Chapter 8
Terrestrial Biological Resources

8.1 Introduction

This chapter describes the environmental setting for terrestrial biological resources and the regulatory setting associated with these resources. It also evaluates environmental impacts on terrestrial biological resources that could result from the Lower San Joaquin River (LSJR) and southern Delta water quality (SDWQ) alternatives 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 Resources*.

For the Lower San Joaquin River (LSJR) alternatives, the plan area includes the LSJR, the three eastside tributaries (the Merced, Tuolumne, and Stanislaus Rivers), and their respective reservoirs (Lake McClure, New Don Pedro, and New Melones). Within the plan area, the area of potential effects for the LSJR alternatives for terrestrial biological resources, including riparian habitats, is defined as the channels of the three eastside tributaries and the LSJR, including the wetted areas directly adjacent to these channels that are affected by the existing flows or the flows that would result from the LSJR alternatives. This includes the bankfull channel below the floodplain and the areas immediately adjacent to the channel.

A summary of impacts on terrestrial biological resources is presented in Table 8-1. LSJR Alternatives 2–4 would result in the release of a percentage of unimpaired inflow from the reservoirs on the three eastside tributaries. There would be no mechanical soil disturbance, grading, grubbing, or other direct perturbation of the terrestrial environments. The alternative flow regimes would generally increase spring flows for February–June, but would not result in flows that are outside the variation observed under baseline flow conditions. As discussed in Chapter 5, *Water Supply, Surface Hydrology and Water Quality*, and Appendix F.1, *Hydrology and Water Quality Modeling*, flows on the Tuolumne and Merced Rivers are currently similar to LSJR Alternative 2 average unimpaired flows, and flows on the Stanislaus River are currently similar to LSJR Alternative 3 average unimpaired flows. These modeled changes in flow are the primary mechanism for impacts on terrestrial biological resources.

For the Southern Delta Water Quality (SDWQ) alternatives, the area of potential effects is defined as the southern Delta, which is generally within the boundary of the of the South Delta Water Agency. As discussed in Chapter 5, it is expected that the range of salinity, as measured by electroconductivity in the southern Sacramento–San Joaquin Delta, (Delta) would be the same as baseline conditions under the SDWQ alternatives (i.e., 0.2 deciSiemens per meter [dS/m]–1.2 dS/m). There would be no mechanical soil disturbance, grading, grubbing, or other direct perturbation of the terrestrial environments. The SDWQ alternatives are not expected to result in significant adverse modifications to the existing terrestrial habitat or result in impacts on plant and animal species. Therefore, the SDWQ alternatives are not analyzed in detail in this chapter.

Impacts related to LSJR Alternative 1 and SDWQ Alternative 1 (No Project) are presented in Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, and the supporting technical analysis is presented in Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*. Impacts related to methods of compliance are discussed in Appendix H, *Evaluation of Methods of Compliance*.

Table 8-1. Summary of Terrestrial Biological Resources Impacts

Alternative	Summary of Impact(s)	Significance Determination
BIO-1 : Have a substantial adverse effect on any riparian habitat or other sensitive natural terrestrial communities identified in local or regional plans, policies, regulations or by DFG and USFWS		
LSJR Alternative 1	See note. [1]	
LSJR Alternative 2	The lower spring median monthly flows and overall cumulative distribution of flows on the Stanislaus River would substantially affect existing riparian or sensitive terrestrial communities. Changes to median monthly flows and the overall cumulative distribution of flows on the Merced and Tuolumne Rivers and the LSJR would not substantially affect riparian or sensitive terrestrial communities because those flows would be within the historical range of existing flow variations. Fluctuations in reservoir elevations would not be substantially different than those that currently occur.	Significant and unavoidable
LSJR Alternatives 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.	Less than significant
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		
LSJR Alternative 1	See note. [1]	
LSJR Alternative 2	Community composition and wetland habitat location may change as a result of reduced monthly median flows on the Stanislaus River, Merced River, and LSJR; however, emergent wetlands typically occur in the river bed adjacent to the low-flow river channels and wetlands are highly resilient ecosystems that are able to withstand a range of hydrologic conditions. Therefore, a substantial adverse effect on wetlands communities would not occur. Monthly median flows on the Tuolumne River are expected to be similar to baseline conditions and, thus, would not pose a substantial adverse effect on wetland communities.	Less than significant

Alternative	Summary of Impact(s)	Significance Determination
LSJR Alternative 3	Community composition and wetland habitat location may change as a result of reduced monthly median flows on the Stanislaus River; however, emergent wetlands typically occur in the river bed adjacent to the low-flow river channels and wetlands are highly resilient ecosystems that are able to withstand a range of hydrologic conditions. Therefore, substantial impacts on wetlands communities would not occur. Monthly median flows and the cumulative distribution of flows on the 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. Therefore, a substantial adverse effect on wetland communities would not occur.	Less than significant
LSJR Alternative 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. Therefore, substantial adverse effects on wetland communities would not occur.	Less than significant
BIO-3: Facilitate an increase in distribution and abundance of invasive plants or nonnative wildlife that would have a substantial adverse effect on native terrestrial species.		
LSJR Alternative 1	See note. [1]	
LSJR Alternatives 2–4	Changes in flows and reservoir elevations may result in alteration of vegetation patterns in specific locations, but there is no information to suggest increased flows would substantially increase the distribution and abundance of invasive plant species.	Less than significant
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 DFG and USFWS		
LSJR Alternative 1	See note. [1]	
LSJR Alternative 2	The special-status animal species present in the area of potential effects are dependent on riparian habitat. Reduced flows on the Stanislaus River would have a substantial adverse effect on riparian habitat, as described above for BIO-1; therefore, it is expected that special-status animal species would be adversely affected.	Significant and unavoidable
LSJR Alternatives 3 and 4	The special-status animal species present in the area of potential effects are dependent on riparian habitat. As described above for BIO-1, there would not be a substantial change to available riparian habitat. Therefore, it is not expected that special-status animal species would be adversely affected.	Less than significant

Alternative	Summary of Impact(s)	Significance Determination
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		
LSJR Alternative 1	See note. [1]	
LSJR Alternatives 2	The lower spring median monthly flows and overall cumulative distribution of flows on the Stanislaus River would substantially affect existing riparian or sensitive terrestrial communities (BIO-1 and BIO-4). Therefore, impacts on biological resources would be significant on the Stanislaus River. By impacting habitat value, there would be a potential to conflict with plans protecting biological resources. Changes to median monthly flows and the overall cumulative distribution of flows on the Merced and Tuolumne Rivers and the LSJR would not substantially affect riparian or sensitive terrestrial communities because those flows would be within the historical range of existing flow variations. Therefore, impacts on habitat value would not occur and there would not be a potential to conflict with plans protecting biological resources.	Significant and unavoidable
LSJR Alternatives 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 or the special-status animal species dependent on them (BIO-1and BIO-4). 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

Notes:

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

8.2 Environmental Setting

The LSJR flows through the San Joaquin Valley, a geologic trough between the Coastal Ranges to the west and the Sierra Nevada mountains to the east. The eastside tributaries convey surface runoff (rain and snow melt) from the Sierra Nevada mountains to the LSRJ. The Upper SJR flows north through the valley and into the area of potential effects. In the Sacramento-San Joaquin River Delta, freshwater from the LSJR mixes 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 (DFG 2011). 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 (DFG 2011). Dams and water diversions have impaired river flow and modified inundation regimes. DFG (2011) 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 reviewto characterize the terrestrial biological resources in the area of potential effects for the LSJR and southern Delta. Field surveys were not conducted. 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, § 2070).
- 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 Game (DFG).

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 Lower San Joaquin River and Tributaries

This section describes the area of potential effects of the LSJR alternatives. Flows would only 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 wetted areas directly adjacent to these channels that are affected by the existing flows or the LSJR alternative flows. This includes the bankfull channel below the floodplain.

Snowmelt runoff from the Sierra Nevada mountains is the major source of water to the SJR and the eastside tributaries. As a result, peak flows historically occurred in May and June. Natural overbank flooding distributed higher flows outside 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 (USBR 2011). The natural levees and floodplains formed by these processes supported as many as 2 million acres of large, diverse riparian forests (DFG 2011). The LSJR and three eastside tributaries are now largely confined within constructed levees 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 2011).

State and federal efforts to preserve existing habitat functions have resulted in the establishment of the San Joaquin River National Wildlife Refuge and the West Hilmar Wildlife Area on the LSJR. The San Joaquin River National Wildlife Refuge was established in 1987 between the Tuolumne River and Stanislaus River confluences and encompasses more than 6,500 acres of riparian forest, wetlands, and grasslands (USFWS 2012a). The 340-acre West Hilmar Wildlife Area is on the east bank of the LSJR downstream of the Merced River confluence and consists of primarily oaks, cottonwoods, and grassland habitat, and is only accessible by boat (DFG 2012a).

Flow and sediment regulation, through the development of the rim dams, have been implicated as factors in the decline of riparian communities, both in general and specifically on the LSJR and eastside tributaries (Capon and Dowe 2006; DFG 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 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 sapling recruitment (TID and Merced ID 2011; USBR 2011). 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 Merced ID 2011; USBR 2011). This evolution has contributed to simplification of channel morphology and loss of channel margins (TID and Merced ID 2011).

Potentially Affected Habitats

Much of the native vegetation in the LSJR and the eastside tributaries has been replaced by introduced species or is disturbed by cultivation, grazing, and development. The extent of the river floodplains has been reduced by channeling and water management (DFG 2007; USBR 2011). Despite the loss of habitat associated with these activities, the rivers are generally flanked by a ribbon of riparian and wetland habitats.

A spatial query of the CNDDB reported the following special-status habitats to be within approximately 1,000 feet 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; DFG 2012b).

ESA defines "critical habitat" as specific geographic areas that contain features essential for the conservation of a threatened or endangered species and that may require special management and protection (16 U.S.C., § 1532.). 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 on the Tuolumne and Stanislaus 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 2012b).

The following sections describe the major vegetation communities and types of land cover in the area of potential effects. 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 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 (DFG 2011). 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 & Merced ID 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 2011).

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 2011).

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 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 2011).

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 2011).

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 2011). 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 2011).

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 2011).

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 2011). 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 heterogeneity (USBR 2011).

Emergent Wetlands

Emergent wetlands typically occur in the river bed adjacent to the low-flow river channels (Sawyer et al. 2009; USBR 2011). 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 2011). 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*) (DFG 2007; USBR 2011).

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.

Various assemblages of nonnative annual and perennial grasses are predominating, as well as occasional nonnative and native forbs (Sawyer et al. 2009; USBR 2011). 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 2011). 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 2011). 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 (DFG 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 very low potential for the LSJR alternatives to affect agriculture and disturbed habitats because they are typically located in upland areas outside of the river channel.

Potentially Affected Vegetation

A spatial query of the CNDDB revealed multiple special-status plant species that could occur within potentially affected habitats (DFG 2012b). 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. Table 8-2 shows those vegetation species that could be located within the area of potential effects.

Table 8-2. Special-Status Plants With Potential to Occur within the Area of Potential Effects

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.

Source: DFG 2012b
FT = Federally listed as threatened
CE = California listed as endangered
CNPS (California Native Plant Society) rarity rank

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 2011). There are a number of governmental agencies and nongovernmental organizations that have goals to limit or remove invasive species (see Sections 8.3.1 and 8.3.2). 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 (DFG 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 (DFG 2007). Invasive plants may not sustain the rich invertebrate communities or provide forage for terrestrial wildlife as effectively as do native riparian plants (DFG 2007; USBR 2010). Invasive riparian plants also colonize channel and floodplain surfaces that can alter hydrologic processes and interfere with flood control (Moyle and Bennett 2008; USBR 2010, 2011). Removal or control of invasive riparian plants constitutes a substantial investment of capital resources (DFG 2007; USBR 2010).

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*) (DFG 2007; USBR 2010, 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).

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 (DFG 2003). A spatial query of the CNDDB revealed 18 special-status animal species reported to occur within the area of potential effects (DFG 2012b); these species are listed in Table 8-3.

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 2010).

Table 8-3. Special-Status Animals With Potential to Occur in the Area of Potential Effects

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.
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	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 inornatus	San Joaquin pocket mouse	CSC	Dependent on riparian forests with dense understory. Present in Caswell Memorial State Park on the Stanislaus River.
Rana aurora draytonii	California red-legged frog	FT, CSC	Permanent and semipermanent 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: DFG 2012b

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

8.2.2 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 (DFG 2007). Today, agricultural land dominates the southern Delta. Levees typically have waterside slopes that are covered with riprap and actively maintained, which includes 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 (DFG 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) (DFG 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 (DFG 2012b). 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 8-4) (DFG 2012b). 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 8-4. Special-Status Plants With Potential to Occur within the Area of Potential Effects

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: DFG 2012b

CE = California listed as endangered
CNPS = 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 (DFG 2007; USBR 2010, 2011). Invasive plants displace native vegetation and provide lower-quality habitat for native wildlife (DFG 2007). Invasive plant stands may not sustain rich invertebrate communities or provide forage for terrestrial wildlife as effectively as do native communities (DFG 2007; USBR 2010). Invasive riparian plants also colonize channel and floodplain surfaces that can alter hydrologic processes and interfere with flood control (Moyle and Bennett 2008; USBR 2010, 2011).

Potentially Affected Wildlife

More than 200 species of wildlife utilize the terrestrial habitats of the Delta (DFG 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 (DFG 2003). About 27 species of waterfowl are found in the Delta and LSJR (DFG 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 (DFG 2003).

Small mammals find suitable habitat in the Delta and upland areas. Vegetated levees, remnants of riparian forest, and undeveloped islands still sustain about 40 species of mammals (DFG 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 8-5) (DFG 2012b). 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 (DFG 2003).

8.3 Regulatory Setting

8.3.1 Federal

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

Federal Endangered Species Act of 1973

USFWS and the National Marine Fisheries Service implement ESA (16 U.S.C., § 1531, et seq.). Threatened and endangered species on the federal list (50 CFR § 17.11, 17.12) are protected from "take" (direct or indirect harm), unless an ESA Section 10 (16 U.S.C., § 1539) Permit is granted or an ESA Section 7 (16 U.S.C., § 1536) BO with incidental take provisions is obtained. Pursuant to the requirements of ESA, an agency reviewing a proposed project within its jurisdiction must determine whether any federally listed species may be present in the project area and determine whether the proposed project would have a potentially significant impact upon such species. Under ESA, habitat loss is considered to be an impact on the species. In addition, the agency is required to determine whether the project would be likely to jeopardize the continued existence of any species proposed to be listed under ESA or result in the destruction or adverse modification of critical habitat proposed to be designated for such species (16 U.S.C. § 1536(a)(2)). 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.

Table 8-5. Special-Status Animals With Potential to Occur within the Area of Potential Effects

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 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 xanthocephalus	yellow-headed blackbird	CSC, MB	Uses wetlands.

Source: DFG 2012b

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

Recovery Plan for Upland Species of California

The R*ecovery 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. While not regulatory in nature, the Recovery Plan needs to 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. The San Joaquin River National Wildlife Refuge has prepared a final CCP. 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 San Joaquin River 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 San Joaquin River National Wildlife Refuge.

Migratory Bird Treaty Act of 1918

Under the Migratory Bird Treaty Act of 1918 (16 U.S.C., §§ 703–712), migratory bird species and their nests and eggs that are on the federal list (50 C.F.R., § 10.13) are protected from injury or death. Disturbances must be reduced or eliminated during the nesting cycle.

Bald and Golden Eagle Protection Act of 1940

The Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. § 668) specifically protects bald and golden eagles from harm and prohibits trade in parts of these species.

Federal Power Act

The Federal Powers Act includes provisions requiring that the Federal Energy Regulatory Commission (FERC) take into account the value of fish and wildlife resources when licensing hydroelectric projects. Section 10 of the Federal Power Act requires FERC to consider resource agency recommendations regarding the protection of wildlife and establishes a federal statutory basis for FERC to impose monitoring obligations on hydroelectric projects. In many instances, this has resulted in hydropower operators regulated by FERC () developing invasive species 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.) prohibits "take" (defined as hunt, pursue, catch, capture, or kill) of species listed under CESA. A CESA permit must be obtained if a project will result in take of listed species, either during construction or over the life of the project. Fish and Game Code Section 2081 establishes an incidental take permit program for state-listed species. Under CESA, DFG has the responsibility for maintaining a list of threatened and endangered species designated under state law (Fish & G. Code, § 2070). DFG also maintains lists of species of special concern that serve as watch lists. Impacts on species on the CESA list would be considered significant and would require mitigation.

Species Protected Under the California Fish and Game Code

California Fish and Game Code Sections 4700, 5050, and 5515 designate certain mammal, amphibian, and reptile species as "fully protected," making it unlawful to take, possess, or destroy these species except under issuance of a specific permit. California Fish and Game Code Sections 3503, 3503.5, and 3800 prohibit the possession, incidental take, or needless destruction of covered birds, nests or eggs. California Fish and Game Code Section 3511 designates certain bird species "fully protected," making it unlawful to take, possess, or destroy these species except under issuance of a specific permit.

California Native Plant Protection Act of 1977

The California Native Plant Protection Act of 1977 (Fish & G. Code, § 1900 et seq.) requires DFG to establish criteria for determining if a species or variety of native plant is endangered or rare. Section 1913 of the code requires that landowners notify DFG at least 10 days prior to initiating activities that will destroy a listed plant to allow for the salvage of plant material.

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 DFG, 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 Department of Boating and Waterways (CDBW) is the lead agency for the survey and control of Brazilian waterweed and water hyacinth in the Delta.
- The Noxious Weed Information Project (NWIP), a product of CDFA, provides maps and other information for CDFA, biologists, and the general public (http://www.cdfa.ca.gov/plant/ipc/noxweedinfo/noxweedinfo_hp.htm).
- California Invasive Plant Council's (Cal-IPC) mission is to protect California's lands and waters from ecologically-damaging invasive plants through science, education, and policy. They work

closely with agencies, industry, and nonprofit organizations to support research, restoration work, and public education (http://www.cal-ipc.org/ip/index.php).

California Weed Management Areas

California's Weed Management Area (WMA) program was created by AB 1168 in 1999. The California Department of Food and Agriculture reviews proposals from established weed management areas 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 on 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. 2006–2012).

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.

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 (San Joaquin County 1992).

8.4 Impact Analysis

This section lists the thresholds used to define impacts on terrestrial biological resources. It describes the methods of analysis and the approach to determine the significance of impacts on terrestrial biological resources. It also identifies impacts that are not evaluated further in the impact discussion. The impact discussion describes the changes to baseline resulting from the alternatives and incorporates the thresholds for determining whether those changes are significant. Measures to mitigate (i.e., avoid, minimize, rectify, reduce, eliminate, or compensate for) significant impacts accompany the impact discussion, where appropriate.

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) and the Environmental Checklist in Appendix G of the State CEQA Guidelines. The thresholds derived from the checklist(s) have been modified, as appropriate, to meet the circumstances of the alternatives (Cal. Code Regs., tit. 23, § 3777, subd. (a)(2)). In this chapter, BIO-3, involving invasive plants and nonnative wildlife, is an addition to the checklist thresholds. Terrestrial biological impacts were determined to be potentially significant (see Appendix B, *State Water Board's Environmental Checklist* in this SED) and therefore are discussed in the analysis. Impacts would be significant if the LSJR alternatives result in any of the following conditions.

- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by DFG or USFWS.
- Have a substantial effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Facilitate a substantial increase in the 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 DFG 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.

As discussed in Appendix B, *State Water Board's Environmental Checklist,* the LSJR and SDWQ alternatives would result in either no impact or less-than-significant impacts to 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

Information from Appendix C, *Technical Report on the Scientific Basis for Alternative San Joaquin River Flow and Southern Delta Salinity Objectives,* is incorporated into the analysis as well as information from Chapter 7, *Aquatic Resources,* as it relates to flow. Results from the State Water Board's Water Supply Effects (WSE) model presented in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality,* and Appendix F.1, *Hydrologic and Water Quality Modeling,* were reviewed. As described in Chapter 3, *Alternatives Description*, the percent of unimpaired flow requirement, as specified by a particular LSJR alternative, would cease to apply during high flows or flooding to preserve public health and safety. The State Water Board would coordinate with federal, state, and local agencies to determine when it is appropriate to waive the requirements. Action stages for the three eastside tributaries are identified in Table 6-4 and are a reasonable proxy for the purposes of the SED analysis to describe when the unimpaired flow requirements might be waived as a result of public health and safety concerns. The WSE modeling performed for this chapter and other chapters uses monthly flow limits derived from observed flows above which the unimpaired flow requirement no longer applies. The modeling and incorporation of the limits is further discussed in Appendix F.1 and Appendix L, *Sensitivity Analyses*.

The National Marine Fisheries Service biological opinion Stanislaus River reasonable and prudent alternative, including Action 3.1.3 (NMFS BO) flows on the Stanislaus River are included in the baseline for modeling purposes. However, these flows are not included in the WSE modeling of the LSJR alternatives. Instead, the WSE modeling of the LSJR alternatives assumes that a certain percent (20, 40 or 60) of unimpaired flow will be met, which may be lower or higher than the NMFS BO flows. As a result, when the WSE model results are compared to baseline, the modeling shows some reductions in flows on the Stanislaus River under some of the LSJR alternative conditions. However, because the State Water Board's plan amendment would not directly result in any changes to the NMFS BO flow requirements on the Stanislaus River, actual reductions in flows below the NMFS BO flows would be unlikely to result from this project. At the same time, the NMFS BO flow requirements may change in the future as a result of coordination between the State Water Board, NMFS, and others. Accordingly, a conservative assessment of potential impacts on the Stanislaus River that captures a range of flow-related impacts was performed. Flows under the NMFS BO fall within this range. In addition, a sensitivity analysis showing the effects of the plan amendments on flows with the NMFS BO in effect is presented in Appendix L, *Sensitivity Analyses.*

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 7, *Aquatic Resources,* Section 7.4, the cumulative distribution[1] 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 a good summary of the range of flows that would be observed 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, and therefore the expected type of terrestrial habitat conditions under baseline and LSJR alternative conditions (see Appendix F.1, Section F.1.3, for additional information and summary data regarding cumulative distributions). Other general trends related to flow are summarized below.

- The Stanislaus River currently experiences flows that are approximately 40 percent of the average unimpaired flow February–June; the lowest monthly flows on the Stanislaus would be eliminated under LSJR Alternatives 2, 3, and 4.

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[1] The cumulative distribution of a particular variable (e.g., flows) is determined by sorting the values from minimum to maximum and graphing them as the percentage of the total number of values. The lowest value is at the left of the graph (e.g., 0 percent) and the highest value is at the right of the graph (100 percent). The cumulative distribution indicates the probability of occurrence for the variable. 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 at the end of resource Chapters 5–14, Chapter 4, *Introduction to Analysis*, Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, and Chapter 16, *Cumulative Impact Summary, Growth-Inducting Effects, and Irreversible Commitment of Resources.*

- The frequency of flows at 2,500 cfs would increase on the Stanislaus River under LSJR Alternatives 3 and 4.
- The Merced and Tuolumne Rivers currently experience flows that are approximately 20 percent of the average unimpaired flow February–June; the lowest monthly flows on the Merced and Tuolumne would be eliminated under LSJR Alternatives 2, 3 and 4.
- The frequency of flows at 2,500 cfs would increase on the Merced and Tuolumne Rivers under LSJR Alternatives 3 and 4.
- The LSJR currently experiences flows that are approximately 20 percent of the average unimpaired flow February–June; the lowest monthly flows on the LSJR would be eliminated under LSJR Alternatives 2, 3, and 4.
- Flood control releases would occur independent of the LSJR Alternatives 2, 3 and 4, and none of the alternatives would modify the flood flows or flood releases on the three eastside tributaries or the LSJR.

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. As described in Chapter 6, *Flooding, Sediment, and Erosion*, there would not be a significantly increased risk of flooding and flows caused by the LSJR alternatives would largely be confined within existing channels. While it is generally assumed that any elevation of the groundwater table or seepage that may result from higher water levels would tend to benefit native Delta species, impacts on the terrestrial system would be largely immeasurable. Therefore, this analysis does not consider potential impacts of the LSJR alternatives below Vernalis.

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; State Water Board 1999; USFWS 2012b; Riparian Habitat Joint Venture 2004; Moyle and Bennett 2008; Moise and Hendrickson 2002; Sawyer et al. 2009; DFG 2012b, 2003). BIO-1 focuses on potential impacts on riparian habitats. Impacts on freshwater marsh are discussed in BIO-2. Impacts on the elderberry savanna are not further considered because this community occurs on floodplains, and there would not be increased flooding as a result of the LSJR alternatives; however, as individual elderberry shrubs are found in riparian vegetation and habitat wthin river channels, the effects to species relying on elderberry shrubs are included in BIO-4.

Baseline conditions and LSJR alternative surface water elevations for the three reservoirs (New Melones, New Don Pedro, and Lake McClure), are presented in Appendix F.1 (Tables F.1-9c, F.1-9h, F.1-9k, F.1-10b, F.1-10f, F.1-10j, F.1-11b, F.1-11f, F.1-11j, F.1-12b, F.1-12f, and F.1-12j). 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 historical record was 63 feet for New Melones, 58 feet for New Don Pedro, and 81 feet for Lake McClure. Year to year fluctuation of reservoir surface water elevation is large. New Melones Reservoir minimum fluctuation range is 18 feet and its maximum fluctuation range is 194 feet; New Don Pedro's minimum fluctuation range is 24 feet and maximum fluctuation range is 174 feet; and Lake

McClure's minimum fluctuation range is 17 feet and maximum fluctuation range is 238 feet. 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. Furthermore, modeled surface water elevations at the reservoirs are expected to remain similar to baseline conditions as discussed in Appendix F.1 because reoperating the reservoirs to meet the LSJR alternatives requires carryover storage similar to baseline conditions. Tables 8-6a, 8-6b, and 8-6c characterize the potential water surface fluctuations under the LSJR alternatives. For the purpose of relative comparison, the tables summarize the percent of time the reservoirs would fluctuate greater than 10 feet. The results show that the fluctuation of elevations under the LSJR alternatives are expected to be similar to baseline conditions, and in many cases would result in a more stable environment throughout the year.

This information was incorporated to qualitatively evaluate direct and indirect impacts on terrestrial biological resources as a result of the LSJR alternatives. 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, non-fatal stresses upon plants and animals, and/or habitat degradation.

Table 8-6a Percent Surface Water Elevation Fluctuation Greater than 10 feet for New Melones Reservoir

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Baseline % Fluctuation	5%	2%	12%	27%	32%	22%	39%	59%	34%	27%	38%	10%
LSJR Alternative 2 Fluctuation	5%	1%	9%	23%	29%	22%	18%	46%	39%	40%	51%	16%
LSJR Alternative 3 Fluctuation	1%	1%	12%	27%	28%	21%	15%	48%	33%	39%	41%	6%
LSJR Alternative 4 Fluctuation	0%	1%	11%	27%	16%	6%	21%	52%	21%	10%	15%	4%

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

Table 8-6b Percent Surface Water Elevation Fluctuation Greater than 10 feet for New Don Pedro Reservoir

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Baseline % Fluctuation	5%	2%	17%	18%	28%	26%	13%	37%	51%	74%	94%	4%
LSJR Alternative 2 Fluctuation	0%	2%	15%	16%	27%	20%	10%	45%	40%	70%	90%	7%
LSJR Alternative 3 Fluctuation	0%	2%	15%	17%	27%	18%	5%	40%	32%	54%	67%	5%
LSJR Alternative 4 Fluctuation	0%	2%	13%	16%	21%	11%	4%	40%	30%	35%	33%	12%

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

Table 8-6c Percent Surface Water Elevation Fluctuation Greater than 10 feet Lake McClure

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Baseline % Fluctuation	22%	4%	10%	17%	28%	56%	55%	77%	39%	91%	94%	74%
LSJR Alternative 2 Fluctuation	26%	1%	9%	13%	24%	60%	61%	68%	39%	85%	91%	61%
LSJR Alternative 3 Fluctuation	20%	2%	9%	13%	28%	48%	41%	66%	40%	80%	89%	52%
LSJR Alternative 4 Fluctuation	22%	2%	10%	16%	30%	34%	27%	62%	38%	77%	83%	32%

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

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). Currently, salinity in the southern Delta ranges between 0.2 dS/m and 1.2 dS/m during all months of the year. In addition, a strong relationship is observed between salinity at Vernalis and salinity in the southern Delta; the measured EC at Brandt Bridge is increased by a maximum of 0.2 dS/m above the Vernalis salinity (Figure F.1-14a) and is increased by a maximum of 0.4 dS/m at Tracy Boulevard (Figure F.1-14b). Thus, because salinity at Vernalis is always below the current objective (0.7 or 1.0 dS/m) (State Water Board 2006, Table 2), salinity in the southern Delta is maintained between 0.2 dS/m and 1.2 dS/m (based on the historical monthly EC record). This information is used to qualitatively asses the effects of the LSJR alternatives on water quality, specifically salinity, in the southern Delta with respect to terrestrial habitat and species.

SDWQ Alternatives

Terrestrial biological resources could be affected if salinity levels change substantially such that existing habitat or plants could not survive. However, as discussed in Chapter 5, *Water Supply, Surface Hydrology, and Water Quality*, the existing water quality in the southern Delta ranges between 0.2 dS/m and 1.2 dS/m during all months of the year. There is a strong relationship between salinity at Vernalis and salinity in the southern Delta, which increases by a maximum of 0.2 dS/m above the Vernalis salinity. Thus, when salinity at Vernalis is at the existing salinity objective, the salinity in the southern Delta generally stays between 0.7 dS/m and 1.2 dS/m (based on the historical monthly salinity record). Any fluctuation of salinity in the southern Delta as a result of the SDWQ alternatives is expected to be similar to that of historical fluctuations because the salinity objective at Vernalis would be maintained. Furthermore, the SDWQ alternatives do not have the ability to result in changes to flow because they are water quality objectives for salinity. The volume of water needed to meet the Vernalis EC objective is included in the WSE modeling results and, therefore, in the impact determinations for the LSJR 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, the SDWQ alternatives are expected not to impact 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 as described in Chapter 5. 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.

Because there is limited potential for the SDWQ alternatives to impact terrestrial species in the southern Delta, 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, there would be no impacts. Therefore, these alternatives are not further discussed in this section.

8.4.3 Impacts and Mitigation Measures

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

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 2010). 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 growing in and adjacent to the river channels. 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 San Joaquin River 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). Riparian habitats at the reservoirs in the area of potential effects are currently subject to fluctuating water levels (Tables 8-6a, b, and c). Furthermore, there is generally a lack of vegetation in the zone of fluctuation created by variations in surface water elevation levels. 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. Shore erosion occurs at all surface water elevation levels but is most severe when surface water elevation levels change rapidly (Baird and Associates 2004).

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). 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 and in Chapter 5. 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 1: No Project

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

LSJR Alternative 2: 20% Unimpaired Flow (Significant and unavoidable)

The modeling results indicate that under LSJR Alternative 2, the Stanislaus River would experience reduced monthly median flows in the spring. As described in Chapter 7, *Aquatic Resources* (Figures 7-4a, and 7-4b) LSJR Alternative 2 would result in lower monthly median flows in April, May and June when compared to baseline conditions on the Stanislaus River. 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 lower under LSJR Alternative 2 when compared to baseline conditions (Figures 7-4b). This means that the total volume of water available February–June on the Stanislaus River would be reduced when compared to baseline conditions (Figures 7-4b). This trend is expected, given that baseline conditions are approximately 40 percent of the average unimpaired flow and the LSJR Alternative 2 would have an unimpaired flow of approximately 20 percent. The baseline flows on the Stanislaus are currently high in April, May, and partially in June as a result of the mandated pulse flows required by the NMFS BO.

The reduction in the overall volume of water February–June on the Stanislaus River would not provide an opportunity to adaptively manage the flows February–June because there would not be enough water to redistribute between months (i.e., February–May) without experiencing substantial reductions in all months. Thus, additional flows could not be provided under LSJR Alternative 2 during mid-April to June, when riparian vegetation and sensitive plant species typically need flows to complete their life cycles. Therefore, because LSJR Alternative 2 is expected to substantially reduce median monthly flows, as well as the overall volume of water February–June when compared to baseline conditions, impacts on riparian or other sensitive plant species or communities on the Stanislaus River would be significant.

An SED must identify feasible mitigation measures for each significant environmental impact identified in the SED. (Cal. Code Regs., tit. 23, § 3777(b)(3)). In order to reduce significant impacts identified above, the State Water Board would need to require more flow on the Stanislaus River. Evaluating the effects of more flow on the different rivers is part of other alternatives (i.e., LSJR Alternatives 3 and 4) and is thus separately considered in this document. Requiring additional flow cannot be independently applied under LSJR Alternative 2 as a mitigation measure because requiring additional flow would be inconsistent with the terms of LSJR Alternative 2 (i.e., requiring 20 percent of unimpaired flow on the Stanislaus River). Furthermore, as noted above, the flows required on the Stanislaus River under LSJR Alternative 2 would be much less than compared to baseline, thus they could not be adaptively managed to provide additional flows in the spring time during the germination period for riparian vegetation. Finally, replacing riparian vegetation through restoration could possibly offset impacts of the lower flows expected under LSJR Alternative 2. In the program of implementation, the State Water Board identifies actions by other agencies, which include restoration efforts on the three eastside tributaries. Because of the timing and overall volume of reduction of flows, it is unlikely restoration actions by other agencies would serve to fully mitigate impacts. Impacts would remain significant and unavoidable.

Modeling results indicate that the median monthly flows would generally be very similar to baseline conditions on the Tuolumne River February–June under LSJR Alternative 2 (Figure 7-5a and Figure 7-5b). Furthermore, the overall volume of water described by the cumulative distribution of flows February–June would be very similar to LSJR Alternative 2. Therefore, significant impacts on riparian vegetation or other sensitive plant communities on the Tuolumne River are not expected. Impacts would be less than significant.

The modeled monthly median flows on the Merced River and LSJR would be reduced in April when compared to the baseline conditions under LSJR Alternative 2 (Figure 7-6a and Figure 7-7a). This reduction may result in vegetation encroachment in the river channel, a lack of hospitable seed beds, and a lower propensity for germination of cottonwood and willow species during their seed release periods (generally mid-April to June). This could curb the recruitment of new cohorts, which may be limiting to the habitat in the long term. However, the cumulative distribution of flows on both the Merced River and LSJR would be similar to baseline conditions (approximately 20 percent of the average unimpaired flow) (Figure 7-6b and Figure 7-7b). This means the overall volume of water in the rivers February–June would be the similar when compared to the baseline conditions. While there may be less flow in April, impacts could be offset by more flow at other times of year (June) and provide a more natural flow pattern for riparian species because the total quantity of water provided by LSJR Alternative 2 is similar to baseline on the Merced River (see Appendix C, *Technical Report on the Scientific Basis for the Alternative San Joaquin River Flow and Southern Delta Salinity Objectives*) . Further, flows would be expected to be adaptively managed to maximize protection for fish as described in Chapter 7, *Aquatic Resources* and Appendix K, *Revised Water Quality Control Plan*. Such adaptive management is expected to indirectly benefit native vegetation because flows could increase during the earlier germination months and sustain the base flows to support the growth of this vegetation community. Therefore, impacts would be less than significant.

Furthermore, monthly median flows on the Merced River and LSJR would be similar to baseline conditions July–September. Many riparian species reproduce throughout the year (under proper growing conditions, including high flows) via vegetative propagules which break off living plants and are transported downstream (Stillwater Sciences 2003b). Following recruitment and establishment, growth of riparian vegetation is dependent, in part, on the availability of groundwater. Because of the typical relationship between surface water flows and groundwater elevations, higher and more stable surface flows in the summer and early fall would be expected to result in the potential capacity for increased growth. Furthermore, once riparian species have established roots in the phreatic zone (i.e., zone of saturation in the subsurface), they are less vulnerable to low surface flows. Therefore, subsequent periods of low flow would not be expected to substantially reduce the quantity of riparian habitat supported by the river system. Although the rivers would experience lower median monthly flows in the early spring, the expected higher flows July–September suggest that the flows would continue to support existing riparian vegetation during the period associated with growth (late spring to early fall). Therefore, the flow patterns under LSJR Alternative 2 are unlikely to adversely affect established individuals. 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 when compared to baseline conditions. For these reasons, significant impacts on riparian communities and other sensitive plant communities are not expected on the Merced River and LSJR. Impacts would be less than significant.

Under LSJR Alternative 2, all three reservoirs would generally experience a decrease in substantial surface water elevation fluctuations (i.e., greater than 10 feet). This would result in a more stable nearshore environment. A decrease in the likelihood of reservoir surface water elevation fluctuation may permit some vegetation establishment in the zone of fluctuation, although such colonization would be limited by substrate suitability, since 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. 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 surface water elevations at the reservoirs. Impacts on riparian habitat or other sensitive terrestrial plant communities or special-status plant species at the reservoirs would be less than significant.

Modeling results indicate that, as a result of LSJR Alternative 2, salinity in the southern Delta would exceed the historical monthly salinity conditions but not exceed the overall historical range experienced by the southern Delta. April–September is the irrigation season when historically salinity increases as a result of agricultural irrigation runoff. Table 5-29a indicates that the change in the April–September median (50 percent cumulative) EC value at Vernalis from baseline to LSJR 2 was 0.024 dS/m (0.516–0.540 dS/m), and the change in the 90 percent cumulative EC value at Vernalis from baseline to LSJR 2 was 0.010 dS/m (0.634–0.644 dS/m). Table 5-29b indicates that the change in the April–September (irrigation season) median (50 percent cumulative) EC value at Brandt Bridge (and Union Island) from baseline to LSJR 2 was 0.031 dS/m (0.554–0.585 dS/m), and the change in the 90 percent cumulative EC value from baseline to LSJR 2 was 0.001 dS/m (0.720–0.721 dS/m). Table 5-29c indicates that the change in the April–September (irrigation season) median (50 percent cumulative) EC value at Tracy Boulevard (and Union Island) from baseline to LSJR Alternative 2 was 0.037 dS/m (0.635–0.673 dS/m), and the change in the 90 percent cumulative EC value from baseline to LSJR Alternative 2 was 0.004 dS/m (from 0.877 to 0.881 dS/m). These changes with respect to terrestrial habitat would be very small, if imperceptible under LSJR Alternative 2 because riparian habitat in the southern Delta tolerates brackish 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.

LSJR Alternative 3: 40% Unimpaired Flow (Less than significant)

Modeled results indicate that LSJR Alternative 3 would result in lower monthly median flows on the Stanislaus River, particularly in April, when compared to the baseline (Chapter 7, *Aquatic Resources,* and Figure 7-4a). Additionally, modeled results for the Stanislaus River indicate that under LSJR Alternative 3, flows would generally remain the same or slightly increase throughout the summer (June–August) and into the fall (September–November) (Chapter 7 and Figure 7-4a). Finally, modeled results indicate that the distribution of flows on the Stanislaus River February–June would be the same under LSJR Alternative 3 when compared to baseline conditions (Chapter 7, Figure 7-4b, and Appendix F.1). Therefore, under LSJR Alternative 3 it would be expected that higher flows July–September would continue to support existing riparian vegetation during the period associated with growth (late spring to early fall), as described under LSJR Alternative 2. Furthermore, since the overall volume of water February–March would be similar to the volume of water in baseline conditions, the water would be adaptively managed such that the lower monthly median flows could be replaced with higher flows from other months without limiting flows in those other months. This would provide flows in the spring time that are needed during germination of riparian plants. As described above under LSJR Alternative 2, the adaptive management process is incorporated into the program of implementation to maximize the benefits to fish (see Chapter 7 and Appendix K, *Revised Water Quality Control Plan*). While the measures and process will be related to fish and aquatic species, they are expected to result in increases to flow during the spring months that would also benefit riparian habitat.

Modeled results indicate LSJR Alternative 3 would result in higher monthly median flows and similar distribution of flows on the Merced and Tuolumne Rivers and the LSJR February–June (Chapter 7 and Figures 7-5a, 7-5b, 7-6a, 7-6b, 7-7a, and 7-7b). As such, riparian habitat 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).

Surface water elevation fluctuations at the reservoirs would remain similar to baseline conditions and would generally not experience a significant increase in fluctuations greater than 10 feet throughout the year (Tables 8-6a, b, and c). In July, reservoir elevation fluctuations greater than 10 feet would increase by 2 percent at New Melones, and would not occur at the other reservoirs. However, 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 because the disturbed substrate would provide limited opportunities for additional vegetation establishment. Impacts on riparian habitat or other sensitive terrestrial communities or special-status plant species would be less than significant.

Modeling results show that under LSJR Alternatives 3, violations of the EC objectives in the southern would decrease (Tables 5-27a–c), and overall salinity in the southern Delta would be reduced (Tables 5-29 a–c). These changes with respect to terrestrial habitat would be very small, if imperceptible under LSJR Alternative 3. 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.

LSJR Alternative 4: 60% Unimpaired Flow (Less than significant)

Modeled monthly median flows on all three eastside tributaries and the LSJR would increase under LSJR Alternative 4. Therefore, the impacts under LSJR Alternative 4 for the increase in average flows on the Merced and Tuolumne Rivers and the LSJR would be the same as described above under LSJR Alternative 3. Additionally, similar impacts on riparian habitat on the Stanislaus River would be expected because modeled monthly median flows in the spring would increase on this river similarly to the other two tributaries when compared to the baseline (Chapter 7 and Figure 7-4b). Therefore, when considering the expected increase in flows and the adaptive management process, it is anticipated that LSJR Alternative 4 would not have a substantial effect on riparian habitat or other sensitive terrestrial communities. Impacts would be less than significant.

Surface water elevation fluctuations at the reservoirs would remain similar to baseline conditions and would not experience a significant increase in fluctuations greater than 10 feet throughout the year (Tables 8-6a, b, and c). 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 or special-status plant species would be less than significant.

Modeling results show that under LSJR Alternatives 4, conditions violations of the EC objectives in the southern would decrease (Tables 5-28a–c), and overall salinity in the southern Delta would be reduced (Tables 5-29 a–c). These changes with respect to terrestrial habitat would be very small, if imperceptible under LSJR Alternative 4. 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.

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

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 to 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 2010). 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 would baseline seasonal flows. 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 2010).

LSJR Alternative 1: No Project

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

LSJR Alternative 2: 20% Unimpaired Flow (Less than significant)

Modeled monthly median flows are expected to decrease on the Stanislaus River, Merced River, and the LSJR in the spring when compared to baseline conditions, as described under BIO-1. Emergent wetlands are the wetland community most likely to occur within the area of potential effects for these rivers. As described above, emergent wetlands typically occur in the river bed adjacent to the low-flow river channels. As a result of LSJR Alternative 2, there may be more exposed soil available for wetland species establishment in the spring on the Stanislaus and Merced Rivers and the LSJR. Wetlands are highly resilient ecosystems that are able to withstand a range of hydrologic conditions. Although community composition and wetland habitat location may change as a result of LSJR Alternative 2, this would not represent an adverse effect on wetland communities. (Note that impacts on special-status plant species are described above under Bio-1). Impacts would be less than significant.

Modeled monthly median flows under LSJR Alternative 2 would generally be similar to baseline conditions on the Tuolumne River. As a result, there would be no substantial change to conditions supporting wetlands in the area of potential effects. Impacts would be less than significant.

Under LSJR Alternative 2, reservoir levels would generally fluctuate less when compared to baseline conditions. As discussed above, the wetland habitats in the area of potential effects are highly resilient and adaptable to changes in the hydrologic regime. 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. Wetlands typically do not exist within the zone of fluctuation at reservoirs because of the lack of suitable soil and the continued fluctuation of surface water 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. Therefore, LSJR Alternative 2 would not substantially alter wetland communities along the LSJR and three eastside tributaries or at the reservoirs. Impacts would be less than significant.

LSJR Alternative 3: 40% Unimpaired Flow (Less than significant)

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; DFG 2011). 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 Resources*). Impacts on wetland communities would be less than significant.

Under LSJR Alternative 3, reservoir levels would generally fluctuate less when compared to baseline conditions. Furthermore, there are no known significant assemblages of wetlands along the shores of these reservoirs that would be isolated as wetlands typically do not exist within the zone of fluctuation at reservoirs because of the lack of suitable soil and the continued fluctuation of surface water elevations. Impacts would be less than significant.

LSJR Alternative 4: 60% Unimpaired Flow (Less than significant)

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.

The reservoir surface water elevation levels are not expected to experience large fluctuations with any greater frequency than under baseline conditions (Tables 8-6a through 8-6c). Furthermore, there are no known significant assemblages of wetlands along the shores of these reservoirs that would be isolated as wetlands typically do not exist within the zone of fluctuation at reservoirs because of the lack of suitable soil and the continued fluctuation of surface water elevations. Finally, wetland communities that occur along the margin of aquatic and upland habitats are generally resilient to changes in the location of this interface and are able to adjust to the new location. Impacts would be less than significant.

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

There are currently nonnative plant species present in the area of potential effects along the rivers and at the reservoirs. 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. 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; DFG 2011). 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; DFG 2011). 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 where root zone inundation becomes more frequent (favoring native riparian plant species) or large areas of bare ground are exposed (favoring nonnative plant species), 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.

LSJR Alternative 1: No Project

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

LSJR Alternatives 2, 3, and 4: 20% Unimpaired Flow, 40% Unimpaired Flow, and 60% Unimpaired Flow (Less than significant)

As described above, invasive plants and animals already exist throughout the area of potential effects. While the LSJR alternatives 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. Therefore, it is anticipated that impacts on native terrestrial species would be less than significant.

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 DFG and USFWS

Numerous special-status animal species are found within the area of potential effects. 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 lead to a reduction in riparian habitat (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 species (DFG 2011). The LSJR alternatives may cause some temporary habitat disturbances, especially within channels, that might adversely affect some special-status animals. However, the LSJR alternatives would also likely 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.

LSJR Alternative 1: No Project

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

LSJR Alternative 2: 20% Unimpaired Flow (Significant and unavoidable)

As discussed in BIO-1, modeled monthly median flows on the Stanislaus River are expected to be lower, and the overall volume of water February–June is expected to be lower, when compared to baseline conditions during riparian recruitment period (i.e., end of April–June). While established riparian species are adapted to periodic fluctuations in flow, there is potential for reduced spring flows to limit establishment of 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. For the Stanislaus River, the impact on special-status animal species dependent on this habitat would be significant.

As described in BIO-1, In order to reduce significant impacts identified above, the State Water Board would need to require more flow on the Stanislaus River. Evaluating the effects of more flow on the different rivers is part of other alternatives (i.e., LSJR Alternatives 3 and 4) and is thus separately considered in this document. Requiring additional flow cannot be independently applied under LSJR Alternative 2 as a mitigation measure because requiring additional flow would be inconsistent with the terms of LSJR Alternative 2 (i.e., requiring 20 percent of unimpaired flow on the Stanislaus River). Furthermore, as noted above, the flows required on the Stanislaus River under LSJR Alternative 2 would be much less than compared to baseline, thus they could not be adaptively managed to provide additional flows in the spring time during the germination period for riparian vegetation. Finally, replacing riparian vegetation through restoration could possibly offset impacts of the lower flows expected under LSJR Alternative 2. In the program of implementation, the State Water Board identifies actions by other agencies, which include restoration efforts on the three eastside tributaries. Because of the timing and overall volume of reduction of flows, it is unlikely restoration actions by other agencies would serve to fully mitigate impacts. Impacts would remain significant and unavoidable.

As discussed under BIO-1, impacts on riparian habitats would be less than significant on the Tuolumne River, Merced River, and LSJR. This is because monthly median flows on the Tuolumne River would be similar to baseline conditions and the overall distribution of flows February–June would be similar to baseline conditions on the Merced River and LSJR. Although there would be periods during which river flows would be lower than baseline conditions, vegetation that comprises riparian habitat has adapted various mechanisms to withstand these conditions. Thus, the changes in riparian habitat are not anticipated to affect animal species dependent upon riparian habitat. Finally, with the adaptive management process, the volume of water that would be allocated to these rivers February–June can be adaptively managed to accommodate the modeled decreases in monthly median flows in April and May such that they would be balanced with the other months and sustain baseline flows. A discussion of special-status species that could reside in the area of potential effects is included below. Species include: elderberry shrubs, California red-legged frogs, California tiger salamanders, western spadefoot toads, 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 species on the Merced River, Tuolumne River, 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 and are generally not subject to regular inundation or scouring, although they can withstand periodic inundation (USBR 2010). 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 Merced and Tuolumne 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. 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 well 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. Nonflood 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. 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.

LSJR Alternatives 3 and 4: 40% Unimpaired Flow and 60% Unimpaired Flow (Less than significant)

Overall, median monthly flows would be higher on the Merced River, Tuolumne River, and LSJR under LSJR Alternatives 3 and 4 and higher on the Stanislaus River under LSJR Alternative 4. Where there would be an increase in river flows, impacts would be similar to those identified above for LSJR Alternative 2.

Modeled monthly median flows on the Stanislaus River under LSJR Alternative 3 would be lower in April; however, the overall volume of water February–June would be similar to that of baseline conditions (as described above under BIO-1 for LSJR Alternative 3). Impacts on riparian habitat would be less than significant because of the various dispersal methods used by riparian vegetative species and the ability of established plants to withstand low flow conditions. Thus, the changes in riparian habitat are not anticipated to affect animal species dependent upon riparian habitat. Additionally, with the adaptive management process, the volume of water February–June can be managed to accommodate the modeled decreases in monthly median flows in April and May on the Stanislaus River such that they would be balanced with the other months and sustain baseline flows. Therefore, it is anticipated that impacts on special-status species as a result of LSJR Alternative 3 on the Stanislaus River would be less than significant.

BIO-5: Conflict with 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

An activity would conflict with a conservation plan, such as the San Joaquin River Wildlife Refuge CCP and the San Joaquin County Multi-Species HCP, if it would substantially reduce the effectiveness of the plan's conservation strategies or otherwise prevent attainment of the plan's goals and objectives (USBR 2010). 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). By all of these mechanisms, an activity can also conflict with a local policy or ordinance for protecting biological resources.

LSJR Alternative 1: No Project

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

LSJR Alternative 2: 20% Unimpaired Flow (Significant and unavoidable)

LSJR Alternative 2 would not create adjacent incompatible land uses, eliminate access to water, or develop land. As described in BIO-1 through BIO-4, it is expected the flows under LSJR Alternative 2 would result in impacts that are less than significant to riparian habitat, special-status species, and other communities on the Merced and Tuolumne Rivers and the LSJR. These alternatives 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 would not occur and impacts on the Merced River, Tuolumne River, and LSJR would be less than significant.

On the Stanislaus River, it is expected the flows under LSJR Alternative 2 would result in impacts that are significant to riparian habitat and special-status species. The San Joaquin River National Wildlife Refuge is approximately 6,500 acres of riparian forest, wetlands and grasslands between the Tuolumne River and Stanislaus River confluences. Because it is between the Tuolumne River and Stanislaus River confluences it is unlikely flows from the Stanislaus River that enter the LSJR and move downstream into the southern Delta would greatly influence the habitat in this wildlife area. The San Joaquin Multi-Species HCP covers the entire San Joaquin County area, which includes parts of the Stanislaus River. Thus the reduced flows could indirectly affect or conflict with the HCP by reducing the habitat value of conserved lands adjacent to the Stanislaus River. As discussed in BIO-1,in order to reduce significant impacts identified above, the State Water Board would need to require more flow on the Stanislaus River. Evaluating the effects of more flow on the different rivers is part of other alternatives (i.e., LSJR Alternatives 3 and 4) and is thus separately considered in this document. Requiring additional flow cannot be independently applied under LSJR Alternative 2 as a mitigation measure because requiring additional flow would be inconsistent with the terms of LSJR Alternative 2 (i.e., requiring 20 percent of unimpaired flow on the Stanislaus River). Furthermore, the flows required on the Stanislaus River under LSJR Alternative 2 would be much less than compared to baseline, thus they could not be adaptively managed to provide additional flows in the spring time during the germination period for riparian vegetation. Finally, replacing riparian vegetation through restoration could possibly offset impacts of the lower flows expected under LSJR Alternative 2. In the program of implementation, the State Water Board identifies actions by other agencies, which include restoration efforts on the three eastside tributaries. Because of the timing and overall volume of reduction of flows, it is unlikely restoration actions by other agencies would serve to fully mitigate impacts. Impacts would remain significant and unavoidable.

LSJR Alternatives 3 and 4: 40% Unimpaired Flow and 60% Unimpaired Flow (Less than significant)

LSJR Alternatives 3 and 4 would not create adjacent incompatible land uses, eliminate access to water, or develop land. While median monthly flows on the Stanislaus River may be reduced from baseline conditions as identified in BIO-1, it is expected this reduction in flows would result in impacts that are less than significant for the reasons identified in BIO-1. Furthermore, the impact determinations for BIO-1 through BIO-4 under LSJR Alternatives 3 or 4 would either result in no impacts or impacts that are less than significant to terrestrial biological species and habitat. These alternatives 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 would not occur. Impacts would be less than significant.

8.5 Cumulative Impacts

8.5.1 Definition

Cumulative impacts are defined in the State CEQA Guidelines (Cal. Code regs., tit. 14, § 15355) as “two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts.” A cumulative impact occurs from “the change in the environment which results from the incremental impact of the project when added to other closely related past, present, and reasonably foreseeable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time” (*Id*., subd. (b)).

Consistent with the State CEQA guidelines (Cal. Code Regs., tit. 14, § 15130, subd. (a)), the discussion of cumulative impacts in this chapter focuses on significant and potentially significant cumulative impacts. The State CEQA Guidelines (*Id*., subd. (b)) state the following.

> The discussion of cumulative impacts shall reflect the severity of the impacts and their likelihood of occurrence, but the discussion need not provide as great detail as is provided for the effects attributable to the project alone. The discussion should be guided by the standards of practicality and reasonableness, and should focus on the cumulative impact to which the identified other projects contribute rather than the attributes of other projects which do not contribute to the cumulative impact.

8.5.2 Past, Present, and Reasonably Foreseeable Future Projects

Chapter 16, *Cumulative Impact Summary*, *Growth-Inducting Effects, and Irreversible Commitment of Resources* includes a list of past, present, and reasonably foreseeable future projects considered for the cumulative analysis.

Present and reasonably foreseeable future projects are projects that are currently under construction, approved for construction, or in final stages of formal planning. These projects were identified by reviewing available information regarding planned projects and are summarized in Chapter 16. Present and reasonably foreseeable future projects related to terrestrial biological resources or that could affect terrestrial resources include all projects listed in Chapter 16.

8.5.3 Significance Criteria

Two significance criteria must be met for any environmental consequence to have a significant cumulative impact: (1) the effect must make a cumulatively considerable incremental contribution to an overall cumulative impact, and (2) the overall cumulative impact (considering past, present, and reasonably foreseeable future projects) must be significant. (See Cal. Code Regs., tit. 14, §§ 15064, 15065, 15130.) The cumulative analysis uses the impact threshold topics discussed in the impact analysis (i.e., substantial adverse effect on: riparian habitat or sensitive natural community; federally protected wetlands; terrestrial animal species identified as special status; or conflict with HCP or NCCP provisions).

8.5.4 Mitigation Measures for Significant Cumulative Impacts

As specified by Section 15130 of the State CEQA Guidelines (2012) the analysis of cumulative impacts will examine feasible options for mitigating or avoiding a project's contribution to any significant cumulative effects. With some projects, the only feasible mitigation for cumulative impacts may be the adoption of ordinances or regulations rather than the imposition of conditions on a project-by-project basis. Mitigation measures to reduce an alternative's contribution to significant cumulative effects are presented below where feasible and appropriate.

8.5.5 Cumulative Impact Analysis

Methodology

The significance of cumulative effects on terrestrial biological resources depends on not only the direct impacts of each past, present, and reasonably foreseeable project, but also the timing and proximity of the projects, the proximity of the projects to migration corridors and special habitats, and the overall character of the area where there are multiple projects. The effects of the alternatives were qualitatively evaluated with past, present, and reasonably foreseeable future projects to identify cumulatively considerable impacts on terrestrial species that may not otherwise take place. Where appropriate, the cumulative analysis is combined for various alternatives.

Geographic Scope

The geographic scope of the cumulative analysis for terrestrial resources is the same as described in the impact analysiss above. It includes the area of potential effects along the three tributaries and the southern Delta and past, present, and reasonably foreseeable future projects that may take place in the area of potential effects and could affect terrestrial biological species.

Analysis

The combined effects of past and present activities in the three tributaries and the southern Delta have led to a decline in the diversity and abundance of terrestrial species and habitats. Specifically, riparian habitat along the three tributaries has substantially declined because of land use alterations in areas within and adjacent to the river channels that include aggregate (e.g., gravel) removal and agriculture. In addition, building dams and levees for flood protection has led to a reduction of terrestrial habitat due to changes in natural river channels and modifications to the frequency, duration, and magnitude of natural river flows. Some present projects and reasonably foreseeable future projects include restoration projects and habitat conservation plans on the three tributaries, LSJR, and southern Delta (e.g., *Bay Delta Habitat Conservation Plan*, Upper San Joaquin River Restoration Program, Knights Ferry Floodplain and Side-channel restoration, Lower Tuolumne River Big Bend Project, Tuolumne River Restoration Projects including Warner Deardorff Segment – Mining Reach Project No. 3, as identified in Chapter 16, *Cumulative Impact Summary, Growth-Inducing Effects, and Irreversible Commitment of Resources*). These efforts are meant to recover certain species (primarily aquatic species) and habitat (including some riparian, floodplain, and adjacent terrestrial habitats). These efforts would work in conjunction to support terrestrial species and replace habitat that has been lost (e.g., riparian) that could benefit terrestrial species. While there may be some short-term impacts on sensitive terrestrial species and habitat, such as indirect effects associated with construction noise or temporary removal of habitat, overall these efforts would support the recovery of sensitive terrestrial species and habitat. However, given the current condition of terrestrial species in the three eastside tributaries, LSJR, and the Bay-Delta, the cumulative impacts of past, present, and reasonably foreseeable future projects combined have been cumulatively considerable and significant with respect to terrestrial resources.

LSJR Alternative 2 is expected to have significant impacts on riparian habitat and sensitive species that may depend on riparian habitat as a result of lower monthly median flows on the Stanislaus River. This alternative is expected to contribute to reductions in habitat necessary for special-status species on the Stanislaus River. Present and future projects that are implemented are not expected to have substantial reductions in flow on the Stanislaus River and, therefore, are not expected to otherwise decrease the quantity of riparian habitat adjacent to the Stanislaus River. However, because of the expected conditions on the Stanislaus River under LSJR Alternative 2, the impacts, in combination with past, present, and reasonably foreseeable projects, are expected to result in cumulatively considerable impacts. Cumulative impacts would be considered significant. As discussed in BIO-1, the significant cumulative impacts on the Stanislaus River associated with riparian habitat, sensitive species, and conflicts with NCCPs/HCPs could be reduced or lessened with additional flow, beyond that which is currently required by LSJR Alternative 2. Additional flow could be provided by reducing existing surface water diversions. Evaluating the effects of more flow and fewer surface water diversions is part of other alternatives (i.e., LSJR Alternatives 3 and 4) and is separately considered in this document. Therefore, it cannot be independently applied as a mitigation measure. Furthermore, as noted above in the impact analysis, the flows required on the Stanislaus River under LSJR Alternative 2 would sometimes be much less than baseline and could not be adaptively managed to provide additional flows. Therefore, there are no feasible mitigation measures to avoid, minimize, rectify, reduce, or eliminate the impact, and this cumulative impact would remain significant and unavoidable. Conditions on the Merced and Tuolumne Rivers and the LSJR under LSJR Alternative 2 are expected to result in generally higher monthly median flows or an overall increase in the volume of water in the rivers February–June. These flows are expected to improve riparian habitat, sensitive plant communities, and sensitive species conditions on these rivers under these flows. Therefore, the incremental contribution of LSJR Alternative 2 on the Merced and Tuolumne Rivers and the LSJR would not be cumulatively considerable, and cumulative impacts would be less than significant.

LSJR Alternatives 3 or 4 are expected to have less than significant impacts on riparian habitat, special-status plan communities and special-status species. The higher monthly median flows on the rivers or the overall increase in the volume of water on the rivers February–June is expected to promote riparian habitat and would support riparian sensitive species because riparian communities withstand variation in flow and that they would experience flows during riparian germination season. Therefore, LSJR Alternatives 3 or 4 are not expected to result in conditions that may be less favorable to special-status species and would not result in a cumulatively considerable contribution to the conditions established by past, present, and reasonably foreseeable future actions. Therefore, the incremental contribution of LSJR Alternative 3 or 4 would not be cumulatively considerable and cumulative impacts would be less than significant.

8.6 References Cited

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