Furthermore, the overall volume of water described by the cumulative distribution of flows February–June would be slightly greater than baseline (Table 5-16 and 5-17a, 5-17b, and 5-17d). Therefore, significant impacts on riparian vegetation or other sensitive plant communities on the Tuolumne and Merced Rivers and LSJR are not expected. Impacts would be less than significant.

Scour and deposition of sediment would not be expected to adversely affect riparian vegetation because riparian scrub is tolerant of these types of physical processes. Furthermore, flows under LSJR Alternative 2 on all three eastside tributaries and the LSJR are not expected to result in substantial bed mobilization or channel modification, as discussed in Chapter 6, *Flooding, Sediment, and Erosion*, Section 6.4.3, *Impacts and Mitigation Measures*, and Chapter 7, *Aquatic Biological Resources*, Section 7.4.3, *Impacts and Mitigation Measures*, when compared to baseline conditions. For these reasons, significant impacts on riparian communities and other sensitive plant communities are not expected. Impacts would be less than significant.

Reservoirs

Under LSJR Alternative 2, all three reservoirs would generally experience little change or a decrease in substantial water surface elevation fluctuations (i.e., fluctuations greater than 10 ft) relative to baseline (Tables 8-7a, 8-7b, and 8-7c). This would result in a more stable nearshore environment. A decrease in the fluctuation of reservoir water surface elevation may permit some vegetation establishment in the zone of fluctuation. However, such colonization would be limited by substrate suitability because these nearshore areas often lack topsoil in the zone of historical fluctuation due to erosion caused by existing surface water elevation changes and wave action. The changes in surface water elevation fluctuation expected under the LSJR alternatives at Lake McClure are not expected to adversely impact habitat for limestone salamander. Riparian habitat or other sensitive plant communities at the reservoirs are not expected to be substantially altered because established riparian habitat, terrestrial communities, and special-status plant species are also sustained by groundwater and are adapted to brief changes in water surface elevations at the reservoirs. Impacts on riparian habitat, other sensitive terrestrial plant communities, or special-status plant species at the reservoirs would be less than significant.

Southern Delta

Modeled results indicate that EC values in the southern Delta could increase or decrease depending on which SDWQ Alternative is implemented (Tables 5-25 and 5-26a, 5-26b, and 5-26c), but overall salinity in the southern Delta would be slightly reduced (Tables 5-29a, 5-29b, and 5-29c) under LSJR Alternative 2. These changes with respect to terrestrial habitat would be very small, if imperceptible. April–September is the irrigation season when, historically, salinity increases as a result of agricultural irrigation runoff. Tables 5-29a, 5-29b, and 5-29c indicate that the change in the April–September (irrigation season) EC values are generally small. Of the three sites evaluated, the largest changes are expected to occur in Old River at Tracy Boulevard. Table 5-29c indicates that the largest changes in the April–September (irrigation season) EC distribution at Tracy Boulevard from baseline to LSJR Alternative 2 was a reduction in the maximum values of 0.62 dS/m (1.038–0.977

dS/m). These changes with respect to terrestrial habitat would be very small, if measurable at all, because riparian habitat plant species in the southern Delta tolerate variable salinity conditions. Therefore, LSJR Alternative 2 is not expected to impact the overall quantity or quality of the habitats in the southern Delta, and impacts would be less than significant.

Adaptive Implementation

Based on best available scientific information indicating that a change in the percent of unimpaired flow is needed to reasonably protect fish and wildlife, adaptive implementation method 1 would allow an increase of up to 10 percent over the 20 percent February–June unimpaired flow requirement (to a maximum of 30 percent of unimpaired flow). A change to the percent of unimpaired flow would take place based on required evaluation of current scientific information and would need to be approved as described in Appendix K, *Revised Water Quality Control Plan*. Accordingly, the frequency and duration of any use of this adaptive implementation method cannot be determined at this time. However, an increase of up to 30 percent of unimpaired flow would potentially result in different effects as compared to 20 percent unimpaired flow, depending upon flow conditions and frequency of the adjustment. The increased flows would potentially benefit riparian habitat because increased water levels during the late spring early summer months would entail a longer growing season with water levels at higher elevations, and as such would promote additional riparian vegetation recruitment at higher elevations along the steam banks and channels.

Based on best available scientific information indicating that a change in the timing or rate of unimpaired flow is needed to reasonably protect fish and wildlife, adaptive implementation method 2 would allow changing the timing of the release of the volume of water within the February–June timeframe. While the total volume of water released February–June would be the same as LSJR Alternative 2 without adaptive implementation, the rate could vary from the actual (7-day running average) unimpaired flow rate. Method 2 would not authorize a reduction in flows required by other agencies or through other processes, which are incorporated in the modeling of baseline conditions. As such, flows would not substantially decrease with respect to baseline conditions and would not substantially affect any riparian habitat or other sensitive natural terrestrial communities.

Adaptive implementation method 3 would not be authorized under LSJR Alternative 2 since the unimpaired flow percentage would not exceed 30 percent.

Adaptive implementation method 4 would allow an adjustment of the Vernalis February–June flow requirement. WSE results show that under LSJR Alternative 2 the 1,200 cfs February–June base flow requirement at Vernalis would require a flow augmentation in the three eastside tributaries and LSJR only 2.7 percent of the time in the 82-year record analyzed. Similarly, flow augmentation would be required 0.7 percent of the time to meet a 1,000 cfs requirement and 0.5 percent of the time for an 800 cfs Vernalis base flow requirement. These results indicate that changes due to method 4 under this alternative would rarely alter the flows in the three eastside tributaries or the LSJR. As such, flows under adaptive implementation method 4 would not substantially decrease with respect to baseline conditions and would not substantially affect any riparian habitat or other sensitive natural terrestrial communities.

Impacts associated with adaptive implementation method 1 may be slightly different from those associated with methods 2 and 3. With method 1, if the specified percent of unimpaired flow were changed from 20 percent to 30 percent on a long-term basis, the conditions and impacts could become more similar to those described under LSJR Alternative 3. It is anticipated that over time the unimpaired flow requirement could increase or not change at all within a year or between years, depending on fish and wildlife conditions and hydrology. If method 2 is implemented, the total annual volume of water associated with LJSR Alternative 2 (i.e., 20 percent of the February–June unimpaired flow) would not change. As a result, the total volume of water that would remain in the river would not change with adaptive implementation method 2 and impacts associated with total volume of water would not change. Terrestrial biological resources, such as riparian species that are dependent on the timing or magnitude of flow, could potentially be affected by method 2. This method would not allow flows to go below what is required by existing requirements on the three eastside tributaries and the SJR. As such, impacts would be similar to those described above for LSJR Alternative 2 without adaptive implementation. Implementing method 4 is expected to have little effect on conditions in the three eastside tributary rivers and LSJR because it rarely would cause a change in flow and the volume of water involved would be relatively small. Consequently, the impact determination of LSJR Alternative 2 with adaptive implementation would be the same as described for LSJR Alternative 2 without adaptive implementation. Impacts would be less than significant.

LSJR Alternative 3 (Less than significant/Less than significant with adaptive implementation)

Rivers

Modeled results indicate LSJR Alternative 3 would generally result in higher monthly flows on the Stanislaus, Merced, and Tuolumne Rivers and the LSJR (Tables 5-16 and 5-17a, 5-17b, 5-17c, and 5-17d). In most cases, these rivers would experience substantial increases in median flows from February–June under LSJR Alternative 3 relative to baseline. Changes during other months would be smaller. In some limited instances, LSJR Alternative 3 would result in reducing/peak flows when compared to baseline, primarily as a result of a reduced need for flood control releases.

Riparian habitat generally would not experience lower flows than they currently do under baseline conditions as a result of this alternative. Plants persisting in riparian habitats are adapted to survive periodic episodes of fluvial (high flow) disturbance (Capon and Dowe 2006). Therefore, any expected higher flows under this alternative would have limited potential to submerge existing vegetation frequently enough and long enough to result in impacts on native riparian plant communities or special-status plant species. The flows modeled for LSJR Alternative 3 are such that riparian vegetation is expected to adjust to the new flow regime (State Water Board 1999).
Any increase in flows would be expected to ultimately result in a net increase in acreage and diversity of riparian and emergent wetland vegetation, depending on the degree of channelization of the river and the encroachment of conflicting land uses. Increasing flows would result in occasional wetting of channels that are typically dry under current conditions and would have potentially beneficial effects. This may promote the natural process of succession, during which willow riparian forest may transition to valley oak riparian forest. Vegetation that has been established in the channel during low baseline flows may be eliminated. Although the alternative may result in a measurable shift in riparian habitats, compositional changes in this dynamic habitat would not be adverse. These changes would support the establishment and persistence of riparian and wetland vegetation. Furthermore, as described in Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*, periodic high flows promote regeneration of riparian habitats. In periods of inundation during spring nonflood releases, floodplains and side channels may be inundated, and surface or groundwater would be accessible to plants over a greater area than at present. Riparian tree species along these rivers have evolved life

history strategies that depend on the river's historical hydrology, including the annual cycles of winter floods and spring snowmelt, as well as infrequent large spring floods (Stillwater Sciences 2003b). The limited instances of lower flows when compared to higher baseline flow conditions on the three eastside tributaries and the LSJR under this alternative are not expected to adversely affect riparian habitat because these reductions generally occur when flow is high and are associated with flood control conditions. Thus, they are not expected to cause a lack of water needed to support riparian vegetation. Therefore, when considering the expected increase in flows and the limited instances in which there would be a reduction in flows, it is not expected that there would be significant impacts on riparian communities and other sensitive plant communities. Impacts would be less than significant.

Reservoirs

The frequency and range in fluctuations of water surface elevations at the reservoirs would generally decrease or remain similar to baseline conditions and generally would not experience a significant increase in fluctuations greater than 10 ft throughout the year (Tables 8-7a, 8-7b, and 8-7c). From December–March, there would be small increases in reservoir elevation fluctuations—greater than 10 ft (increases of 5 percent or less)—at New Don Pedro Reservoir and Lake McClure, but in other months, these fluctuations would decrease relative to baseline. As described above for LSJR Alternative 2, conditions in the zone of fluctuation would generally remain similar to those under baseline conditions at the reservoir, in part because the disturbed substrate would provide limited opportunities for additional vegetation establishment. Impacts on riparian habitat or other sensitive terrestrial communities, such as habitat for limestone salamander around Lake McClure and the Red Hills and Bagby Serpentine ACECs, or special-status plant species would be less than significant.

Southern Delta

Modeled results indicate that EC values in the southern Delta would decrease (Table 5-25 and Tables 5-27a, 5-27b, and 5-27c), and overall salinity in the southern Delta would be reduced (Tables 5-29a, 5-29b, and 5-29c) under LSJR Alternative 3. These changes with respect to terrestrial habitat would be very small, if imperceptible. Therefore, LSJR Alternative 3 is not expected to impact the overall quantity or quality of the habitats in the southern Delta. Impacts would be less than significant.

Adaptive Implementation

Under LSJR Alternative 3, impacts associated with adaptive implementation method 1 may be slightly different from those associated with adaptive implementation methods 2 and 3.

Implementing method 1 would allow an increase or decrease of up to 10 percent in the February–June, 40 percent unimpaired flow requirement (with a minimum of 30 percent and maximum of 50 percent) to optimize implementation measures to meet the narrative objective, while considering other beneficial uses, provided that these other considerations do not reduce intended benefits to fish and wildlife. Adaptive implementation must be approved using the process described in Appendix K, *Revised Water Quality Control Plan*. Accordingly, the frequency and duration of any use of this adaptive implementation method cannot be determined at this time. Adaptive implementation method 1 could affect the amount of water available for water supply and the volume of water and level of flow in the LSJR and the three eastside tributaries. However, the frequency and duration of such a change is unknown. If the specified percent of unimpaired flow were changed from 40 percent to 30 percent or 40 percent to 50 percent on a long-term basis, the conditions and impacts could become more similar to LSJR Alternatives 2 or 4, respectively. It is anticipated that over time the unimpaired flow requirement could increase, decrease, or not change at all within a year or between years, depending on fish and wildlife conditions and hydrology. At those times of increased flows, 50 percent unimpaired flow would increase the volume of water in the LSJR and the three eastside tributaries compared to 40 percent unimpaired flow. This would potentially benefit riparian habitat because the increased water levels during the late spring early summer months would entail a longer growing season with water levels at higher elevations, and as such would promote additional riparian vegetation recruitment at higher elevations along the steam banks and channels.

Under adaptive implementation methods 2 or 3, the overall volume of water from the February–June time period or after June would be the same as LSJR Alternative 3 without adaptive implementation, but the volume within each month could vary. Impacts associated with the total volume of water would not be affected by method 2 or 3, but terrestrial biological resources, such as riparian species, that are dependent on the timing or magnitude of flow could potentially be affected. Wetland resources are somewhat dependent on the timing or magnitude of flow; however these resources are adapted to natural flood and drought cycles. Higher flows under adaptive implementation method 1 would not exceed the higher range of flows that could be experienced under baseline for some water years. However, given that these two methods would not allow flows to go below what is required by existing requirements on the three eastside tributaries and the LSJR, impacts would be similar to those described above for LSJR Alternative 3 without adaptive implementation. Finally, adaptive implementation method 3 is incorporated into the modeling; thus, the range of terrestrial biological effects is reflected in the results presented above for LSJR Alternative 3 without adaptive implementation.

Implementing method 4 is expected to have little effect on conditions in the three eastside tributary rivers. WSE results show that under Alternative 3 the 1,200 cfs February–June base flow requirement at Vernalis would require a flow augmentation in the three eastside tributaries and LSJR only 1.2 percent of the time in the 82-year record analyzed. Similarly, flow augmentation would be required only 0.2 percent of the time to meet either a 1,000 cfs or 800 cfs Vernalis base flow requirement. These results indicate that method 4 would rarely alter the flows in the three eastside tributaries or the LSJR under this alternative.

Consequently the impact determination of LSJR Alternative 3 with adaptive implementation would be the same as described for LSJR Alternative 3 without adaptive implementation. Impacts would be less than significant.

LSJR Alternative 4 (Less than significant/Less than significant with adaptive implementation)

Rivers

Monthly flows on all three eastside tributaries and the LSJR would generally increase under LSJR Alternative 4 (Table 5-16 and 5-17a, 5-17b, 5-17c, and 5-17d). In most cases, these rivers would experience substantial increases in median flows from February–June under LSJR Alternative 4 relative to baseline. Changes during other months would be smaller. In some limited instances, LSJR Alternative 4 would result in a reduction in flow, and these reductions would affect the highest flows when compared to baseline.

The impacts under LSJR Alternative 4 for the increase in average flows on the Stanislaus, Tuolumne, and Merced Rivers and the LSJR would be the same as described above under LSJR Alternative 3. Therefore, when considering the expected increase in flows and the limited instances in which there would be a reduction in flows, significant impacts on riparian communities and other sensitive plant communities are not expected. Impacts would be less than significant.

Reservoirs

The frequency and range of water surface elevation fluctuations at the reservoirs would generally decrease or remain similar to baseline conditions such that there would not be a significant increase in month to month fluctuations greater than 10 ft (Tables 8-7a, 8-7b, and 8-7c). As described for LSJR Alternative 3, the disturbed substrate would provide limited opportunities for additional vegetation establishment. These modifications to riparian habitat or other sensitive terrestrial communities, such as habitat for limestone salamander around Lake McClure and the Red Hills and Bagby Serpentine ACECs, or special-status plant species would be less than significant.

Southern Delta

Modeled results indicate exceedances of the EC objectives in the southern would decrease (Table 5-25 and Tables 5-28a, 5-28b, and 5-28c), and overall salinity in the southern Delta would be reduced (Tables 5-29a, 5-29b, and 5-29c) under LSJR Alternative 4. These changes with respect to terrestrial habitat would be very small, if imperceptible. Therefore, LSJR Alternative 4 is not expected to impact the overall quantity or quality of the habitats in the southern Delta. Impacts would be less than significant.

Adaptive Implementation

Under LSJR Alternative 4, impacts associated with adaptive implementation method 1 may be slightly different from those associated with methods 2 and 3.

Adaptive implementation method 1 would allow a decrease of up to 10 percent in the annual February–June 60 percent unimpaired flow (to 50 percent) to optimize implementation measures to meet the narrative objective, while considering other beneficial uses, provided that these other considerations do not reduce intended benefits to fish and wildlife. Adaptive implementation must be approved using the process described in Appendix K, *Revised Water Quality Control Plan*. Accordingly, the frequency and duration of any use of this adaptive implementation method cannot be determined at this time. Adjusting the percent of unimpaired flow through adaptive implementation is not anticipated to result in impacts different than those identified under LSJR Alternative 3 because LSJR Alternative 3 includes 50 percent within its range of adaptive implementation.

Adaptive implementation methods 2 and 3 would manage flows from February–June or outside of that time period. Given that these two methods would not allow flows to go below what is required by existing requirements on the three eastside tributaries and the SJR, impacts would be similar to those described above for LSJR Alternative 4 without adaptive implementation. Finally, method 3 is incorporated into the modeling; thus, the range of terrestrial biological effects is reflected in the results presented above for LSJR Alternative 3 without adaptive implementation.

Implementing method 4 is expected to have little effect on conditions in the three eastside tributary rivers and LSJR. WSE results show that under Alternative 4 the 1,200 cfs February–June base flow requirement at Vernalis would require a flow augmentation in the three eastside tributaries and LSJR only 0.7 percent of the time in the 82-year record analyzed. Similarly, flow augmentation would be required only 0.2 percent of the time to meet a 1,000 cfs requirement and is not affected at all for an 800 cfs requirement. These results indicate that method 4 would rarely alter the flows in the three eastside tributaries or the LSJR under this alternative.

Consequently, the impact determination of LSJR Alternative 4 with adaptive implementation would be the same as described for LSJR Alternative 4 without adaptive implementation. Impacts would be less than significant.

Impact BIO-2: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means

No Project Alternative (LSJR/SDWQ Alternative 1)

The No Project Alternative would result in implementation of flow objectives identified in the 2006 Bay–Delta Plan. See Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative impact discussion and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative technical analysis.

LSJR Alternatives

The LSJR alternatives do not have the potential to significantly physically fill, divert, or isolate wetland communities and would not discharge dredged or fill material into waters of the United States (e.g., wetlands). Most potential effects on wetland communities as a result of a change in flows would be comparable to the effects of periodic flood flows that have occurred historically (Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*). The effects of these alterations on wetland vegetation would be similar to those previously described for riparian vegetation because wetland plants can also survive inundation, are resistant to the effects of scouring deposition, and are growth-limited by water availability (USBR 2010a). Many effects are beneficial, such as greater availability of water to support growth of riparian or wetland vegetation and the deposition of new sediment rich in organic material. The primary and most ecologically important difference from baseline flows would be the duration and seasonality of inundation; increased flows could inundate some areas for longer periods than baseline seasonal flows would. At the local level, these alterations could adversely or beneficially affect wetlands and riparian habitat, depending on site-specific hydrologic changes. In the long term, plant communities may shift in elevation or species composition to accommodate changes in river flows (USBR 2010a).

LSJR Alternative 2 (Less than significant/Less than significant with adaptive implementation)

Rivers

As described under Impact BIO-1, modeled monthly flows on the Stanislaus River are expected to be similar to baseline flows. Flows for the Tuolumne and Merced Rivers and the LSJR are expected to be generally similar to or generally greater than baseline flows, depending on the month. As a result, there would be no substantial adverse change to conditions supporting wetlands in the area of potential effects. Impacts would be less than significant.

Reservoirs

Under LSJR Alternative 2, reservoir levels would generally fluctuate at a similar or reduced frequency compared to baseline. There are no known significant assemblages of wetlands along the shores of the reservoirs that would be inundated as a result of changes in reservoir elevations. Any impacts from higher water levels would be temporary and would last only until the marsh habitat could respond by shifting in elevation and species composition to accommodate the changes. There are some wetlands and riparian habitat around the reservoirs within the zone of fluctuation; however, these areas are not expected to experience negative impacts due to LSJR Alternative 2 since water elevation fluctuations are not expected to change significantly compared to baseline conditions (Tables 8-7a, 8-7b, and 8-7c). There are also barren areas at the reservoirs because of the lack of suitable soil and the continued fluctuation of water surface elevations. More stable reservoir elevations may result in perennial water availability, which may benefit the establishment and maintenance of wetland vegetation along the shores of the reservoirs. Consequently, impacts would be less than significant.

Adaptive Implementation

As discussed in Impact BIO-1, adaptive implementation method 1 could result in higher flows during some times of the year than under the specified unimpaired flow requirement of 20 percent. However, it is anticipated that over time the unimpaired flow requirement could increase, decrease, or not change at all within a year or between years, depending on fish and wildlife conditions and hydrology. Adaptive implementation method 2 could result in a reallocation of flows between months. Wetland resources are somewhat dependent on the timing or magnitude of flow; however these resources are adapted to natural flood and drought cycles. Higher flows under adaptive implementation method 1 would not exceed the higher range of flows that could be experienced under baseline for some water years. But adaptive implementation method 2 is unlikely to cause flows to be less than baseline flows or to cause overall annual volumes that are released to be different from baseline because method 2 would not authorize a reduction in flows required by other agencies or through other processes, which are incorporated in the modeling of baseline conditions. Method 3 would not be authorized under LSJR Alternative 2 since the unimpaired flow percentage would not exceed 30 percent. Adaptive implementation method 4 would allow an adjustment of the Vernalis February–June minimum flow requirement; however, changes due to method 4 under this alternative would rarely alter the flows in the three eastside tributaries or the LSJR. At the local level, these alterations could adversely or beneficially affect wetlands and riparian habitat, depending on site-specific hydrologic changes. In the long term, plant communities may shift in elevation or species composition to accommodate changes in river flows. Consequently the impact determination of LSJR Alternative 2 with adaptive implementation would be the same as described above for LSJR Alternative 2 without adaptive implementation. Impacts would be less than significant.

LSJR Alternative 3 (Less than significant/Less than significant with adaptive implementation)

Rivers

LSJR Alternative 3 would represent a change in the timing of river flows that would better correspond with the growth and dispersal periods for native wetland vegetation. These native wetland plant communities have evolved life history characteristics that coincide with the unimpaired flow patterns (Moyle and Bennett 2008; CDFW 2014a). LSJR Alternative 3 may encourage the establishment of wetlands and plant assemblages that mimic the original wetland ecosystems that existed before hydromodification. Furthermore, LSJR Alternative 3 is not expected to result in flows of higher velocity than are known to occur in the system or that would result in substantial scour (see Chapter 6, *Flooding, Sediment, and Erosion,* and Chapter 7, *Aquatic Biological Resources*). Impacts on wetland communities would be less than significant.

Reservoirs

Under LSJR Alternative 3, fluctuations in water surface elevation at the reservoirs would generally decrease or remain similar to baseline conditions and generally would not experience a significant increase in fluctuations greater than 10 ft throughout the year (Tables 8-7a, 8-7b, and 8-7c). Although there are no large wetland areas, there are small segments of wetland and riparian habitat along the shores of these reservoirs within the zone of water elevation fluctuation. These habitats are not expected to be negatively impacted by LSJR Alternative 3 since water surface elevation fluctuations would be similar to baseline conditions, and would not lead to further isolation of these small wetland areas. Therefore, LSJR Alternative 3 would not substantially alter or reduce wetland communities at the reservoirs. Impacts would be less than significant.

Adaptive Implementation

Similar to LSJR Alternative 2 with adaptive implementation methods 1, 2, and 4, LSJR Alternative 3 may result in some modifications, at the local level, to wetland assemblages. Adaptive implementation method 3 would keep the overall volume of water from the February–June time period or after June the same as LSJR Alternative 3 without adaptive implementation, but the volume within each month could vary. Wetland resources are somewhat dependent on the timing or magnitude of flow but are also adapted to natural flood and drought cycles. Nevertheless, higher flows under adaptive implementation method 1 would not exceed the flows that could be experienced under normal operations for some water years. Given that method 3 would not allow flows to go below what is required by existing requirements on the three eastside tributaries and the SJR, impacts would be similar to those described above for LSJR Alternative 3 without adaptive implementation. In the long term, plant communities may shift in elevation or species composition to accommodate changes in river flows. Consequently the impact determination of LSJR Alternative 3 with adaptive implementation would be the same as described above for LSJR Alternative 3 without adaptive implementation. Impacts would be less than significant.

LSJR Alternative 4 (Less than significant/Less than significant with adaptive implementation)

Rivers

As described above for LSJR Alternative 3, LSJR Alternative 4 flows are expected to better coincide with the growth and dispersal periods for native wetland vegetation (spring time) and not result in substantial scour. LSJR Alternative 4 would have a less-than-significant impact on existing wetland communities within the area of potential effects along the rivers.

Reservoirs

The reservoir water surface elevation levels are generally not expected to experience large fluctuations with any greater frequency than under baseline conditions (Tables 8-7a, 8-7b, and 8-7c). As described above, there are small segments of wetland and riparian habitat along the shores of the reservoirs within the zone of water elevation fluctuation. These habitats are not expected to be negatively affected by LSJR Alternative 4 because water surface elevation fluctuations are expected to be similar to baseline conditions and, therefore, would not lead to isolation of these small wetland areas. Impacts would be less than significant.

Adaptive Implementation

Similar to LSJR Alternative 3 with adaptive implementation methods 1, 2, 3, and 4, LSJR Alternative 4 with adaptive implementation may result in some modifications at the local level to wetland assemblages. However, in the long term, plant communities may shift in elevation or species composition to accommodate changes in river flows. Consequently, the impact determination of LSJR Alternative 4 with adaptive implementation would be the same as described above for LSJR Alternative 4 without adaptive implementation. Impacts would be less than significant.

Impact BIO-3: Facilitate a substantial increase in distribution and abundance of invasive plants or nonnative wildlife that would have a substantial adverse effect on native terrestrial species

No Project Alternative (LSJR/SDWQ Alternative 1)

The No Project Alternative would result in implementation of flow objectives identified in the 2006 Bay–Delta Plan. See Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative impact discussion and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative technical analysis.

LSJR Alternatives

There are currently nonnative plant species present in the area of potential effects along the rivers and at the reservoirs, as well as in the area of potential indirect effects (see Section 8.2.1, *LSJR and the Three Eastside Tributaries*, under the subsections *Potentially Affected Habitats*, and *Potentially Affected Vegetation*, for a description of the invasive plant species). Invasive species programs have been established to reduce and control the spread of these species, including invasive species management plans developed in compliance with FERC regulations, various regional invasive species plans, and goals established by local weed management areas (see Section 8.3, *Regulatory Background*, for a description of the relevant invasive species plans and regulations).

LSJR Alternatives 2, 3, and 4 (Less than significant/Less than significant with adaptive implementation)

Invasive plants and animals already exist throughout the area of potential effects. It is acknowledged that baseline flow regimes both harm native plants and encourage nonnative species because flows and habitats are often mismatched (e.g., riparian habitats that need more variable flows do not receive them) (Moyle et al. 2010; CDFW 2014a). However, there is insufficient evidence to conclude that the baseline flow regime is the definitive factor in the establishment and spread of invasive species. It is likely that other habitat modifications, such as wetland reclamation and agricultural cultivation, are very important factors in the spread of invasive species. The LSJR alternatives would create a more variable flow regime in which flows vary by season to more closely mimic the natural hydrograph. This is expected to favor native species that have evolved life history characteristics that respond to seasonal flow patterns (Moyle and Bennett 2008; CDFW 2014a). However, more variable flow regimes constitute an ecosystem perturbation, and habitat disturbance can encourage the establishment and spread of invasive species (Davis and Thompson 2000). In light of these factors, the modifications in flow regimes under the LSJR alternatives are not anticipated to change the relative abundance of native and nonnative terrestrial species. Although modifying flows in the system may foster the development of expanded riparian zones, the diversity and richness of these habitats would generally follow baseline conditions. Compositional shifts may occur locally, but the relative abundance of these species at the ecosystem level would be consistent with baseline conditions. Likewise, the use of these habitats by nonnative wildlife species would continue and the relative abundance of these species is expected to be unchanged. While the LSJR alternatives (including the various adaptive implementation methods) may result in some alteration of vegetation patterns at specific locations, there is no information available to suggest that modified flows would substantially alter or facilitate the establishment of invasive plant or animal species. Furthermore, native species are more ecologically adapted to more natural flows (Moyle and Bennett 2008; CDFW 2014a; Moyle et al. 2010). There are also not expected to be increases in abundance or distribution of nonnative plants or wildlife species in the area of potential effects around the reservoirs since there are not likely to be large changes in water surface fluctuation compared to baseline conditions (Tables 8-7a, 8-7b, and 8-7c). Therefore, it is anticipated that impacts would be less than significant.

Area of Potential Indirect Effects

Decreased surface water diversions associated with LSJR Alternative 2 has the potential to result in decreased surface water available for agricultural irrigation in the plan area. Existing agricultural lands that do not receive irrigation water may not necessarily be fallowed in perpetuity or potentially converted to non-agricultural uses. Some agricultural activities on existing agricultural land would continue to occur in the form of dryland farming, rotational farming, or deficit irrigation depending on the type of crop affected, market conditions, and the individual decisions of farmers. These activities would help limit the distribution and abundance of invasive plant and wildlife species. Additionally, the potential for invasive plants and nonnative wildlife species to increase due to reduction in irrigation water availability would not be expected to exceed existing levels because if land is fallowed agricultural activities could occur to maintain the land even during periods when no crops are being grown on a particular field. In the event that the LSJR alternatives result in permanent reversion of some currently irrigated agricultural lands within the area of potential indirect effects to upland habitats or unirrigated grazing lands, a mix of native and nonnative vegetation could be expected to become re-established in the area. Such plant growth, even if heavily weighted towards non-native species, may foster a return to, or at least tend towards, increases in habitat diversity. This can favor increased species abundance or species richness (Crooks 2002). In some instances, non-native plant species may be useful catalysts for ecosystem restoration (Ewel & Putz 2004). Swainson's hawk (*Buteo swainsoni*) nesting densities in Central California have been noted to be the highest in areas with either a mixture of native habitat and agriculture or a high diversity of irrigated crops (England et al 1995). Finally, the invasive species programs as described in Section 8.3, *Regulatory Background*, would continue to be implemented throughout the plan area to reduce and control invasive species. Therefore, impacts would be less than significant.

Impact BIO-4: Have a substantial adverse effect, either directly or through habitat modifications, on any terrestrial animal species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by CDFW or USFWS

No Project Alternative (LSJR/SDWQ Alternative 1)

The No Project Alternative would result in implementation of flow objectives identified in the 2006 Bay–Delta Plan. See Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative impact discussion and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative technical analysis.

LSJR Alternatives

Numerous candidate, sensitive or special-status animal species (special-status species) are found within the area of potential effects (see Tables 8-4a and 8-6), including around Lake McClure, where a fully protected species, Limestone salamander, was found to be present. Western pond turtle were also observed around the shore of Lake McClure and New Don Pedro Reservoir. Many of these special-status animal species are dependent on riparian habitat. The baseline flows have constrained riparian vegetation by reducing the amount of wetted habitat; however, land use changes and levee development along rivers have also led to a reduction in riparian habitat (see Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*). The loss of riparian vegetation has been an important factor in the decline of the California yellow warbler, western yellow-billed cuckoo, Least Bell's Vireo, and little willow flycatcher (Riparian Habitat Joint Venture 2004). Within California's Central Valley, all of these species depend on riparian vegetation for cover, foraging, and breeding. Valley elderberry longhorn beetle depends on elderberry shrub, a riparian species. Two mammal species, San Joaquin woodrat and riparian brush rabbit, also require riparian vegetation. Therefore, declines in riparian vegetation have likely caused declines in populations of these special-status species (CDFW 2014a). The analysis considered whether the LSJR alternatives may cause some temporary habitat disturbances, especially within, and nearby, stream channels, which might adversely affect some special-status animals. The analysis also examined whether the LSJR alternatives would have beneficial effects on some special-status species, particularly to the extent that increased flows encourage additional riparian habitat establishment. Habitat modifications that benefit special-status terrestrial animal species would be consistent with the goals of ESA, CESA, and the USFWS Recovery Plan.

Candidate, sensitive, or special-status animal species (special-status species) are found within the area of potential indirect effects (see Tables 8-4b). The analysis considers whether a reduction in irrigation water supply to existing agricultural lands would indirectly result in land cover that could substantially adversely affect a special-status species.

LSJR Alternative 2 (Less than significant/Less than significant with adaptive implementation)

Rivers

As discussed in Impact BIO-1, modeled monthly flows on the Stanislaus River are expected to be similar to baseline flows. Flows for the Tuolumne and Merced Rivers and the LSJR are expected to be similar to or greater than baseline flows, depending on the month. In addition, as described under Impact BIO-1, adaptive implementation could increase the volume of water in the rivers compared to what would occur under 20 percent unimpaired flow at those times of increased releases/flows. Increases in flow are expected to be largest during the riparian recruitment period (i.e., end of April–June). While established riparian species are adapted to periodic fluctuations in flow, there is potential for increased spring flows to help establish new vegetation. The viability of this habitat is key for the continued existence of many special-status species, and the loss of riparian vegetation has been an important factor in their decline. A discussion of potential impacts on special-status species that could reside in the area of potential effects is included below. Special-status species include: elderberry longhorn beetle, California red-legged frog, California tiger salamander, western spadefoot toad, giant garter snake, western pond turtle, special-status bird species, several bat species, riparian brush rabbit, and San Joaquin Valley woodrat. Overall, impacts on these special-status species on the Stanislaus, Tuolumne, and Merced Rivers and LSJR would be less than significant.

In the area of potential effects, elderberry shrubs typically are located on the higher portions of levees and streambanks within the levees and are generally not subject to regular inundation or scouring, although they can withstand periodic inundation (USBR 2010a). LSJR Alternative 2 is not likely to result in direct loss of elderberry shrubs or any resident beetles. LSJR Alternative 2 would generally increase the amount of water available to elderberry roots, which may stimulate growth of elderberry shrubs and ultimately have a beneficial effect on habitat for this species on the Stanislaus, Tuolumne, and Merced Rivers and the LSJR. Impacts would be less than significant.

The area of potential effects contains suitable habitat for California red-legged frogs, California tiger salamanders, and western spadefoot toads. However, there are no known populations in close proximity to the channels affected by LSJR Alternative 2 (CDFG 2012). The best aquatic habitats for amphibian and reptile use are the backwaters and ponds that are not influenced greatly by rising and falling flows. In addition, any amphibian and reptile use of the channels in the LSJR area of potential effects would already be subject to rising and falling flows, and such populations would be adapted to this variable habitat. Thus, LSJR alternatives would not have a significant adverse effect on the primary habitat elements for special-status amphibians. Impacts would be less than significant.

Special-status aquatic reptiles, including giant garter snake and western pond turtle, may occur in the portions of the river channel that would be inundated by the LSJR Alternative 2. These species require aquatic habitat for breeding and foraging during spring and summer. Additional flows during these seasons, as well as in winter, would have a beneficial effect on these species. Although water velocities would increase in certain areas, it is expected that velocity would not be substantially altered from historical flow regimes. Impacts on upland habitats that these species use for refuge are not expected under the LSJR alternatives because flows generally would be restricted to the river channel. Impacts would be less than significant.

Many special-status birds build nests in large trees or shrubs that would be elevated above the areas affected by LSJR Alternative 2. Some special-status species nest closer to the ground in emergent in-stream or on-terrace marsh vegetation that could be present in portions of the river channel. Non-flood flows during the breeding season (typically February–September) are expected to increase on the Tuolumne and Merced Rivers and the LSJR under LSJR Alternative 2, and there would be a potential for increased flows to inundate nest sites of ground nesters. However, these areas already are subject to regular or periodic inundation from seasonal flood flows, the breeding populations are adapted to this variable environment, and the aggregate of the individual breeding periods for the different species results in a relatively large window of breeding time. As the flow alters the channels of the rivers, ground nesters would move with the establishment of emergent vegetation that they use as nesting habitat. Impacts would be less than significant.

Various special-status mammal species occur in the area of potential effects, including several bat species, riparian brush rabbit, and San Joaquin Valley woodrat. Changes in flows associated with LSJR Alternative 2 would be largely confined to existing channels and are not expected to affect upland breeding and foraging sites required by these mammals. Impacts would be less than significant.

Reservoirs

Special-status species found to occur in the area of potential effects around the reservoirs include Limestone salamander, which has been documented to occur at Lake McClure, and western pond turtle, which were observed within the zone of fluctuation around New Don Pedro Reservoir (TID and MID 2013a). Implementation of LSJR Alternative 2 is not expected to negatively impact special-status species around the reservoirs since the resulting water surface elevation fluctuations are not expected to be very different from the baseline conditions (Tables 8-7a, 8-7b, and 8-7c). Western pond turtles typically select nesting sites with at least some vegetation (low grasses and forbs), therefore these sites would not be impacted by frequent inundation and would therefore not be negatively impacted by implementation of LSJR Alternative 2.

Southern Delta

Modeled results indicate that EC values in the southern Delta could increase or decrease depending on which LSJR alternative is implemented (Tables 5-25 and Tables 5-26a, 5-26b, and 5-26c), but overall salinity in the southern Delta would be slightly reduced (Tables 5-29a, 5-29b, and 5-29c) under LSJR Alternative 2. These changes would be very small, if imperceptible. According to Impact BIO-1, LSJR Alternative 2 is not expected to impact the overall quantity or quality of the habitats in the southern Delta. Since habitats are not expected to be affected, the special-status species are not expected to be affected. Impacts would be less than significant.

Adaptive Implementation

Adaptive implementation of method 1 would allow an increase of up to 10 percent over the 20-percent minimum February–June unimpaired flow requirement (to a maximum of 30 percent of unimpaired flow). A change to the percent of unimpaired flow would take place based on required evaluation of current scientific information and would need to be approved as described in Appendix K, *Revised Water Quality Control Plan*. Accordingly, the frequency and duration of any use of this adaptive implementation method cannot be determined at this time. Adaptive implementation method 2 would allow changing the timing of the release of the volume of water within the February–June timeframe. While the total volume of water released February–June would be the same as LSJR Alternative 2 without adaptive implementation, the rate could vary from the actual (7-day running average) unimpaired flow rate. Method 2 would not authorize a reduction in flows required by other agencies or through other processes, which are incorporated in the modeling of baseline conditions. Method 3 would not be authorized under LSJR Alternative 2 since the unimpaired flow percentage would not exceed 30 percent. Adaptive implementation method 4 would allow an adjustment of the Vernalis February–June minimum flow requirement. WSE results show that changes due to method 4 under this alternative would rarely alter the flows in the three eastside tributaries or the LSJR.

If method 1 is implemented, an increase of up to 30 percent of unimpaired flow would potentially result in different effects as compared to 20 percent unimpaired flow, depending upon flow conditions and frequency of the adjustment, and more similar to those described under LSJR Alternative 3. Generally increased flows are expected to be largest during the riparian recruitment period (i.e., end of April–June). While established riparian species are adapted to periodic fluctuations in flow, there is potential for increased spring flows to help establish new vegetation. The viability of this habitat is key for the continued existence of many special-status species, and the loss of riparian vegetation has been an important factor in their decline. It is anticipated that an increase in flow would not result in a loss of riparian habitat. If method 2 is implemented, the total annual volume of water associated with LJSR Alternative 2 (i.e., 20 percent of the February–June unimpaired flow) would not change. As a result, the total volume of water that would remain in the river would not change with adaptive implementation method 2, and impacts associated with total volume of water would not change. Resources that are dependent on the timing or magnitude of flow could potentially be affected by method 2. Riparian resource recruitment in stream channels is somewhat dependent on the timing or magnitude of flow; however these resources are adapted to natural flood and drought cycles. Higher flows under adaptive implementation method 1 would not exceed the higher range of flows that could be experienced under baseline for some water years. However, given that this method would not allow flows to go below what is required by existing requirements on the three eastside tributaries and the SJR, impacts would be similar to those described above for LSJR Alternative 2 without adaptive implementation. Impacts would be less than significant.

Area of Potential Indirect Effects

Decreased surface water diversions associated with LSJR Alternative 2 with adaptive implementation has the potential to result in decreased surface water available for agricultural irrigation in the plan area. Existing agricultural lands that do not receive irrigation water may not necessarily be fallowed in perpetuity or potentially converted to non-agricultural uses. Other less intensive uses, such as dryland farming, deficit irrigation (i.e., reduction in irrigation), and grazing could take place on lands that experience a reduction in irrigation water. For example, some crops (e.g., alfalfa and pasture) are able to survive under deficit irrigation where only a portion of the crop water demands are met (Putnam et al. 2015a, 2015b). If the full water requirements were continually restricted, they could still potentially remain in agricultural use (Putnam et al. 2015a, 2015b). Furthermore, a reduction of irrigation water supply would not reduce the amount of other habitat within the plan area suitable for sensitive species, including riparian corridors, rangeland, and native and introduced trees.

While agricultural lands can be an important tool for species conservation, their value is usually derived from comparing habitat function to urban or industrial land use types. Therefore, it is expected that potential removal or reduction of active agriculture on lands which remain in a fallowed or other undeveloped or open space use would not result in a significant adverse effect on special-status and sensitive species. Moreover, a reduction of active agricultural management, soil tilling, crop harvesting, and herbicide and pesticide application, primarily in the plan area, would potentially benefit special-status species by reducing disturbance to potentially suitable habitat and by reducing overall population and habitat fragmentation. Special-status species within the plan area, such as California tiger salamander (*Ambystoma californiense*), San Joaquin kit fox (*Vulpes macrotis mutica*), Swainson's hawk (*Buteo swainsoni*), and various other California native wildlife populations declined as a result of the conversion California's annual grasslands to agricultural lands (CDFG 2000; Estep 1989; Loredo et al. 1996; Wheeler 2003; CDFW n.d.). Several Central Valley species identified in the USFW Recovery Plan (USFWS 1998) that occur in the San Joaquin Valley and in intermittent areas of the plan area, including the kit fox (noted as a keystone species for the Valley) and the blunt nosed leopard lizard (*Gambelia sila*), are particularly susceptible to active agricultural activities. Active agricultural activities have been identified as being detrimental to their habitat and survival (USFWS 1998). In particular, the principal factors in the decline of the San Joaquin kit fox were loss, degradation, and fragmentation of habitats associated with agricultural, industrial, and urban developments in the San Joaquin Valley. The conservation strategy for San Joaquin kit fox has been identified as strategically retiring agricultural lands that have serious drainage problems to reduce the effects of widespread habitat fragmentation of populations (USFWS 1998). Similarly, effects on the blunt nosed leopard lizards have been attributed to active agriculture as more than 95 percent of the original natural communities have been destroyed and collectively have caused the reduction and fragmentation of populations and decline of this species (USFWS 1998).

Lands that receive less irrigation water could prove valuable in providing habitat connectivity and reducing fragmentation for special-status and sensitive species, depending on the location of the land and the acreage. The special-status terrestrial wildlife habitat value for idle fields or pasture lands is typically higher than that of active agricultural fields due to the lack of seasonal anthropogenic disturbances and a reduction of the overall vegetative uniformity (USFWS 2009; USFWS 2010c; CDFW 2014b; Woodbridge 1991). For example, there is limited habitat functionality of orchard trees for nesting or roosting under active agricultural management. The existing limited habitat value would be exceeded by eventual establishment of native or suitably adapted introduced vegetation. This vegetation would not be subjected to the regular pruning, harvesting, and other disturbance activities typically associated with orchard trees, thereby providing more secure nesting opportunities. Similarly, native grass and shrub communities would provide greater foraging habitat value than intensively managed crops experiencing regular and periodic disturbance (e.g., plowing, mowing) and rodent control. All of these active agriculture activities reduce the available prey base for raptors. Populations of California tiger salamander, found in the San Joaquin Valley and in the plan area, would also benefit from the development of rodent communities in undisturbed land. Rodent holes are suitable habitat for the California tiger salamander and a reduction of heavily controlled rodent activities on active agricultural lands would result in a potential increase in habitat for this species. As such, the potential reduction of irrigation water to agricultural lands under LSJR Alternative 2 with adaptive implementation, with the resultant halting of mechanized agriculture, pesticide and rodenticide application, and anthropogenic disturbance is unlikely to result in a substantial adverse effect on sensitive or special-status species. Further, the potential reduction of monocultural irrigated crops is likely to support the species and ecosystem recovery strategy outlined in the USFWS recovery strategy. As such, it is not expected that a reduction in irrigation water supply would result in a substantial adverse indirect effects through habitat modification on special-status species. Impacts would be less than significant.

LSJR Alternatives 3 and 4 (Less than significant/Less than significant with adaptive implementation)

Rivers

Overall, median monthly flows would be higher on the Stanislaus, Tuolumne, and Merced Rivers and the LSJR under LSJR Alternatives 3 and 4. In some limited instances, LSJR Alternatives 3 and 4 would result in a reduction in flow, primarily during the wettest years, as a result of a reduced need for flood control releases. The overall volume of water February–June would be greater when compared to baseline conditions (Table 5-16) under the specified unimpaired flow requirements (i.e., 40 percent and 60 percent) and under the adaptive implementation methods 1, 2, and 3. Impacts on riparian habitat would be less than significant. Thus, the changes in riparian habitat are not anticipated to affect special-status animal species dependent upon riparian habitat, as described under the discussion for LSJR Alternative 2. Therefore, it is anticipated that impacts on special-status species as a result of LSJR Alternatives 3 and 4 would be less than significant.

Reservoirs

Special-status species found to occur in the area of potential effects around the reservoirs include Limestone salamander and western pond turtle. Results from the limestone salamander survey conducted around Lake McClure (Merced ID 2011b) indicate that while high water elevations occasionally inundate suitable habitat for limestone salamanders, these inundations rarely occur during periods when the salamanders are above ground. During rare periods when high water levels coincide with above-ground activity, it is likely that salamanders would be able to relocate upslope to avoid submersion. Western pond turtles typically select nesting sites with at least some vegetation (low grasses and forbs), therefore these sites would not likely be impacted by inundation due to water level fluctuation at the reservoirs. Implementation of LSJR Alternatives 3 and 4 is not expected to negatively impact special-status species around the reservoirs since the resulting water surface elevation fluctuations would not be very different from the baseline conditions (Tables 8-7a, 8-7b, and 8-7c).

Southern Delta

Modeled results indicate violations of the EC objectives in the southern Delta would decrease (Table 5-25 and Tables 5-27a, 5-27b, and 5-27c), and overall salinity in the southern Delta would be reduced (Tables 5-29a, 5-29b, and 5-29c) under LSJR Alternatives 3 and 4. These changes would be very small, if imperceptible. According to Impact BIO-1, LSJR Alternatives 3 and 4 are not expected to impact the overall quantity or quality of the habitats in the southern Delta. Since habitats are not expected to be affected, the special-status species are not expected to be affected. Impacts would be less than significant.

Area of Potential Indirect Effects

Decreased surface water diversions associated with LSJR Alternatives 3 or 4 with or without adaptive implementation have the potential to result in decreased surface water available for agricultural irrigation in the plan area. As discussed above under LSJR Alternative 2, with adaptive implementation, existing agricultural lands that do not receive irrigation water may not necessarily be fallowed in perpetuity or potentially converted to non-agricultural uses. Other less intensive uses such as dryland farming, deficit irrigation (i.e., reduction in irrigation), and grazing, could take place on lands that experience a reduction in irrigation water. For example, some crops (e.g., alfalfa and pasture) are able to survive under deficit irrigation where only a portion of the crop water demands are met (Putnam et al. 2015a, 2015b). If the full water requirements were continually restricted, they could still potentially remain in agricultural use (Putnam et al. 2015a, 2015b). Furthermore, a reduction in irrigation water supply would not reduce the amount of other habitat within the plan area suitable for sensitive species, including riparian corridors, rangeland, and native and introduced trees.

Similar to the discussion above for LSJR Alternative 2 with adaptive implementation, agricultural lands can be an important tool for species conservation, their value is usually derived from comparing habitat function to urban or industrial land use types. Therefore, it is expected that potential removal of active agriculture on lands which remain in a fallowed or other undeveloped use or open space uses would not result in a significant adverse effect on special-status and sensitive species. Moreover, a reduction of active agricultural management, soil tilling, crop harvesting, and herbicide and pesticide application, would potentially benefit special-status species by reducing disturbance to potentially suitable habitat and by reducing overall population and habitat fragmentation(CDFG 2000; Estep 1989; Loredo et al. 1996; Wheeler 2003; CDFW n.d.). Active agricultural activities have been identified as being detrimental to the habitat and survival of several special-status species, including the San Joaquin kit fox (*Vulpes macrotis mutica*) and blunt nosed leopard lizard (*Gambelia sila*) (USFWS 1998).

Lands that receive less irrigation water could prove valuable in providing habitat connectivity and reducing fragmentation for special-status and sensitive species, depending on the location of the land and the acreage. The special-status terrestrial wildlife habitat value for idle fields or pasture lands is typically higher than that of active agricultural fields due to the lack of seasonal anthropogenic disturbances and a reduction of the overall vegetative uniformity (USFWS 2009; USFWS 2010c; CDFW 2014b; Woodbridge 1991).

As such, the potential reduction of irrigation water to agricultural lands under the flow requirements, with the resultant halting of mechanized agriculture, pesticide and rodenticide application, and anthropogenic disturbance is unlikely to result in a substantial adverse effect on sensitive or special-status species. Further, the potential reduction of monocultural irrigated crops is likely to support the species and ecosystem recovery strategy outlined in the USFWS recovery strategy. As such, potential impacts on sensitive or special-status species as a result of a reduction in irrigation water under LSJR Alternatives 3 or 4 with or without adaptive implementation would be less than significant.

Impact BIO-5: Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan or conflict with any local policies or ordinances protecting biological resources

No Project Alternative (LSJR/SDWQ Alternative 1)

The No Project Alternative would result in implementation of flow objectives identified in the 2006 Bay–Delta Plan. See Chapter 15, *No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative impact discussion and Appendix D, *Evaluation of the No Project Alternative (LSJR Alternative 1 and SDWQ Alternative 1),* for the No Project Alternative technical analysis.

LSJR Alternatives

An activity could conflict with a conservation plan, such as the SJR Wildlife Refuge CCP and the San Joaquin County Multi-Species HCP, management plans of existing national wildlife refuges or other wildlife areas, natural community conservation plants, or local policies or ordinances, if it would substantially reduce the effectiveness of the plan's conservation strategies or otherwise prevent attainment of the plan's goals and objectives. Conflicts can result from reducing the viability of populations that are targets of the plan's goals, objectives, and conservation strategies. Also, other actions can conflict with implementing conservation plans and reduce the habitat value of conserved lands (e.g., by creating adjacent, incompatible land uses), interfere with the management of conserved lands (e.g., by eliminating access or water supplies), or eliminate opportunities for conservation activities (e.g., by developing land identified for preservation in the plan).

LSJR Alternative 2 (Less than significant/Less than significant with adaptive implementation)

LSJR Alternative 2 would not create adjacent incompatible land uses, develop land, or otherwise result in actions incompatible with conservation plans or activities as this alternative does not require or result in those types of activities. As described in Impact BIO-1 through Impact BIO-4, it is expected flows under LSJR Alternative 2 with adaptive implementation would have an overall cumulative distribution (i.e., the range of flows distributed between the minimum flow [thousand acre-feet] and the maximum flow over the entire 82-year historic modeling period) similar to baseline conditions on the Stanislaus River. The median monthly flows would generally be very similar to or greater than baseline flows on the Tuolumne and Merced Rivers and the LSJR under LSJR Alternative 2 with adaptive implementation. Furthermore, the overall volume of water described by the cumulative distribution of flows February–June would be slightly greater than baseline, with adaptive implementation. Similarly, implementation of LSJR Alternative 2 with adaptive implementation is not expected to lead to significant changes in water level fluctuation around the reservoirs and would not be incompatible with habitat conservation plans or activities at those locations. As such, the river flows and reservoir elevations are not expected to reduce the viability of populations that are targets of the various plan goals.

LSJR Alternative 2 could adjust existing water supply diversions; however, the average annual adjustment could be a reduction of approximately 3 percent in the entire plan area and vary between 2 and 6 percent in each of the tributaries (Table 5-19). This is within the general variability of surface water supply diversions provided from the three eastside tributaries and the LSJR (Table 5-20). As such, adjustments to water supply diversions are not expected to reduce the viability of populations that are targets of various plan goals.

LSJR Alternative 2 with adaptive implementation, is not expected to reduce the viability of populations that are targets of the various plan goals. Therefore, conflicts with an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan would not occur. Impacts would be less than significant.

LSJR Alternatives 3 and 4 (Less than significant/Less than significant with adaptive implementation)

LSJR Alternatives 3 and 4 would not create adjacent incompatible land uses, develop land, or otherwise result in actions incompatible with conservation plans or activities as these two alternatives do not require or result in those types of activities.

As described in Impact BIO-1 through Impact BIO-4, it is expected that flows under LSJR Alternatives 3 and 4 with or without adaptive implementation, would generally result in higher monthly flows on the three eastside tributaries and the LSJR. The expected increases in flows and the limited instances in which there would be a reduction in flows, would generally benefit biological species. Similarly, implementation of LSJR Alternatives 3 and 4 with adaptive implementation is not expected to lead to significant changes in water level fluctuation around the reservoirs and would not be incompatible with habitat conservation plans or activities. As such, the river flows and reservoir elevations are not expected to reduce the viability of populations that are targets of the various plan goals.

As discussed in Table 8-2, there are national wildlife refuges and other wildlife areas that receive water from the three eastside tributaries and the LSJR. Some of these have management plans and some do not. The wildlife areas that do not have management plans (Stanley Wakefield Wilderness Area, West Hilmar Wildlife Area, and Calaveras River Wildlife Area) rely on surface water supplies from flows of the rivers they are adjacent. Under LSJR Alternatives 3 and 4 with adaptive implementation these areas would typically experience higher flows when compared to baseline conditions. As such, it's expected that these areas would not experience elimination or reduced water supplies. Although these areas do not have management plans, given the flows in the rivers, and the discussion under Impacts BIO-1 through BIO-4, biological species would not be affected. The following wildlife refuges and areas have management plans or CCPs: North Grasslands Wildlife Area; SJR National Wildlife Refuge; Merced National Wildlife Refuge; and San Luis National Wildlife Refuge (Table 8-1 and Section 8.3, *Regulatory Background*). These refuges and areas rely on surface water supplies from the rivers through different mechanisms, including: appropriative rights; riparian rights; and contracts, as described in their water management plans (Table 8-1). Groundwater supplies augment surface water supplies, or provide water supply, for those areas that have groundwater wells (Table 8-1).

As described in Tables 5-19 and 5-20, water supply diversions may be reduced under LSJR Alternatives 3 and 4. This outcome has the potential to affect the sources of water for the wildlife areas. However, groundwater wells would continue to be used on all wildlife areas under the LSJR alternatives to provide water and augment water supply when needed, as they are currently under baseline conditions. In addition, existing policies and procedures in place on pooling, transfers, reallocations, and exchanges would be followed to ensure adequate water supply. These existing policies and procedures are established either within the management plans or in the CVPIA, or in water supply contracts. Furthermore, the wildlife areas have prioritized the habitat cover types that receive water during different year water types, depending on the availability of water, and this would continue under LSJR Alternatives 3 and 4. For example, under baseline conditions L4 (see Table 8-2) water is frequently not delivered to some wildlife areas, and the areas follow their plans and policies with respect to prioritization of the habitat cover types that receive water. Given the management of the different areas' water supplies, it is anticipated that adjustments to water supply under LSJR Alternatives 3 and 4 would not be expected to reduce the viability of populations that are targets of various plan goals.

LSJR Alternatives 3 and 4 with adaptive implementation are not expected to reduce the viability of populations that are targets of the various plan goals. Therefore, conflicts with an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan would not occur. Impacts would be less than significant.

8.4.4 Impacts and Mitigation Measures: Extended Plan Area

Bypassing flows, as described in Chapter 5, *Surface Hydrology and Water Quality,* in the extended plan area could potentially impact terrestrial biological resources in upstream reservoirs on the Stanislaus and Tuolumne Rivers differently in the extended plan area than described for the plan area. The reservoirs on the Stanislaus and Tuolumne Rivers may experience substantial changes in reservoir volume, especially under drought conditions under LSJR Alternatives 3 and 4, which are not experienced by the rim reservoirs in the plan area. This different potential impact occurs because these reservoirs are smaller than the downstream rim reservoirs, which could magnify individual changes. Reservoir drawdown would reduce the area and volume of water available for foraging, hunting, and fishing by avian and mammal species (e.g., shore birds, ducks, hawks, and bears). Reservoir drawdown could also remove the hydrologic connection of shoreline wetlands from the reservoir water. If this occurred, it would cause them to dry out during the drawdown period and could affect species reliant on these habitats. Amphibians dependent on wetlands or reservoir-associated aquatic habitat could also be affected. The extent and severity of the effect to mobile species would be reduced by their ability to move and use another reservoir or nearby aquatic resources. Sensitive plant species and wetland habitat that occur within the high water mark of the reservoirs may be affected the most. However, sensitive plant species in these reservoir fringe communities already experience desiccation during baseline reservoir drawdown and the impacts on them would not be substantially increased. Amphibian species in these fringe communities could be affected the most but some could also move to adjacent aquatic habitats such as inflowing streams and rivers.

Under LSJR Alternative 2 and under LSJR Alternative 3 in most years, the type and scale of impacts on these species and wetlands during individual reservoir drawdown events would be similar to what is experienced during baseline reservoir operations (USGS Reservoir Gage Data). Additionally, these reservoirs would refill during the subsequent wet season, limiting the duration of reduced reservoir elevation levels. In the most extreme cases, during drought years and years with substantial increases in bypasses in the extended plan area under LSJR Alternative 2 with adaptive implementation and LSJR Alternatives 3 and 4 with or without adaptive implementation, some reservoirs might be drawn more quickly, to lower levels, and for longer periods than under baseline conditions. If these conditions occurred, there would be adverse impacts on terrestrial species, primarily plant species and wetland habitats, because the reservoir habitat would be greatly reduced when compared to baseline conditions. Under these conditions, impacts on wetlands and wetland-associated species would be substantially longer than under baseline conditions.

The riparian habitat is limited along the steep bedrock banks of the rivers in the extended plan area. An increase in flow is not expected to impact terrestrial biological species (similar to the plan area). However, flows in the extended plan area could decrease in the fall relative to baseline under the LSJR alternatives, which is not anticipated to occur in the plan area. This could result in the potential for reduced habitat conditions for terrestrial species.

The increased frequency of lower reservoir levels and potential reduction in river flow in the fall resulting from the LSJR alternatives, however, would be limited by the program of implementation under each of the LSJR alternatives. The program of implementation requires minimum reservoir carryover storage targets or other requirements to help ensure that providing flows to meet the flow objectives will not have adverse temperature or other impacts on fish and wildlife. Other requirements, for example, include, but are not limited to, limits on required bypass flows for reservoirs that store water only for non-consumptive use so that some water can be temporarily stored upstream. The program of implementation also states that the State Water Board will take actions as necessary to ensure that implementation of the flow objectives does not impact supplies of water for minimum health and safety needs, particularly during drought periods. Accordingly, when the State Water Board implements the flow objectives in a water right proceeding, it will consider impacts on fish, wildlife, and other beneficial uses and health and safety needs, along with water right priority. Until the State Water Board assigns responsibility to meet the flow objectives in the Bay-Delta Plan, it is speculative to identify the exact extent, scope, and frequency of reduced diversions, reduced reservoir levels and their effects on wildlife and plant species, in the extended plan area. When implementing the flow objectives, the State Water Board would identify project-specific impacts and avoid or mitigate significant impacts of lower reservoir levels on wildlife species and habitat in accordance with CEQA.

At the time of preparation of this programmatic analysis, it is unclear to what extent any significant impacts could be fully mitigated to wildlife, wetland and other sensitive plant species. Thus, the potential exists for significant impacts. Therefore, this analysis conservatively concludes that impacts associated with lower reservoir levels under LSJR Alternatives 2 with adaptive implementation and LSJR Alternatives 3 and 4 with or without adaptive implementation are significant. The following mitigation measure is proposed: when considering carryover storage and other requirements to implement the flow water quality objectives in a water right proceeding, the State Water Board shall ensure that reservoir levels upstream of the rim dams do not cause significant wildlife impacts, unless doing so would be inconsistent with applicable laws. The impact is considered significant, even with mitigation, because the mitigation may not fully mitigate the impact in all situations.

8.5 Cumulative Impacts

For the cumulative impact analysis, refer to Chapter 17, *Cumulative Impacts, Growth-Inducing Effects, and Irreversible Commitment of Resources.*

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