3.6 Biological Resources—Terrestrial

This section describes terrestrial biological resources that could be affected by implementation of the proposed program—specifically, sensitive habitats and sensitive plant and wildlife species. Sensitive habitats and species as used in this document fall into several categories:

- Habitats and species regulated under federal law, the California Fish and Game Code, or other State laws
- Habitats recognized as sensitive by the California Department of Fish and Game (DFG) or other resource agencies
- Plant species considered by DFG to be rare, threatened, or endangered (plants assigned a rank in the California Rare Plant Rank system, formerly known as the California Native Plant Society (CNPS) Lists)

These are terrestrial plants, animals, and natural communities that may be experiencing threats to their populations and habitats.

This section is composed of the following subsections:

- Section 3.6.1, "Environmental Setting," describes the physical conditions in the study area as they apply to terrestrial biological resources.
- Section 3.6.2, "Regulatory Setting," summarizes federal, State, and regional and local laws and regulations pertinent to evaluation of the proposed program's impacts on terrestrial biological resources.
- Section 3.6.3, "Analysis Methodology and Thresholds of Significance," describes the methods used to assess the environmental effects of the proposed program and lists the thresholds used to determine the significance of those effects.
- Section 3.6.4, "Environmental Impacts and Mitigation Measures for NTMAs," discusses the environmental effects of near-term management activities (NTMAs) and identifies mitigation measures for significant environmental effects.
- Section 3.6.5, "Environmental Impacts, Mitigation Measures, and Mitigation Strategies for LTMAs," discusses the environmental effects of long-term management activities (LTMAs), identifies mitigation

measures for significant environmental effects, and addresses conditions in which any impacts would be too speculative for evaluation (CEQA Guidelines, Section 15145).

NTMAs and LTMAs are described in detail in Section 2.4, "Proposed Management Activities."

See Section 3.5, "Biological Resources—Aquatic," for a discussion of effects on aquatic species.

3.6.1 Environmental Setting

Information Sources Consulted

Sources of information used to prepare this section include the following:

- The California Wildlife Habitat Relationships System, operated by DFG's Biogeographic Data Branch (DFG 2010)
- Multisource land cover data for the State of California, available from the California Department of Forestry and Fire Protection's Fire and Resource Assessment Program (CAL FIRE 2002)
- The CNPS Online Inventory of Rare and Endangered Plants (CNPS 2010)
- California Natural Diversity Database GIS data for sensitive species occurrences (CNDDB 2010)

Geographic Areas Discussed

Terrestrial biological resources are discussed separately for the following geographic areas within the study area (see Figure 1-1 in Chapter 1.0, "Introduction") because of differences in the terrestrial biological resources that may occur and the potential effects of the program on those resources:

- Extended systemwide planning area (Extended SPA) divided into the Sacramento and San Joaquin Valley and foothills, and the Sacramento–San Joaquin Delta (Delta) and Suisun Marsh
- Sacramento and San Joaquin Valley watersheds
- SoCal/coastal Central Valley Project/State Water Project (CVP/SWP) service areas

The Sacramento and San Joaquin Valley and foothills geographic area of the Extended SPA extends from an elevation of 13 feet in the city of Stockton to roughly 4,500 feet at Lake Almanor. The Sacramento and San

Joaquin Valley watersheds extend from an elevation of approximately 40 feet in the city of Manteca to 14,248 feet at the peak of North Palisade in the Sierra Nevada. None of the management activities included in the proposed program would be implemented in the SoCal/coastal CVP/SWP service areas. In addition, implementation of the proposed program would not result in long-term reductions in water deliveries to the SoCal/coastal CVP/SWP service areas (see Section 2.6, "No Near- or Long-Term Reduction in Water or Renewable Electricity Deliveries"). Given these conditions, only negligible to no effects on terrestrial biological resources are expected in the portion of the SoCal/coastal CVP/SWP service areas located outside of the Sacramento and San Joaquin Valley and foothills and the Sacramento and San Joaquin Valley watersheds; therefore, that geographic area is not discussed in detail in this section.

Greater detail is provided in this section for the Extended SPA than for the rest of the study area because the proposed program would have more varied and substantially greater effects on the Extended SPA than on the Sacramento and San Joaquin Valley watersheds, where effects would be localized, or on the SoCal/coastal CVP/SWP service areas where no project activities would occur. For the Sacramento and San Joaquin Valley and foothills portion of the Extended SPA, the description of terrestrial biological resources is organized by habitat type. For each habitat type in this area, a discussion of habitat structure and value for sensitive species is provided; where related to the analysis of potential effects, important ecological processes and past and present habitat alterations are discussed. For the remainder of the study area, the discussion is largely limited to potentially affected resources that were not previously discussed for the Sacramento and San Joaquin Valley and foothills.

For the entire study area, the environmental setting focuses on biologically sensitive terrestrial habitats and species that may experience substantial effects, and more specifically on the aspects of their ecology that could be affected by the proposed program.

Extended Systemwide Planning Area

Sacramento and San Joaquin Valley and Foothills The Sacramento and San Joaquin Valley and foothills include a variety of both upland and lowland habitats. This section discusses these habitats in terms of ecological processes, community composition, sensitivity, and relative habitat value for sensitive plant and wildlife species. Because of the sensitivity of riparian habitat and freshwater emergent wetlands, and because the proposed program could substantially affect most of the remaining riparian vegetation and much of the remaining freshwater emergent wetland in the Sacramento and San Joaquin Valley, the ecology

of these two habitat types is discussed in greater detail than that of other habitat types.

Overview of Habitat Types and Sensitive Wildlife Species Figures 3.6-1a and 3.6-1b show the extent and location of the major habitat types in the Sacramento and San Joaquin Valley and foothills and the Delta–Suisun Marsh, as mapped for the California Fire and Resource Assessment Program (FRAP) (CAL FIRE 2002). The FRAP provides a single information source on habitat types that encompasses the entire program area. However, because of the methodology used, FRAP mapping does not capture all community types present or the full extent of each type. FRAP is a compilation of the best available land cover data as of 2002 (CAL FIRE 2002). The land cover data, provided as a 100-meter grid, were compiled into the California Wildlife Habitat Relationships (WHR) classification system. The WHR system does not include categories for plant communities associated with vernal pools and seasonal wetlands and has only two categories for riparian communities (montane riparian and valley and foothill riparian). Vernal pools and other seasonal wetlands are ephemeral and not easily identified without on-the-ground investigations and are therefore not typically included in regional-scale land cover data; however, they are described as a sensitive habitat in this discussion of environmental setting.

Table 3.6-1 provides a brief description and the acreage of each habitat type mapped by the FRAP in the Sacramento and San Joaquin Valley and foothills and in the Delta–Suisun Marsh, as well as descriptions of additional sensitive habitats not mapped by the FRAP (e.g., seasonal wetlands). Table 3.6-2 lists the number of special-status species associated with each habitat type (which are discussed in more detail below).

Riparian and Open-Water Habitats Because riparian and open-water habitats are located in channels and on streambanks and floodplains, and because flood flows play a major role in their ecology, these habitats may experience greater and more varied effects than other sensitive habitats in the Sacramento and San Joaquin Valley and foothills with implementation of the proposed program. Thus, these habitats are described in more detail to support the analysis of these potential impacts. Open-water habitats are discussed in Section 3.5, “Biological Resources—Aquatic”; however, use of open water by terrestrial wildlife is included in the following description of riparian habitats. This description is organized into four subsections: vegetation structure, ecological processes, wildlife use, and historical alterations.

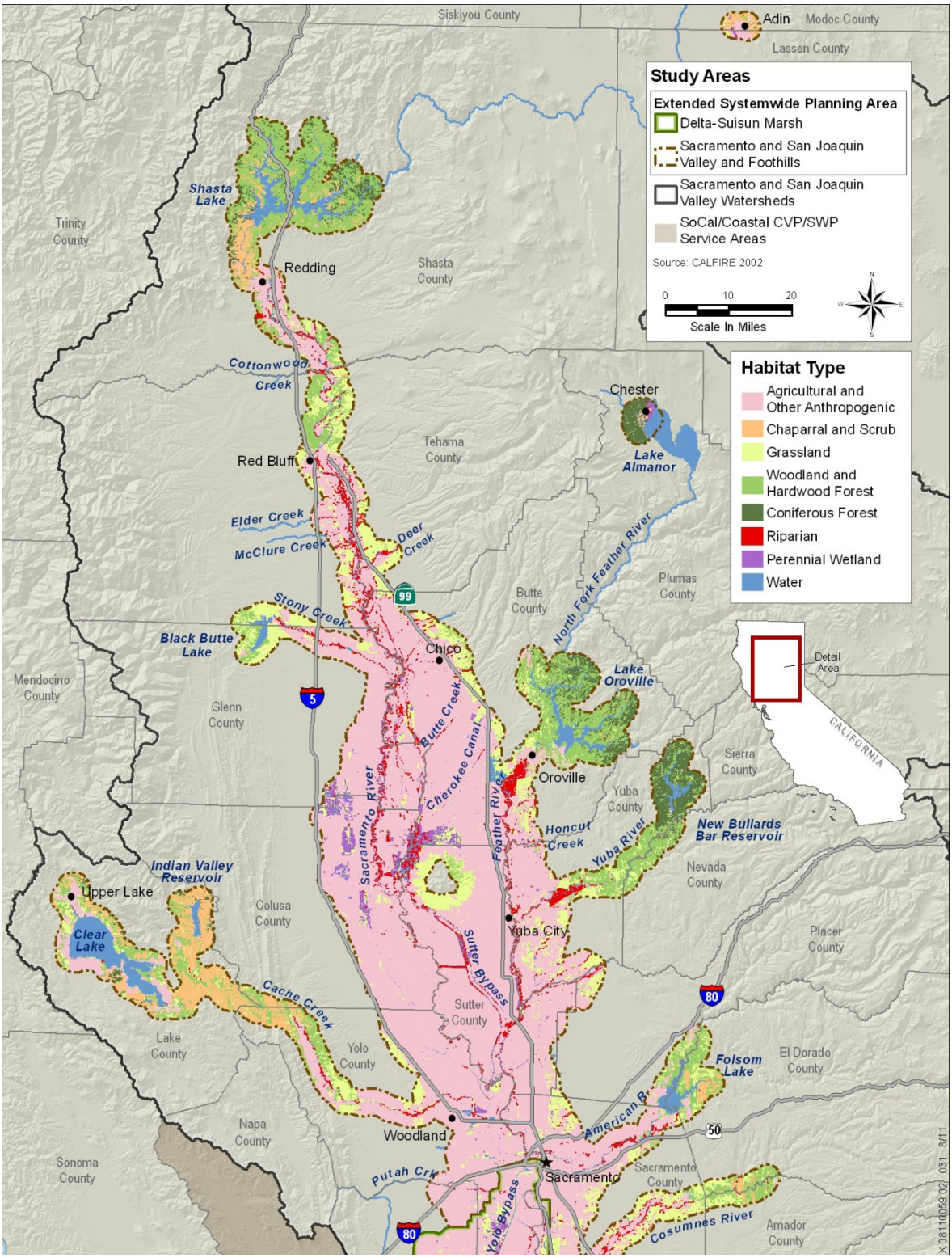

Figure 3.6-1a. Habitats of the Extended Systemwide Planning Area (Northern Portion)

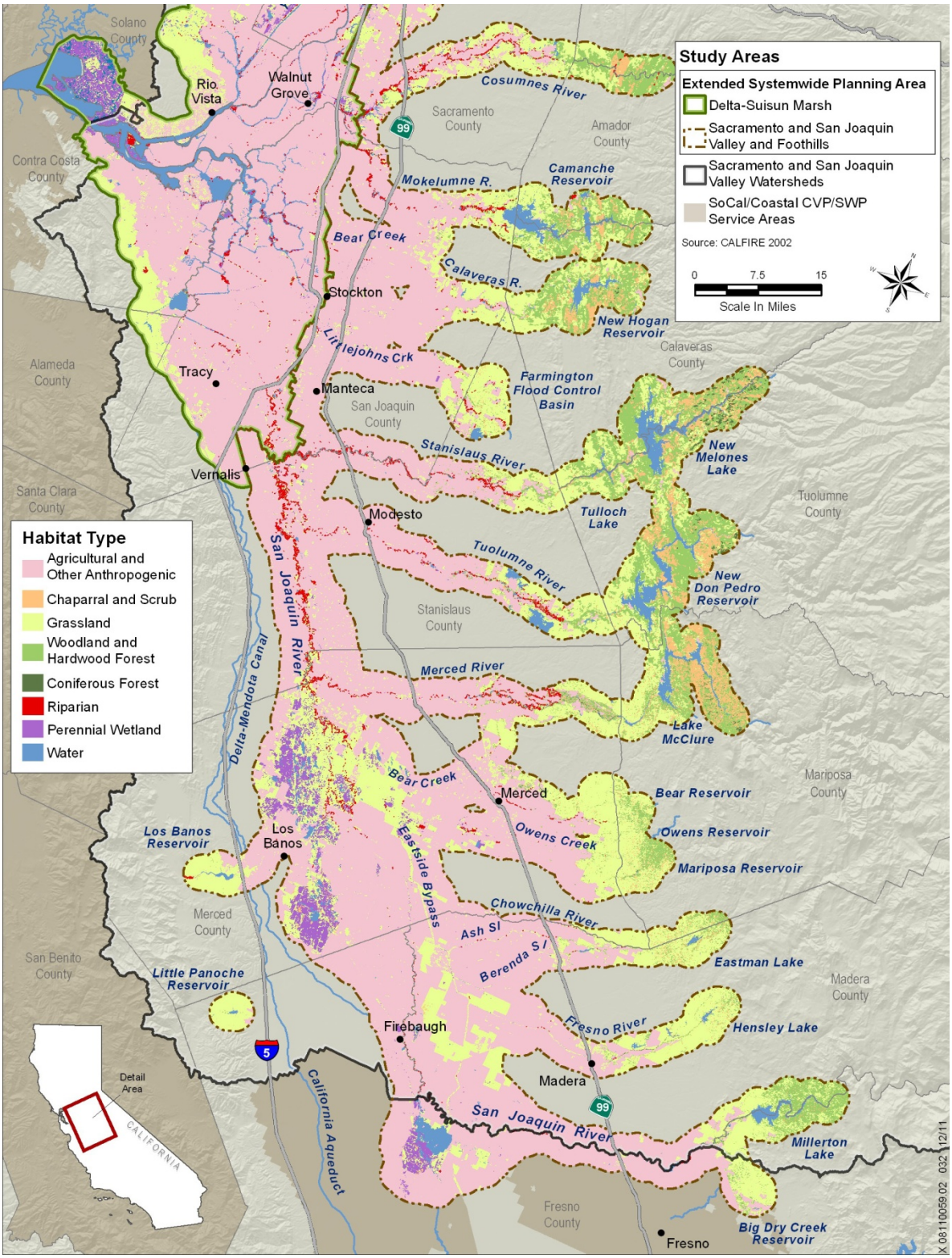

Figure 3.6-1b. Habitats of the Extended Systemwide Planning Area (Southern Portion)

Several riparian communities are present within the floodplains of the Sacramento and San Joaquin Valley and foothills: scrub, woodland, and forest communities. All of these riparian communities are included within the valley and foothill riparian category in the FRAP mapping; however, the composition and structure of these riparian habitats vary drastically, from dense, shrubby thickets dominated by a single shrub species to complex, multilayered forests with multiple codominant tree species, a well-developed shrub layer, and lianas such as California grape (*Vitis californica*) intertwined throughout.

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1]

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Riparian and Open-Water Habitats		
Valley Foothill Riparian[2]: A wide variety of forest, woodland, and scrub communities dominated by broadleaved, deciduous trees and shrubs. The climax valley foothill riparian type is a dense, multilayered forest with a tree canopy dominated by any combination of cottonwood, sycamore, and valley oak; a subcanopy of shorter, shade-tolerant tree species such as box elder and Oregon ash; and an understory of shrubs such as willow, wild rose, and buttonbush.	58,500	4,900
Open Water[2]: Aquatic habitats that include both riverine and lacustrine communities. Riverine communities are in sloped stream channels with intermittent or continually flowing water. Lacustrine habitats are in inland depressions or dammed river channels containing standing water. Submerged aquatic vegetation may be sparse to dense in shallower depths (generally less than 10 feet).	233,900	19,400

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1] (contd.)

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Perennial Wetland Habitats		
Freshwater Emergent Wetland[2]: Dense, tall herbaceous community dominated by perennial hydrophytic plant species (plants that grow in water or saturated soil), typically monocots up to 7 feet tall. Occurs throughout the Sacramento and San Joaquin Valley and foothills in permanently flooded or saturated soils in depressions or at the edges of streams, rivers, ponds, and lakes. Distinct vegetation zones often form, as rings, strips, or patches, in response to varying water depths and hydroperiods.	127,200	21,200
Saline Emergent Wetland[2]: Dense herbaceous community dominated by perennial hydrophytic species adapted to saline or brackish conditions. Found in the Delta–Suisun Marsh within the intertidal zone or on lands that historically were subject to tidal exchange (i.e., diked wetlands). This type category includes both saltwater and brackish marshes.	–	19,100
Wet Meadow[2]: A dense herbaceous community dominated by rushes, sedges, and grasses. This community is similar to the freshwater emergent wetland community found at lower elevations in being highly variable in size and associated with riparian habitats along rivers, creeks, lakes, reservoirs, and ponds. However, wet meadow species are adapted to colder temperatures and to periods of frost or snow and typically contain a wide variety of wildflowers.	-[3]	-
Grassland Habitats		
Annual Grassland: Open herb community dominated by nonnative annual grasses, primarily of Mediterranean origin; also typically includes a variety of native herbaceous species, the abundance and composition of which varies greatly depending on environmental conditions in the particular stand. Some annual grassland has inclusions of vernal pools (seasonal wetlands dominated by native plants). Occurs throughout the Sacramento and San Joaquin Valley and foothills, where it has replaced most native perennial grasslands.	1,042,800	111,200
Perennial Grassland: Open herb community characterized by perennial bunchgrasses and annual native wildflowers. This community exists primarily as relict patches within annual grasslands.	–	700

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1] (contd.)

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Anthropogenic (Human-Made) Habitats		
Agriculture: Lands cultivated for production of food and fiber crops. Consists of irrigated field and row crops and orchards and vineyards. Most of the irrigated field and row crops grown in the study area are annual crops, but perennial crops such as alfalfa, asparagus, and strawberries are also present. Found throughout the study area, but mostly on flat to gently rolling terrain in the fertile soils of the Central Valley and Delta floodplains. In the foothills, vineyards and orchards are the most common crops.	2,660,100	550,100
Pasture: A dense mixture of perennial grasses, clovers, and alfalfa planted and maintained to provide forage for horses or cattle. Plant height generally varies from a few inches to about 2 feet. Found on flat to gently rolling terrain throughout the Sacramento and San Joaquin Valley and foothills, but primarily in the valley portion. This habitat type is often very similar in composition and structure to annual grassland habitat and provides similar habitat values to many wildlife species.	12,700	1,400
Urban: A mixture of tree grove, street tree strip, ornamental tree/shrub, shade tree/lawn, lawn, and shrub cover. Plant height varies from 2 inches with ground cover to several feet with trees. Found throughout the Sacramento and San Joaquin Valley and foothills. Species composition in urban habitats varies with planting design and climate. Monoculture is commonly observed in tree groves and street tree strips. A distinguishing feature of the urban wildlife habitat is the mixture of native and exotic species. Both native and exotic species are valuable, with exotic species providing a good source of additional food in the form of fruits and berries.	414,800	77,700
Barren: Nonvegetated. Composed of rock, gravel, or bare soil, including unplanted agricultural fields that are maintained to prevent plant growth.	19,500	800

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1] (contd.)

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Chaparral and Scrub Habitats		
Chamise Chaparral: Dense, sclerophyllous shrub community strongly dominated by chamise. (Sclerophyllous shrubs have hard, leathery, evergreen leaves adapted to prevent moisture loss.) Herbaceous ground cover is generally lacking. Occurs in the foothills on south and west aspects, typically on steep slopes and ridges.	82,700	–
Mixed Chaparral: Moderate to dense sclerophyllous shrub community supporting a rich mixture of woody species, typically with a sparse to nonexistent herb layer. Structure varies with time since last fire. Occurs in the foothills at low to middle elevations on moister sites, either at higher elevations or on shadier slopes than chamise chaparral.	134,000	–
Montane Chaparral: Highly variable in both structure and composition, but dominated by sclerophyllous shrubs. For example, may consist entirely of prostrate and short shrubs less than 3 feet tall or include a dense canopy of treelike shrubs up to 10 feet tall. Found at middle to high elevations (down to 3,000 feet) on a variety of sites.	3,700	–
Sagebrush Scrub: Open habitat dominated by widely spaced big sagebrush shrubs, mostly 2–3 feet tall, and typically containing other, shorter soft woody shrubs such as common rabbitbrush. There is a sparse herbaceous understory of perennial bunch grasses and associated forbs. Found on a wide variety of soils and terrain from rocky, well-drained slopes to fine-textured valley soils with a high water table (Holland 1986).	7,000	–
Alkali Desert Scrub: Characterized by low-growing, widely spaced shrubs and subshrubs, especially saltbushes and other species in the goosefoot family that are tolerant of high alkalinity. During wet cycles there is an understory of grasses and forbs adapted to salinity and periodic flooding, such as pickleweed, alkaliweed, and saltgrass. Found in the southern San Joaquin Valley, typically on sandy to loamy soils on rolling, dissected alluvial fans with low relief.	2,000	–
Other Shrub-Dominated Habitats: Low sage, bitterbrush scrub, coastal scrub, and unknown shrub types. The majority of the acreage in this category (22,300 acres) consists of shrub-dominated habitats that could not be identified at the regional mapping scale. These are generally open scrub habitat types with similar structure to the scrub habitats described above, but with different species composition.	21,100	1,300

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1] (contd.)

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Woodland and Hardwood Forest Habitats		
Blue Oak Woodland:[2] A broadleaved, deciduous community dominated by blue oak trees. The tree canopy is generally open but may be dense on some sites, and a shrub layer is either lacking or sparse. The understory is characterized by moderate to dense herbaceous cover, primarily of annual grasses and forbs. Occurs on shallow, rocky, infertile, well-drained soils in the foothills.	250,000	–
Blue Oak Foothill Pine Woodland:[2] A mixed hardwood conifer woodland with an open to dense multilayered tree canopy. Includes an intermediate oak tree layer and a taller foothill pine layer, a shrub layer that occurs as dense patches or scattered individuals, and a sparse to dense herbaceous layer. Dead woody debris, snags, and cavities are generally present. Occurs in the foothills on sites that have deeper soils or more shade than blue oak woodland, especially on east and northeast aspects.	59,000	–
Montane Hardwood: A mixed evergreen and deciduous hardwood community with an open to dense tree canopy, a poorly developed shrub layer, and a sparse herbaceous layer. Occurs in the foothills on rocky, poorly developed and well-drained soils, often in major river canyons.	282,400	–
Montane Hardwood-Conifer: A mixed woodland community with an upper coniferous tree layer and a subcanopy of oak and other broadleaved trees. The tree canopy is generally dense and the shrub layer is poorly developed. Herbaceous species are sparse or lacking. Occurs in the foothills and is transitional between lower elevation montane hardwood and higher elevation coniferous forest.	101,500	–
Valley Oak Woodland:[2] Broadleaved deciduous woodland with an open to dense canopy consisting almost exclusively of valley oak trees. Tree density is greatest along drainage channels and becomes more open in drier, less fertile sites higher on floodplain terraces. A shrub layer is generally present near the drainage channel but absent farther upland. A dense layer of annual grasses and forbs is typically present. Occurs in the valley and foothills on deep, well-drained alluvial soils.	8,000	–

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1] (contd.)

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Other Woodland Habitats: Juniper woodland and eucalyptus woodland. Both types have an open to dense tree canopy and are similar in structure to the woodland habitats described above; however, eucalyptus woodland includes groves planted for hardwood production and stands planted in rows for wind protection, as well as woodlands established from escaped progeny of this nonnative species.	1,000	200
Coniferous Forest Habitats		
Sierran Mixed Conifer Forest: Multilayered forest dominated by a mix of conifer species and often including black oak in the subcanopy. Moderate to dense (up to 100 percent overlapping) canopy cover with shrubs common in openings. Native grasses and forbs are typically present. Found at middle elevations down to 2,500 feet in the northern Sierra Nevada.	25,800	–
Douglas Fir Forest: A highly variable forest habitat that typically includes a tall, irregular canopy of Douglas fir with a subcanopy of broadleaf evergreen trees, such as tanoak and madrone, and deciduous black oak trees. Plant diversity and density in the shrub and herbaceous understory vary considerably depending on topographic and environmental factors such as elevation, aspect, and age of the stand. Found at low to middle elevations of the Coast Ranges, Klamath Mountains, and northern Sierra Nevada on moderately deep, well-drained soils.	54,100	–
Ponderosa Pine Forest: An open to dense tree canopy consisting exclusively of ponderosa pine, or 50 percent ponderosa pine with other conifers, with generally 10–30 percent shrub and 5–10 percent herbaceous cover in the understory. Found at low to middle elevations in foothills and mountains throughout California.	30,300	–
Other Coniferous Forest Habitats: Closed-cone pine-cypress, eastside pine, Klamath mixed conifer, lodgepole pine, white fir, and unknown conifer types (i.e., habitats dominated by conifers, but exact type could not be determined at the mapping scale). Except for dominant species, their structure is similar to the structure of the habitats described above.	12,500	–

Table 3.6-1. Habitats and Acreage of Habitat Types Mapped in the Extended Systemwide Planning Area[1] (contd.)

Habitat and Description	Acreage	
	Sacramento and San Joaquin Valley and Foothills	Delta–Suisun Marsh
Other Sensitive Habitats		
Seasonal Wetlands:[2] Herbaceous wetlands that are subject to inundation during the winter months; these features generally occur in topographically low areas. Seasonal wetlands are generally dominated by hydrophytes during the winter and spring months. The vegetation of these features may transition to species that are characteristic of surrounding nonwetland habitat as the drying down process occurs. Evidence of hydrology including algal matting, flow patterns, or presence of decedent hydrophytes, is usually evident in the dry season upon close inspection.	–[3]	–[3]
Vernal Pools:[2] Natural ephemeral wetlands that form in shallow depressions underlain by an impervious or restrictive soil layer near the surface that restricts the percolation of water. Vernal pools are supported by direct precipitation and surface runoff. They pond during the wet season and typically become dry by late spring. Vernal pools are typically characterized by a high percentage of native plant species, many of which may be endemic (restricted) to vernal pools.	–[3]	–[3]
Inland Dunes:[2] Mosaic of vegetated, stabilized, sand dunes associated with river and estuarine systems. This habitat type includes remnants of low-lying, ancient stabilized dunes related to the Antioch Dunes formation, located near the town of Antioch. The vegetation of these ancient interior dunes historically included perennial grassland, oak woodland, and local “blowout” areas (i.e., naturally disturbed, unstable, wind-eroded and depositional sites, or river-cut sand cliffs within stabilized dunes) that supported distinctive dune species.	–	–[3]
Alkali Seasonal Wetlands:[2] Herbaceous communities on alkaline soils that remain inundated or saturated for prolonged periods during the growing season; these seasonal wetlands are in a surrounding matrix of grassland. At low elevations, found at seasonal drainages, historical lake beds, and basin rims.	–[3]	–[3]

Sources: CAL FIRE 2002; DFG 2010

Notes:
[1] Acreages are rounded to the nearest 100 acres.
[2] Sensitive habitat.
[3] Present but mapped as inclusions in other vegetation types.

Key:
Delta = Sacramento–San Joaquin Delta
Extended SPA = extended systemwide planning area

Table 3.6-2. Number of Sensitive Plant and Wildlife Species in the Extended Systemwide Planning Area, by Habitat Type

Habitat Type	Plants	Invertebrates	Amphibians	Reptiles	Birds	Mammals	Total
Riparian and Open-Water Habitats							
Valley Foothill Riparian	6	1	1	1	11	2	22
Open Water (Lacustrine and Riverine)	3	–	6	1	4	–	14
Perennial Wetland Habitats							
Freshwater Emergent Wetland	12	5	5	2	5	1	30
Wet Meadow	15	–	4	–	1	1	21
Saline Emergent Wetland	7	–	–	1	6	2	16
Grassland Habitats							
Annual and Perennial Grassland	35	5	5	3	8	8	64
Vernal Pools (and other seasonal wetlands)[1]	41	5	3	–	–	–	49
Anthropogenic (Human-Made) Habitats							
Agriculture and Pasture	–	5	3	2	9	3	22
Urban	–	–	–	–	1	–	1
Barren	–	–	–	1	4	5	10
Chaparral and Scrub Habitats							
Chaparral (Chamise Chaparral, Mixed Chaparral, Montane Chaparral)	45	–	2	2	1	4	54
Alkali Desert Scrub	10	–	–	4	3	6	23
Sagebrush Scrub	2	–	–	–	2	1	5
Woodland and Hardwood Forest Habitats							
Woodlands (Blue Oak Woodland, Blue Oak Foothill Pine Woodland, Valley Oak Woodland, Juniper Woodland)	55	1	8	1	9	5	79
Woodland and Hardwood Forest Habitats (contd.)							
Eucalyptus	–	–	–	–	3	4	7
Montane Hardwood and Hardwood-Conifer	2	–	2	–	3	4	11
Coniferous Forest Habitats							
Coniferous Forest (Sierran Mixed Conifer Forest, Douglas Fir Forest, Ponderosa Pine Forest, Other Coniferous Forest Habitats)	24	–	5	1	6	5	41
Other Sensitive Habitats							
Vernal Pools and Other Seasonal Wetlands	*See Grassland Habitats Above*						
Inland Dunes	2	–	–	1	–	–	3
Alkali seasonal wetlands	18	3	2	1	6	1	31

Sources: CNDDB 2010, CNPS 2010

Note:

[1] These are lumped with the annual grassland acreage in Table 3.6-1.

Vegetation Structure More than 15 native tree and shrub species occur in the riparian communities of the Sacramento and San Joaquin Valley and foothills (Vaghti and Greco 2007). Most of these species are

hydrophilic (water loving), but they differ in several key attributes, such as shade tolerance and longevity. These attributes, in combination with site conditions (e.g., soils and soil moisture) and disturbance events, determine the abundance of species and the structure of riparian vegetation. The species composition and structure of riparian vegetation change with increasing distance from the river channel. In-channel islands, point bars, and areas adjacent to the channel are generally at lower elevation; thus, they are exposed to longer inundation periods and more frequently disturbed by geomorphic processes, particularly lateral displacement of the river channel (channel migration). Consequently, these areas are dominated by species such as cottonwood (*Populus* spp.) and willows such as sandbar willow (*Salix exigua*) and arroyo willow (*Salix lasiolepis*), which have less shade tolerance, greater tolerance of inundation, and greater tolerance of disturbance than other shrubs and trees. For these species, recruitment (germination, establishment, and growth of new individuals) depends on conditions created by frequent flooding (e.g., exposed, moist mineral soil) and these species are relatively short-lived (e.g., 50–150 years) (Strahan 1984). Higher floodplains farther from the channel are dominated by species that require less water and tolerate more shade, but are less tolerant of disturbance, such as Oregon ash (*Fraxinus latifolia*), valley oak (*Quercus lobata*), and California buttonbush (*Cephalanthus occidentalis*) (Stuart and Sawyer 2001). These species are less dependent on recently disturbed sites for their recruitment and may live as long as 250 years.

Ecological Processes River flows and associated hydrologic and geomorphic processes are integral to riparian ecosystems. Most aspects of a flow regime—the magnitude, frequency, timing, duration, and sediment load of flows—affect a variety of riparian habitat processes. Two of the most important processes for riparian ecosystems are plant recruitment and disturbances. The interaction of these processes across the landscape is primarily responsible for the pattern and distribution of riparian vegetation and for its species composition and habitat structure.

The recruitment of cottonwood and willow especially depends on geomorphic processes that create bare mineral soil through erosion and deposition of sediment along river channels and on floodplains, and on flow events that result in floodplain inundation. Receding flood flows that expose moist mineral soil create ideal conditions for germination of cottonwood and willow seedlings. After germination occurs, the water surface must decline gradually to enable seedling establishment. If the water surface declines too quickly, seedlings are prone to mortality by desiccation. For a river to supply seedlings with adequate water as their roots elongate toward the water table, the decline in the river's water surface should not exceed 1 to 1.5 inches per day (Mahoney and Rood 1998).

After germination, seedlings typically grow within a zone defined by the elevation of peak flows and elevation of low flows. Seedlings in this zone often succumb to drought or to subsequent high-flow events that either scour newly established seedlings or kill new seedlings via prolonged inundation (Sprenger et al. 2001). Those that persist through the first two growing seasons typically reach sapling size and persist in subsequent years.

Both prolonged drought and prolonged inundation can lead to plant death and loss of riparian plants (Kozlowski and Pallardy 2002). Riparian plants require a large amount of moisture; during the active growing season (spring through fall), dry soil conditions can reduce growth, damage plant parts, or kill plants. On the other hand, prolonged inundation creates anaerobic conditions that, during the active growing season, can also reduce growth, damage plant parts, or kill plants. For actively growing woody plants, prolonged inundation of the root system can be sufficient to cause damage or death.

Disturbance removes riparian vegetation and frequently alters the course of recruitment and succession within such vegetation. Absent disturbance, larger trees and species less tolerant of frequent disturbance begin to dominate riparian woodlands. Large flow events and associated scour, deposition, and prolonged inundation create openings in riparian communities. Early successional species, like cottonwood and willow that recruit into these openings, become more abundant in the landscape as vegetation grows within disturbed areas. As a result, structural and species diversity within riparian vegetation increases, as do overall wildlife habitat values.

Although riparian habitats are biologically rich and provide important habitat values to wildlife, relatively few riparian-associated plants are considered sensitive species (Table 3.6-3).

Table 3.6-3. Sensitive Plant Species of Riparian and Wetland Habitats in the Extended Systemwide Planning Area

Species	Status			Habitat	Geographic Area(s)
	Federal[a]	State[b]	CRPR[c]		
Heartscale *Atriplex cordulata*	–	–	1B.2	Chenopod scrub, meadows and seeps, sandy areas within valley and foothill grassland; on saline or alkaline soils.	SSJVF, DSM
Brittlescale *Atriplex depressa*	–	–	1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools; on alkaline, clay soils.	SSJVF, DSM
San Joaquin spearscale *Atriplex joaquiniana*	–	–	1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland; on alkaline soils.	SSJVF, DSM
Bristly sedge *Carex comosa*	–	–	2.1	Coastal prairie, valley and foothill grassland, along margins of marshes and swamps.	SSJVF, DSM
Pointed broom sedge *Carex scoparia*	–	–	2.2	Mesic soils in Great Basin scrub.	SSJVF
Sheldon's sedge *Carex sheldonii*	–	–	2.2	Mesic soils in lower montane coniferous forest, freshwater marshes and swamps, riparian scrub.	SSJVF
Brown fox sedge *Carex vulpinoidea*	–	–	2.2	Riparian woodland, freshwater marshes and swamps.	SSJVF, DSM
Pink creamsacs *Castilleja rubicundula* ssp. *rubicundula*	–	–	1B.2	Openings in chaparral, cismontane woodland, meadows and seeps, serpentinite soils in valley and foothill grassland.	SSJVF
Pappose tarplant *Centromadia parryi* ssp. *parryi*	–	–	1B.2	Mesic areas in coastal prairie, meadow, and grassland habitats, often on alkaline substrates.	SSJVF
Bolander's water-hemlock *Cicuta maculata* var. *bolanderi*	–	–	2.1	Marshes and swamps in coastal freshwater or brackish water.	DSM
Slough thistle *Cirsium crassicaule*	–	–	1B.1	Chenopod scrub, riparian scrub, and marshes and swamps within sloughs.	DSM

Table 3.6-3. Sensitive Plant Species of Riparian and Wetland Habitats in the Extended Systemwide Planning Area (contd.)

Species	Status			Habitat	Geographic Area(s)
	Federal[a]	State[b]	CRPR[c]		
Hispid bird's-beak *Cordylanthus mollis* ssp. *hispidus*	–	–	1B.1	Mesic, alkaline soils in meadows and seeps, playas, and valley and foothill grassland.	SSJVF, DSM
Soft bird's-beak *Cordylanthus mollis* ssp. *mollis*	E	R	1B.2	Coastal saltwater marshes and swamps.	SSJVF, DSM
Silky cryptantha *Cryptantha crinita*	–	–	1B.2	Within gravelly streambeds in cismontane woodland, lower montane coniferous forest, riparian forest, riparian woodland, and valley and foothill grassland.	SSJVF
Delta button-celery *Eryngium racemosum*	–	E	1B.1	Vernally mesic clay depressions within riparian scrub.	SSJVF, DSM
Bogg's Lake hedge-hyssop *Gratiola heterosepala*	–	E	1B.2	Marshes and swamps along lake margins, vernal pools in clay soils.	SSJVF, DSM
Diablo helianthella *Helianthella castanea*	–	–	1B.2	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland.	SSJVF
Woolly rose-mallow *Hibiscus lasiocarpus* var. *occidentalis*	–	–	2.2	Freshwater marshes and swamps.	SSJVF, DSM
California satintail *Imperata brevifolia*	–	–	2.1	Mesic areas in chaparral, coastal scrub, Mojavean desert scrub, meadows and seeps that are often alkali, riparian scrub.	SSJVF
Northern California black walnut *Juglans hindsii*	–	–	1B.1	Riparian forest and woodland.	DSM
Knotted rush *Juncus nodosus*	–	–	2.3	Mesic soils in meadows and seeps and along lake margins in marshes and swamps.	SSJVF
Burke's goldfields *Lasthenia burkei*	E	E	1B.1	Mesic soils in meadows and seeps, vernal pools.	SSJVF
Coulter's goldfields *Lasthenia glabrata* ssp. *Coulteri*	–	–	1B.1	Coastal salt marshes and swamps, playas, vernal pools.	SSJVF

Table 3.6-3. Sensitive Plant Species of Riparian and Wetland Habitats in the Extended Systemwide Planning Area (contd.)

Species	Status			Habitat	Geographic Area(s)
	Federal[a]	State[b]	CRPR[c]		
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	–	–	1B.2	Freshwater or brackish water marshes and swamps.	SSJVF, DSM
Cantelow's lewisia *Lewisia cantelovii*	–	–	1B.2	Mesic, granitic, and sometimes serpentinite seeps in broadleafed upland forest, chaparral, cismontane woodland, lower montane coniferous forest.	SSJVF
Mason's lilaeopsis *Lilaeopsis masonii*	–	R	1B.1	Freshwater or brackish water marshes and swamps, riparian scrub.	SSJVF, DSM
Delta mudwort *Limosella subulata*	–	–	2.1	Marshes and swamps.	DSM
Elongate copper moss *Mielichhoferia elongata*	–	–	2.2	Usually vernally mesic metamorphic, rocky soils within cismontane woodland.	SSJVF
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	–	–	1B.1	Mesic soils in cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools.	SSJVF, DSM
Prostrate vernal pool navarretia *Navarretia prostrata*	–	–	1B.1	Mesic areas in coastal scrub, meadows and seeps, alkaline soils of valley and foothill grassland, vernal pools.	SSJVF
Shasta snow-wreath *Neviusia cliftonii*	–	–	1B.2	Often in streamsides; sometimes carbonate, volcanic or metavolcanic soils of cismontane woodland, lower montane coniferous forest, riparian woodland.	SSJVF
Slender-leaved pondweed *Potamogeton filiformis*	–	–	2.2	Assorted shallow, freshwater marshes and swamps.	SSJVF
Eel-grass pondweed *Potamogeton zosteriformis*	–	–	2.2	Assorted freshwater marshes and swamps.	SSJVF, DSM

Table 3.6-3. Sensitive Plant Species of Riparian and Wetland Habitats in the Extended Systemwide Planning Area (contd.)

Species	Status			Habitat	Geographic Area(s)
	Federal[a]	State[b]	CRPR[c]		
Sticky pyrrocoma *Pyrrocoma lucida*	–	–	1B.2	Alkaline clay soils in Great Basin scrub, lower montane coniferous forest, meadows and seeps.	SSJVF
California beaked-rush *Rhynchospora californica*	–	–	1B.1	Bogs and fens, lower montane coniferous forest, meadows and seeps, marshes and swamps.	SSJVF
Sanford's arrowhead *Sagittaria sanfordii*	–	–	1B.2	Assorted shallow, freshwater marshes and swamps.	SSJVF, DSM
Marsh skullcap *Scutellaria galericulata*	–	–	2.2	Meadows, seeps, marshes and swamps.	DSM
Red Hills ragwort *Senecio clevelandii* var. *heterophyllus*	–	–	1B.2	Serpentinite seeps in cismontane woodland.	SSJVF
Marsh skullcap *Scutellaria galericulata*	–	–	2.2	Lower montane coniferous forest, marshes and swamps, mesic soils in meadows and seeps.	SSJVF, DSM
Side-flowering skullcap *Scutellaria lateriflora*	–	–	2.2	Marshes and swamps, mesic soils in meadows and seeps.	SSJVF
Suisun Marsh aster *Symphyotrichum lentum*	–	–	1B.2	Freshwater and brackish water marshes and swamps.	SSJVF, DSM
Wright's trichocoronis *Trichocoronis wrightii* var. *wrightii*	–	–	2.1	Alkaline soils of marshes and swamps, meadows and seeps, riparian forest, and vernal pools; usually on mud flats.	SSJVF, DSM
Red Hills vervain *Verbena californica*	T	T	1B.1	Mesic, usually serpentinite seeps or creeks within cismontane woodland and valley and foothill grassland.	SSJVF
Brazilian watermeal *Wolffia brasiliensis*	–	–	2.3	Assorted shallow, freshwater marshes and swamps.	SSJVF

Sources: CNDDB 2010; CNPS 2010

Table 3.6-3. Sensitive Plant Species of Riparian and Wetland Habitats in the Extended Systemwide Planning Area (contd.)

Notes:
[a] U.S. Fish and Wildlife Service—Federal Listing Categories:
- T = Threatened
- E = Endangered
- – = No status

[b] California Department of Fish and Game—State Listing Categories:
- R = Rare
- E = Endangered
- – = No status

[c] California Department of Fish and Game—California Rare Plant Ranks:
- 1A = Presumed extinct
- 1B = Plants rare, threatened, or endangered in California and elsewhere
- 2 = Plants rare, threatened, or endangered in California, but more common elsewhere

Extensions:
- 1 = Seriously endangered in California (> 80 percent of occurrences are threatened and/or high degree and immediacy of threat)
- 2 = Fairly endangered in California (20–80 percent of occurrences are threatened)
- 3 = Not very endangered in California (< 20 percent of occurrences are threatened or no current threats are known)

Key:
CRPR = California Rare Plant Rank
DSM = Delta–Suisun Marsh
SSJVF = Sacramento and San Joaquin Valley and foothills

Wildlife Use Riparian habitats in the Sacramento and San Joaquin Valley and foothills support a great diversity of wildlife, including sensitive invertebrates, amphibians, reptiles, birds, and mammals (Table 3.6-4). Wildlife use these habitats for food, water, and cover during foraging, reproduction, and movement (e.g., dispersal and migration). In the semiarid western United States, riparian vegetation communities contain the most species-rich and abundant communities of birds, and provide critically important habitat for many other wildlife taxa (Knopf et al. 1988). Large expanses of the valley lack substantial blocks of natural habitat that support native biodiversity or essential areas of connectivity among these blocks; therefore, the riparian corridors play a critical role in connecting wildlife among the few remaining natural areas of this geographic area (Spencer et al. 2010). The variety and abundance of wildlife species and the relative importance of riparian communities to wildlife are related to the diversity of vegetation types and physical habitat structure associated with riparian communities, the size and continuity of vegetation types on the landscape, and the seasonal migration of birds.

Table 3.6-4. Sensitive Wildlife Species of Riparian and Wetland Communities in the Sacramento and San Joaquin Valley and Foothills

Species	Status[1]	Habitat Description
Invertebrates		
Conservancy fairy shrimp *Branchinecta conservatio*	FE	Vernal pools and swales.
Longhorn fairy shrimp *Branchinecta longiantenna*	FE	Vernal pools and swales.
Vernal pool fairy shrimp *Branchinecta lynchii*	FT	Vernal pools and other seasonal wetlands.
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	FT	Elderberries in riparian woodlands or savanna communities.
Vernal pool tadpole shrimp *Lepidurus packardi*	FE	Vernal pools, swales, and other ephemeral wetlands.
Amphibians		
Tailed frog *Ascaphus truei*	CSC	Cold, clear, rocky streams in wet forests from near sea level to 8,400 feet.
Shasta salamander *Hydromantes shastae*	CT	Mixed conifer, woodland, and chaparral habitats, especially near limestone.
Foothill yellow-legged frog *Rana boylii*	CSC	Streams and rivers with rocky substrate and open, sunny banks, in forests, chaparral, and woodlands from sea level to 6,700 feet. Sometimes found in isolated pools, vegetated backwaters, and deep, shaded, spring-fed pools.
California red-legged frog *Rana draytonii*	FT CSC	Permanent or ephemeral water sources including lakes, ponds, reservoirs, slow streams, marshes, bogs, and swamps from sea level to 5,000 feet in woodlands, grasslands, and riparian areas.
Northern leopard frog *Rana pipiens*	CSC	Grasslands, wet meadows, potholes, forests, woodland, brushlands, springs, canals, bogs, marshes, and reservoirs from sea level to 11,000 feet. Generally prefers permanent water with abundant aquatic vegetation.

Table 3.6-4. Sensitive Wildlife Species of Riparian and Wetland Communities in the Sacramento and San Joaquin Valley and Foothills (contd.)

Species	Status[1]	Habitat Description
Reptiles		
Western pond turtle *Actinemys marmorata*	CSC	Ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches with abundant vegetation and either rocky or muddy bottoms, in woodland, forest, and grassland.
Silvery legless lizard *Anniella pulchra pulchra*	CSC	Moist, warm, loose soil with plant cover in sparsely vegetated areas of beach dunes, chaparral, woodlands, desert scrub, sandy washes, and stream terraces.
Giant garter snake *Thamnophis gigas*	FT CT	Marshes, sloughs, drainage canals, and irrigation ditches, especially around rice fields, and occasionally in slow-moving creeks from sea level to 400 feet. Prefers locations with vegetation close to the water for basking.
Birds		
Tricolored blackbird *Agelaius tricolor*	CSC	*Foraging:* On ground in croplands, grassy fields, flooded land, and along edges of ponds. *Nesting:* Dense cattails, tules, or thickets near freshwater.
Short-eared owl *Asio flammeus*	CSC	*Foraging and nesting:* Open prairies, coastal grasslands, marshes, bogs, savanna, and dunes.
Swainson's hawk *Buteo swainsoni*	CT	*Foraging:* Open desert, grassland, or cropland containing scattered, large trees or small groves. *Nesting:* Open riparian habitat, in scattered trees or small groves in sparsely vegetated flatlands. Usually found near water in the Central Valley.
Black tern *Chlidonias niger*	CSC	*Foraging and nesting:* Freshwater emergent wetlands. marshes, lakes, ponds, moist grasslands, and agricultural fields.
Northern harrier *Circus cyaneus*	CSC	*Nesting:* Tall grasses and forbs in emergent wetland, along rivers or lakes, grasslands, grain fields, or on sagebrush flats several miles from water.
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	FC CE	*Nesting:* Extensive deciduous riparian thickets or forests with dense, low-level or understory foliage adjacent to slow-moving watercourses, backwaters, or seeps. Willow is almost always a dominant component of the vegetation. In the Sacramento Valley, also utilizes adjacent walnut orchards.
Black swift *Cypseloides niger*	CSC	*Nesting:* Canyon walls near water and sheltered by overhanging rock or moss, preferably near waterfalls.
Yellow warbler *Dendroica petechia brewsteri*	CSC	*Nesting*: Low, open-canopy riparian deciduous woodlands with a heavy brush understory; sometimes in montane shrubbery in open conifer forests.
White-tailed kite *Elanus leucurus*	FP CSC	*Foraging:* Undisturbed, open grasslands, meadows, farmlands, and emergent wetlands. *Nesting:* Large groves of dense, broad-leafed deciduous trees close to foraging areas.

Table 3.6-4. Sensitive Wildlife Species of Riparian and Wetland Communities in the Sacramento and San Joaquin Valley and Foothills (contd.)

Species	Status[1]	Habitat Description
Willow flycatcher *Empidonax traillii*	CE FE	*Foraging:* Willow thickets and adjacent meadows. *Nesting:* Extensive thickets of low, dense willows at edge of wet meadows, ponds, or backwaters.
Greater sandhill crane *Grus canadensis tabida*	CT FP	*Foraging:* Open grasslands, grain fields, and open wetlands. *Roosting:* In flocks standing in moist fields or in shallow water. *Nesting:* Open habitats with shallow lakes and freshwater emergent wetlands.
Bald eagle *Haliaeetus leucocephalus*	CE FP	*Foraging:* Large bodies of water or free-flowing rivers with abundant fish and adjacent snags or other perches. *Nesting:* Large, old-growth trees or snags in remote, mixed stands near water.
Yellow-breasted chat *Icteria virens*	CSC	*Foraging and nesting:* Riparian thickets of willow and other brushy thickets near streams or other watercourses.
Loggerhead shrike *Lanius ludovicianus*	CSC	*Breeding: S*hrublands or open woodlands with areas of grass cover and areas of bare ground. *Foraging:* Tall shrubs or trees with open areas of short grasses, forbs, or bare ground. *Nesting:* Large shrubs or trees.
California black rail *Laterallus jamaicensis coturniculus*	CT FP	*Foraging and nesting:* Tidal emergent wetlands dominated by pickleweed, in the high wetland zones near upper limit of tidal flooding, or in brackish marshes supporting bulrushes and pickleweed. In freshwater, usually found in bulrushes, cattails, and saltgrass adjacent to tidal sloughs.
Suisun song sparrow *Melospiza melodia maxillaries*	CSC	*Foraging:* The bare surface of tidally exposed mud among tules and along slough margins in brackish marshes. *Nesting:* Along edges of sloughs and bays supporting mixed stands of bulrush, cattail, and other emergent vegetation.
Purple martin *Progne subis*	CSC	*Foraging:* Conifer, woodland, and riparian habitats. *Nesting:* Snags in old-growth, multilayered, open forests and woodlands.
Bank swallow *Riparia riparia*	CT	*Foraging:* Open riparian areas, grassland, wetlands, water, and cropland. *Nesting:* Vertical banks and cliffs with fine-textured or sandy soils near streams, rivers, ponds, and lakes.
Least Bell's vireo *Vireo bellii pusillus*	FE CE	*Foraging and nesting:* Low, dense riparian growth along water or along dry parts of intermittent streams.
Yellow-headed Blackbird *Xanthocephalus xanthocephalus*	CSC	*Foraging:* Freshwater emergent wetland and sometimes along shorelines and in nearby open fields, preferably on moist ground. *Nesting:* Dense emergent wetland of cattails and tules, often along border of lake or pond.

Table 3.6-4. Sensitive Wildlife Species of Riparian and Wetland Communities in the Sacramento and San Joaquin Valley and Foothills (contd.)

Species	Status[1]	Habitat Description
Mammals		
Pallid bat *Antrozous pallidus*	CSC	*Foraging:* Over water in mixed conifer forests and conifer/woodlands. *Roosting:* Rocky outcrops, cliffs, and crevices.
Spotted bat *Euderma maculatum*	CSC	*Foraging:* Over water and along washes in deserts, grasslands, and mixed conifer forests from below sea level to above 10,000 feet. *Roosting:* Rock crevices in cliffs.
Western mastiff bat *Eumops perotis*	CSC	*Foraging:* Over water in broad, open areas of mixed conifer forests and conifer/woodlands. *Roosting:* Crevices in vertical cliffs, usually granite or consolidated sandstone, and in broken terrain with exposed rock faces.
Western red bat *Lasiurus blossevillii*	CSC	*Foraging:* Over water edges in open areas of mixed conifer and conifer/woodlands. *Roosting:* Trees along edges or in habitat mosaics in a variety of habitats.
Riparian (=San Joaquin Valley) woodrat *Neotoma fuscipes riparia*	FE CSC	Riparian habitats with associated evergreen and deciduous oak with dense understories; willow thickets.
Townsend's big-eared Bat *Plecotus townsendii*	CSC	*Roosting:* Caves, mines, tunnels, buildings, or other human-made structures in mixed conifer and conifer woodlands. Prefers mesic habitats.
Salt-marsh harvest mouse *Reithrodontomys raviventris*	FE CE FP	Salt marsh dominated by pickleweed and salt grass. Generally requires nonsubmerged, salt-tolerant vegetation for escape during high tides.
Riparian brush rabbit *Sylvilagus bachmani riparius*	FE CE	Riparian woodlands dominated by oaks with a dense understory of wild roses, grapes, and blackberries.

Sources: CNDDB 2010, DFG 2010

Note:

[1] Status definitions:
FC = federal candidate for listing
FE = federally listed as endangered
FT = federally listed as threatened
CE = California listed as endangered
CT = California listed as threatened
FP = California fully protected
CSC = California species of special concern

Wildlife species vary considerably in their habitat requirements and preferences for different structures (e.g., a dense shrub layer or large trees) in riparian vegetation. For example, nesting requirements for birds range from dense herbaceous vegetation to larger trees, tree cavities, and even eroding bluffs (for bank swallow (*Riparia riparia*)).

Most wildlife species also require several habitat features and vegetation types at various times during their life cycles. For example, several raptors

(such as Swainson's hawk (*Buteo swainsoni*)) nest in riparian forests and woodlands, but forage in grasslands and cropland; resident waterfowl forage in shallow open water, seasonal wetlands, and croplands, but use dense cover in marshes for resting and reproduction; and in marshes, rice fields, and associated waterways and uplands, giant garter snakes (*Thamnophsis gigas*) disperse and forage along the water's edge, bask on open banks, and use uplands to hibernate and as a refuge from floodwaters. Therefore, riparian habitats that are diverse in both the composition of vegetation species and physical habitat structure are likely to accommodate a wider variety of wildlife (RHJV 2004).

Additionally, the number of wildlife species in riparian corridors increases with corridor size, width, and continuity (Hagar 1999; Hannon et al. 2002; Heath and Ballard 2003). Large, mature stands of riparian forest support the most dense and diverse breeding bird communities in California (Gaines 1974). These dense stands provide high-quality nesting habitat for raptors and cavity-nesting birds. Some species depend primarily on larger riparian patches and corridors; for example, small or narrow patches of riparian vegetation are unsuitable for reproduction of yellow-billed cuckoo (*Coccyzus americanus*) (Laymon and Halterman 1987; USFS 1989). For more widely distributed species, the importance of wide, contiguous corridors may be related to increased habitat heterogeneity in larger corridors; the absence of interior habitats in narrower, fragmented corridors; and the ability of larger corridors to support species with larger home ranges.

The width and continuity of riparian corridors also affect the use of riparian and adjacent uplands for wildlife movement. Larger flows that inundate floodplains, basins, and bypasses create expanses of shallow water that provide seasonal habitat for wintering waterfowl, shorebirds, and wading birds. Conversely, very narrow corridors—or corridors fragmented by developed or agricultural land, or lacking dense cover—may not be used by some species. In particular, if riparian and adjacent upland does not meet a species' habitat requirements, it may not be used for dispersal, and hence will not provide a suitable corridor connecting habitat patches, particularly for smaller, less mobile animals (Noss et al. 1996; Rosenberg et al. 1997).

Migrating and nesting neotropical migrant birds contribute substantially to the richness and abundance of the avian community during the spring and summer. The Sacramento and San Joaquin Valley lies within the Pacific Flyway, the major pathway for migratory bird species on the West Coast. During fall and winter, wintering waterfowl, shorebirds, wading birds, and raptors are conspicuous in their use of riparian and wetland vegetation for foraging and cover. During spring and summer, a large number of neotropical migratory birds (such as Bullock's oriole (*Icterus bullockii*) and

black-headed grosbeak (*Pheucticus melanocephalus*)) forage and nest in riparian and wetland vegetation.

Historical Alterations Riparian habitats have been reduced substantially from their historical extents throughout the Sacramento and San Joaquin Valley and foothills, as is the case for riparian and wetland habitats throughout California. Only about 2–5 percent of the historic riparian habitat of interior California still exists (RHJV 2004). Furthermore, much of the riparian habitat that remains statewide has been degraded. Historically, belts of riparian forest were more than 5 miles wide in some places along the Sacramento River (Jepson 1893; Thompson 1961). More than 90 percent of this historical riparian habitat has been converted to agricultural or developed land cover, and the remainder has been fragmented, simplified, and substantially altered in other ways by dams, diversions, gravel mining, grazing practices, and invasive species (Hunter et al. 1999; CALFED 2000a). In general, only narrow remnants of these riparian forests remain in the Sacramento and San Joaquin Valley (Figure 3.6-2). The loss of distribution and quality of these riverine-associated vegetation communities has been implicated as the most important driver in the decline of western landbird species (DeSante and George 1994).

Figure 3.6-2. Representative Photograph of Riparian Habitat along the Sacramento River (at River Mile 71)

Construction, operation, and maintenance of facilities to reduce flooding have contributed to the loss and alteration of riparian habitats. Levee and bank protection structures associated with the flood protection system are

present along more than 2,600 miles of rivers in the Central Valley and in the Delta (DWR 2005). These levees have isolated historic floodplains from natural geomorphic processes and facilitated conversion of these areas to agricultural and developed uses. The remaining riparian vegetation is often confined to levee slopes and a narrow waterside strip along the levee, where levee maintenance activities have affected habitat structure. Numerous maintenance activities have simplified habitat structure and reduced habitat diversity. Among these activities are mowing floodways; removing downed and dying trees, the lower limbs of tree branches, and shrubs and small trees; removing beaver dams; and armoring levee slopes.

Bank and levee reinforcement (i.e., installation of riprap) has substantially reduced streamside wetlands and suitable sites for recruitment of some riparian plants. Riprap has also reduced habitat for several rare plant species that depend on open areas along the banks of the lower Sacramento and San Joaquin rivers, and along channels in the Delta. Among the species affected are Delta mudwort, Mason's lilaeopsis, woolly rose-mallow, Delta tule pea, and Suisun marsh aster. Furthermore, riprap has excluded the use of current habitat and precluded the potential formation of new habitat (i.e., cut banks via channel migration) for many species of wildlife, including threatened and endangered species, such as nesting habitat for bank swallow.

Furthermore, regulation of flows from dams has reduced the magnitude and frequency of larger flow events and increased their recession rates, and has increased summertime flows. Disturbance of riparian vegetation that creates sites for recruitment of early successional species has been reduced. Also, regulated recession rates are often too rapid for recruitment of cottonwoods (Mahoney and Rood 1998; Stillwater Sciences 2007). Consequently, vegetation along Central Valley rivers and streams has been changing as the abundance of cottonwoods has decreased and the abundance of species such as box elder (*Acer negundo*), Oregon ash, and California black walnut (*Juglans hindsii*) has increased (Vaghti and Greco 2007; Fremier 2003).

Most riparian habitats are considered sensitive because of historical alterations and reduction in extent, and their importance to wildlife. DFG regulates effects on riparian habitats under Section 1600 et seq. of the California Fish and Game Code.

Perennial Wetland Habitats In the Sacramento and San Joaquin Valley and foothills, perennial wetland habitats include freshwater emergent wetlands and wet meadows. Freshwater emergent wetlands, or marshes, are dominated by large, perennial herbaceous plants, particularly tules (*Schoenoplectus* spp.) and cattails (*Typha* spp.). Tules and cattails have

stems that grow horizontally beneath the substrate (rhizomes) and stems that emerge above the water surface (culms). Seedlings can only establish on exposed surfaces, but growth from rhizomes allows them to subsequently occupy sites at lower elevations (i.e., in deeper water). Their growth is reduced by submergence and by damage to their culms (aerial stems of grasses, sedges, and similar plants) from animals, currents, and wave action (Coops et al. 1991, 1996). Thus, vegetation dominated by tules and cattails is restricted to shallow water, typically less than 2 feet deep (Atwater and Hedel 1976).

In marshes, vegetation structure and the number of species are strongly influenced by disturbance, changes in water levels, and the range of elevations present at a site. Disturbances and water-level drawdowns that expose previously submerged surfaces enable annuals, short-lived perennials, and other species to establish, which creates diversity in species composition and vegetation structure.

Herbaceous wetland species germinate and recruit through a process similar to that described for early successional riparian trees and shrubs. Like cottonwood and willow, species such as cattail and tule require exposed mineral soil for germination. Typically, germination takes place immediately at the water line or slightly above or below it (i.e., within an inch or less) (Kellogg et al. 2003). Once germination occurs, saturated soils are required throughout the growing season.

Also, as with woody riparian plants, prolonged drought and prolonged inundation events can lead to death and loss of marsh plants (Touchette et al. 2008; Seabloom et al. 2001). However, herbaceous wetland plants have belowground parts adapted to anaerobic conditions, and thus are more resistant than woody riparian plants to prolonged inundation of their root systems. For these species, submergence of aboveground parts is required to cause damage or death.

The ecology of wet meadows is similar to that of freshwater emergent wetlands in many regards. However, wet meadows are dominated by a greater variety of perennial rushes, sedges, and grasses than freshwater emergent wetlands, and many of these species are smaller than the cattails and tules that dominate many freshwater emergent wetlands. Also, wet meadow species are adapted to colder temperatures and to periods of frost or snow, and wet meadows typically contain a wider variety of wildflowers than freshwater emergent wetlands.

Table 3.6-3 provides a comprehensive list of special-status plant species that have been documented in freshwater emergent wetland and wet meadow habitats in the Sacramento and San Joaquin Valley and foothills.

Perennial freshwater wetlands (particularly freshwater emergent wetlands) are among the most productive wildlife habitat in California (Kramer 1988). In the Sacramento and San Joaquin Valley and foothills, these wetlands support several sensitive amphibians, reptiles, birds, and mammals (Table 3.6-4). Perennial freshwater wetlands also provide food, cover, and water for numerous common species of wildlife that rely on wetlands for all or part of their life cycle.

Wetlands in the Sacramento and San Joaquin Valley and foothills are especially important to migratory birds. The combination of vegetation and open water in wetlands provides food, rearing areas, and cover for waterfowl and shorebirds. These wetlands are the primary waterfowl wintering area in the Pacific Flyway, providing wintering habitat for about 60 percent of the total migratory waterfowl population.

Most perennial freshwater wetlands are considered sensitive habitats because they provide important habitat to many common wildlife species, support sensitive species, have limited distribution, and have been substantially reduced from their historical extent. In addition, perennial freshwater wetlands of the Sacramento and San Joaquin Valley and foothills provide important ecological functions related to water quality and hydrology. These habitats generally qualify as jurisdictional wetlands subject to U.S. Army Corps of Engineers (USACE) jurisdiction under Sections 401 and 404 of the federal Clean Water Act (CWA). Perennial freshwater wetland habitats are considered sensitive by DFG and are tracked in the California Natural Diversity Database (CNDDB).

Seasonal Wetland Habitats Seasonal wetlands are topographic depressions that are seasonally saturated and can support hydrophytic plant species and hydric soils. Seasonal wetland habitats may occur in both topographic depressions and swales. Hydrologically, seasonal wetlands are similar to vernal pools (see the “Vernal Pools” section below) because they remain inundated or saturated for extended periods during winter and spring. Seasonal wetland swales do not pond water appreciably, but are inundated by flowing water during rainfall and support a saturated upper soil horizon for an extended period of time during the growing season.

Seasonal wetlands are generally dominated by hydrophytes during the winter and spring months. The vegetation of these features may transition to species that are characteristic of surrounding nonwetland habitat as the drying down process occurs. Evidence of hydrology, including algal matting, flow patterns, or presence of dead hydrophytes, is usually evident in the dry season upon close inspection.

Characteristic plant species in seasonal wetlands and seasonal wetland swales consist of both natives and nonnatives. Native species include coyote thistle (*Eryngium vaseyi*), toad rush (*Juncus bufonius*), hyssop loosestrife (*Lythrum hyssopifolium*), foothill meadowfoam (*Limnanthes striata*), and common spikerush. Nonnative species include dallis grass (*Paspalum dilatatum*), rabbitsfoot grass (*Polypogon monspeliensis*), and Italian ryegrass (*Lolium multiflorum*).

Seasonal wetlands provide food, cover, and water for numerous common and special-status species of wildlife that rely on wetlands for all or part of their life cycle. Some of the special-status plant and wildlife species associated with wetland habitats in Tables 3.6-3 and 3.6-4 may also be found in seasonal wetlands (e.g., brittlescale), and there is considerable overlap in the special-status species found in vernal pools (described below). Like perennial wetlands, seasonal wetlands have been substantially reduced from their historical extent. These habitats sometimes qualify as jurisdictional wetlands subject to USACE jurisdiction under Sections 401 and 404 of the federal CWA. They may be considered sensitive by DFG and are tracked in the CNDDB.

Vernal Pools Associated with grassland habitats (see the "Grasslands Habitats" section below), vernal pools are natural ephemeral wetlands that form in shallow depressions underlain by an impervious or restrictive soil layer near the surface that limits the percolation of water. In California, vernal pools become wetted in November with the onset of winter rains, then remain inundated for varying lengths of time during winter and spring, draining slowly because of the restrictive soil layer. The soil remains moist through spring, then desiccates and stays dry until the following winter rains. Vernal pools are supported by direct precipitation and surface runoff.

Vernal pools are characterized by low-growing annual grasses and forbs that have adapted to live both on land and in water. Vernal pools are typically distinguished by a unique assemblage of primarily native plant species adapted to the extreme conditions created by the cycles of inundation and drying. Many of these native plant species may be endemic (restricted) to vernal pools. Characteristic vernal pool species may include annual hairgrass (*Deschampsia danthonioides*), Fremont's goldfields (*Lasthenia fremontii*), common spikerush, coyote thistle, stipitate popcorn flower (*Plagiobothrys stipitatus*), white-headed navarretia (*Navarretia leucocephala*), and horned downingia (*Downingia bicornuta*).

Many of the plant species associated with vernal pools also are federally listed or State listed as threatened or endangered or are otherwise considered sensitive. Among these are several species of grasses in the *Orcuttieae* tribe, and a number of other vernal pool–associated species that

are restricted to the Sacramento and San Joaquin Valley and foothills. Several sensitive wildlife species are also associated with vernal pools; among these species are invertebrates such as fairy shrimp (*Branchinecta* sp.) that rapidly complete their life cycles while pools are seasonally inundated. Various amphibians, such as California tiger salamander (*Ambystoma californiense*), require both wetland habitat of vernal pools and burrows in upland habitats that surround vernal pools (for wintering habitat).

The extent of vernal pool habitat has also been reduced: an estimated 75–90 percent of the California's historic vernal pool habitat has been lost. In surveys of vernal pool distribution in the Central Valley, 13 percent of the approximately 1,033,000 acres of vernal pool habitat mapped in 1997 was gone by 2005 (Holland 2009).

Vernal pools are generally considered sensitive habitats because they provide important (and in many cases the only) habitat for many sensitive plants and animals, and also provide important ecological values and functions. Vernal pools are tracked as sensitive communities in the CNDDB. When they meet specific criteria established by USACE, they are considered jurisdictional wetlands under Section 404 of the CWA, and they generally qualify as waters of the State subject to the jurisdiction of the appropriate regional water quality control board (RWQCB) under the Porter-Cologne Water Quality Control Act. In addition, the extent of vernal pool habitat has been substantially reduced throughout California.

Grassland Habitats In the FRAP mapping, grassland habitats include annual grassland, perennial grassland, and vernal pools. In the Sacramento and San Joaquin Valley, the largest remaining blocks of natural habitats are largely restricted to the foothill margins and consist primarily of annual grasslands (Spencer et al. 2010), which indicates the importance of grasslands to the biodiversity of the valley and adjacent foothills. Annual grassland habitat is composed of an assemblage of native and nonnative annual grasses and, to a lesser extent, native perennial grasses and native and nonnative forbs. The species composition and abundance of this habitat varies over its large range, depending on site-specific factors such as soil chemistry and texture, topography, and disturbance regime. In addition, species composition and abundance vary temporally from season to season and year to year (Sawyer et al. 2009).

Vernal pools, which are discussed in the section above, are common within annual grasslands where a restrictive soil layer is present (e.g., hardpan or claypan).

Annual grasslands support a large number of sensitive plant species (Table 3.6-2), aside from the species that are restricted to vernal pools or other seasonal wetland habitats within annual grasslands. This large number of sensitive plant species is attributable to several factors: the extent of annual grassland, the richness of the native flora that persist within this habitat, the high degree of competition from nonnative and invasive species that now dominate these habitats, incompatible grazing regimes, and habitat conversion. Annual grasslands provide food, cover, burrowing, and nesting opportunities for a variety of common and sensitive wildlife species. Kangaroo rats, squirrels, and other small mammals forage primarily on seeds and insects in grasslands. The San Joaquin kit fox (*Vulpes macrotis mutica*) feeds on small mammals, insects, and ground-nesting birds in grasslands; like small mammals, it depends on subterranean burrows for protection from predators and heat, and for reproduction and rearing of young. Large, open grasslands that support an abundant community of small mammals provide food for many raptors (e.g., Swainson's hawk), which forage over grasslands and nest in trees of adjacent habitat. Reptiles such as blunt-nosed leopard lizard (*Gambelia sila*) use burrows in grasslands and edges of agricultural lands. Burrowing owls (*Athene cunicularia*) prefer to utilize burrows in open, low-lying grasslands. Many ground-nesting birds forage on insects and spiders, and rest, seek cover, and build nests in the cover of grassland habitats.

Annual grasslands located primarily in the foothills of the Sacramento and San Joaquin Valley are also important for maintaining wildlife connectivity among remaining natural lands. Historically, these grasslands were particularly important for species such as the Tule elk (*Cervus canadensis* ssp. *Nannodes*), which have large home ranges, disperse long distances, and/or have population centers that otherwise would be isolated and thus less viable (Spencer et al. 2010). Grassland habitats were historically more extensive in the Central Valley and may have contained a substantial component of perennial grasses, particularly in more mesic locations of the Sacramento Valley. (Perennial grasslands now exist primarily as small patches in annual grassland.) In other areas, such as the southern San Joaquin Valley, areas now characterized by annual grasslands were historically dominated by diverse assemblages of native annual wildflowers (Sawyer et al. 2009). Most of these grasslands have been converted to agricultural, urban, and industrial uses, and remaining grasslands are now dominated by nonnative species.

Despite their reduced extent, annual grasslands are not considered sensitive habitats. However, as discussed in the section above, vernal pools are generally considered sensitive habitats because they provide important habitat for many sensitive species and provide important ecological values and functions. Native perennial grasslands are also considered sensitive

natural communities and are tracked in the CNDDB because of the very limited amount of this community type that remains in California.

Anthropogenic (Human-Made) Habitats Substantial portions of the native habitats within the Sacramento and San Joaquin Valley and foothills have been converted to agricultural or urban uses or otherwise disturbed. (Extensive disturbed areas are mapped as barren in the FRAP data summarized in Table 3.6-1.) Of anthropogenic habitats, agricultural habitats are the most extensive and provide important habitat for some wildlife species.

Agricultural habitats consist primarily of irrigated row and field crops (e.g., rice, beans, melons, and alfalfa) and orchards and vineyards (e.g., grapes, walnuts, almonds, and grapes). Agricultural lands go through frequent, often seasonal cycles of tillage, seedbed preparation, seeding, crop growth, and harvesting, with applications of irrigation water, fertilizers, pesticides, and herbicides.

The value of agricultural habitat for sensitive and common wildlife species varies greatly among crop types and agricultural practices. Rice fields can provide relatively high-quality agricultural habitat. Seasonal flooding creates surrogate wetlands that can be exploited by a variety of resident and migratory birds, and dry rice fields can attract rodents and their predators (e.g., raptors). Flooded rice fields and irrigation canals also provide important habitat for the giant garter snake, a sensitive species that, like waterfowl and shorebirds, has had its preferred wetland habitat greatly reduced and now uses rice fields as surrogate habitat.

Field crops provide forage for raptors, waterfowl, and small rodents at certain times of year. For example, pasture and irrigated hayfields provide valuable foraging habitat for raptors, particularly after mowing or grazing, when rodents may be especially available for these species. Shorebirds and gulls may also make extensive use of these habitats, particularly when flood irrigation creates areas of shallow inundation and moist, bare soil that provide foraging opportunities for these species.

Agricultural lands that undergo intense management and frequent harvests and/or lack structural diversity and sources of water tend to have a lower value as wildlife habitat. Most monocultural row crops provide relatively poor wildlife habitat because of the intensity of management and lack of structural diversity. However, raptors and other birds still frequently use row crops for foraging. Like row crops, orchards and vineyards have relatively low value for wildlife because understory vegetation that would provide food and cover typically is removed or maintained at a low height. However, the structural integrity and insect community associated with

some vineyards and older orchards attracts many bat species that forage and roost in these habitat types.

Chaparral and Scrub Habitats Several chaparral and scrub habitats occur in the Sacramento and San Joaquin Valley and foothills. Chaparral habitats are found within the foothills surrounding the Sacramento and San Joaquin Valley, generally at elevations between 500 and 4,000 feet, and may be dominated by a variety of shrub species (Table 3.6-1). Fire is an integral component of these habitats, which are dominated by plant species with traits that make them resilient after fires occur (e.g., shoots that regenerate from the base of the plant, seeds whose germination is triggered by fire).

A relatively large number of plant species associated with chaparral habitats are considered sensitive (Table 3.6-2)—particularly on unique soil types, such as serpentinite and gabbroic soils, that are difficult for many plant species to grow on because they are low in macronutrients and high in heavy metals. Several sensitive plant species are specifically adapted to the harsh growing conditions of these soils and rarely grow anywhere else.

Shrub-dominated upland scrub habitats are also present in the Sacramento and San Joaquin Valley and foothills. Unlike chaparral, scrub habitats are not resilient to fire.

With the exception of alkali desert scrub, upland scrub habitats support few sensitive plant species. Plant species occurring in alkali desert scrub habitat must be adapted to alkaline and saline soil conditions; therefore, several species are endemic to this habitat. Because of habitat reduction and the relatively large number of species restricted to this particular habitat, a number of sensitive plant species can be found in alkali desert scrub habitat (Table 3.6-2).

Chaparral and scrub habitats provide habitat for a wide variety of wildlife, including sensitive species (Table 3.6-2). Chaparral provides seeds, fruit, and protection from predators and harsh weather; for example, it provides summer-range foraging areas, escape cover, and fawning habitat for deer. It also provides singing, roosting, and nesting sites for many species of birds (England 1988; Risser and Fry 1988).

Alkali desert scrub habitat provides food, shelter, and cover for a variety of common and sensitive wildlife species (Table 3.6-2). Many of the sensitive reptile, bird, and mammal species found in this habitat type are also found in grasslands. Like grasslands, alkali desert scrub provides seeds, insects, and other food items that support the diet of a variety of wildlife. Alkali desert scrub also provides burrowing opportunities for reptiles (e.g., silvery legless lizard (*Anniella pulchra pulchra*)), small mammals (e.g., kangaroo

rats, squirrels), and burrowing owls. All of these species use burrows to reproduce, rear their young, and seek protection from predators and heat. Similarly, many ground-nesting birds build nests and seek cover under the shrub layer of alkali desert scrub.

Most chaparral and scrub habitats are widespread and have not been substantially reduced in extent or altered by human activities. However, some low-elevation chaparral habitats (such as those on gabbro soils) have been fragmented and altered by development and other human activities. Alkali desert scrub was formerly extensive but has been greatly reduced, primarily by agricultural conversions and groundwater pumping. These habitats have also been affected by altered fire regimes and by grazing practices that facilitate the spread of annual grasses (which in turn increases fire frequency and intensity) or that replace scrub habitats with introduced bunchgrasses that provide better forage for livestock. Where chaparral and scrub habitats are associated with serpentine soils, these are considered sensitive.

Woodland and Hardwood Forest Habitats Woodland habitats are found primarily in the foothills of the Sacramento and San Joaquin Valley. Valley oak woodland is the predominant woodland habitat in the valley itself. Hardwood forests are more characteristic of higher elevations than oak woodlands and are located primarily in the Sacramento and San Joaquin Valley watersheds.

Woodland habitats are extensive and include a large number of species. They are often located on serpentine or gabbroic soils that support a large number of specially adapted, endemic species. Many of the special-status plants found in chaparral are also found in woodland habitats, when the appropriate soils are present. In addition, open woodland habitats typically have an annual grassland understory and have been subjected to similar effects from livestock grazing and competition from invasive species. A total of 57 special-status plant species have been documented in the CNDDB (2010) within woodland habitat types in the Sacramento and San Joaquin Valley and foothills portion of the study area (Table 3.6-4), more than in any other habitat type in this area.

Oak woodlands and other hardwood forests are important for many wildlife species, including sensitive species (Table 3.6-2). Oaks and other hardwood trees provide shelter for wildlife through shading and cavities within tree trunks: nesting habitat for birds, roosting sites for bats, and denning sites for mammals. Acorn crops produced by oak woodlands and hardwood forests, as well as diverse insect fauna, provide high-quality food for a wide variety of wildlife.

Oak woodlands are considered sensitive communities. Incremental losses of oak woodland habitat have occurred throughout California as a result of habitat conversions, residential and commercial uses, and other compounding factors such as lack of regeneration, spread of Sudden Oak Death Syndrome, and competition from invasive species. For these reasons, as well as the threat of global climate change, the status of oak-dominated woodlands has become a concern to ecologists and resource managers (Tyler et al. 2006). Valley oak woodland in particular has been dramatically reduced over its entire range and is tracked in the CNDDB as a sensitive natural community.

Hardwood forest habitats have been less altered by human activities than oak woodlands, in part because of their distribution at higher elevations and their ownership and management by federal agencies, such as the U.S. Forest Service. Thus, hardwood forests are not considered sensitive habitats.

Coniferous Forest Habitats Coniferous forest habitats are found at the upper elevations of the Sacramento and San Joaquin Valley and foothills geographic area of the study area, primarily upslope of the northern study area reservoirs (Table 3.6-1). Eastside pine forest is the only coniferous forest type in this geographic area that is considered a sensitive habitat.

In general, fewer sensitive plant species exist in coniferous forest habitats in the foothills of the Sacramento and San Joaquin Valley than in grassland, chaparral, and woodland habitats (Table 3.6-2). Part of the reason for this difference is that many effects on these forests have been less extensive than effects on other habitats. Agriculture and urban development are not as widespread in areas that support coniferous forest habitats as in other areas, and competition from invasive plant species is relatively low. In addition, most coniferous forests in the study area are owned and managed by federal agencies, such as the U.S. Forest Service, and are therefore not available for development.

Coniferous forests can support a diverse community of wildlife, including sensitive species, by providing a variety of cover, food, and nesting and roosting opportunities (Table 3.6-2). Coniferous forests produce pine needles, cones, buds, pollen, twigs, seeds, and associated fungi and insects that provide food for many species of birds and mammals. High-density stands with relatively closed canopies can provide cover for many species, including large mammals, and breeding opportunities for birds. Mature conifer trees provide nesting habitat for raptors, while snags and hollow logs provide shelter for mammals.

The extent of coniferous forests has not been substantially reduced. However, timber harvesting and fire suppression have substantially altered most coniferous forest habitats at lower elevations. Coniferous forests are not considered sensitive habitats.

Delta and Suisun Marsh The Delta and Suisun Marsh is an area of more than 825,000 acres divided into numerous islands by hundreds of miles of waterways. Some of the habitats of the Delta–Suisun Marsh area are the same as habitats described for the Sacramento and San Joaquin Valley and foothills (Table 3.6-1). Differences in the ecology of riparian and wetland habitats in the Delta, and habitats unique to the Delta, are described in this section.

Overview of Habitat Types and Sensitive Wildlife Species Historically, the Delta was inundated each year by winter and spring runoff. Channel geometry changed in response to flood conditions and tidal influence. Consequently, the Delta historically had extensive areas of wetlands.

Nearly all of the Delta's wetlands have been reclaimed for agriculture and other land uses by construction of levees and lowering of water tables with a system of drains and pumps. Drainage has exposed wetland soils rich in organic matter to aerobic conditions and relatively rapid decomposition, which has resulted in a continual loss of soil volume (Drexler et al. 2009). More than 1,000 miles of levees protect this reclaimed and subsiding land (CALFED 2000b).

However, some small islands remain in a quasi-natural state. (These quasi-natural islands include "flooded islands" that were once reclaimed land, but were abandoned after levee failures.) Some other areas also support aquatic and wetland communities, including riparian and marsh habitats similar to the ones described for the Sacramento and San Joaquin Valley and foothills.

Although there are similarities, the species composition and ecology of riparian and wetland habitats in the Delta–Suisun Marsh area differ in several important ways from the corresponding habitats in the Sacramento and San Joaquin Valley and foothills. The disturbances that remove riparian vegetation, or create newly exposed surfaces where riparian vegetation can establish, differ somewhat. Disturbances related to meander migration are more limited in the Delta (and in Suisun Marsh) than upstream, but anthropogenic (human-made or caused) disturbances, such as levee maintenance and trampling, are greater in the Delta and Suisun Marsh. The close proximity to levees, extensive placement of bank protection, and greater density of human population in this area are the primary reasons for this greater level of disturbance. In addition, emergent

wetland habitats in the Delta and Suisun Marsh are influenced by the daily tides, whereas the freshwater emergent habitats in the Sacramento and San Joaquin Valley and foothills are nontidal.

The habitats and habitat components of the Delta support a variety of common and sensitive wildlife species (Tables 3.6-2 and 3.6-4). For example, riparian trees are an important feature of the Delta landscape, providing nesting opportunities for numerous wading birds, raptors, and cavity-nesting birds, and roosting habitat for some bat species. Both nontidal and tidal marshes in the Delta have dense emergent vegetation that provide essential cover, resting, and foraging sites for a variety of wildlife species. Tidal marshes and associated mudflats are exposed at low tides and support a variety of foraging shorebirds and dabbling ducks. Adjacent upland habitats are also required for seasonal hibernation and reproduction in some species; they serve as important resting, cover, and nesting sites for many birds and mammals that move into uplands during high tide. Canals, side channels, and backflow pools of the Delta that contain emergent vegetation provide forage and cover habitat. They also are dispersal corridors that link habitat areas for terrestrial and semiaquatic species as well as many bird species.

Saline Emergent Wetlands In addition to the wetland habitats described for the Sacramento and San Joaquin Valley and foothills, the Delta–Suisun Marsh area has saline emergent wetlands that, like freshwater marshes, are dominated by perennial plants. This community occurs on instream islands and along mostly unleveed, tidally influenced waterways. In addition to the environmental factors affecting freshwater marshes, the species composition of tidal marshes in the Delta and Suisun Marsh is affected by regional salinity gradients. Salinity may range from less than 5 parts per thousand in the brackish marsh habitats with regular freshwater inflows to up to 145 parts per thousand of saltwater in closed lagoons.

Saline emergent wetlands are generally considered a sensitive habitat because they support sensitive species, have limited distribution, have been substantially reduced from their historic extent, and generally qualify as jurisdictional wetlands subject to USACE jurisdiction under Section 404 of the CWA. Many special-status plant species are associated with saline emergent wetlands (Table 3.6-3). Saline emergent wetlands provide food, cover, and nesting and roosting habitat for a variety of sensitive species (Tables 3.6-2 and 3.6-4). For example, various birds will forage in saline emergent wetlands and roost in nearby trees or adjacent upland habitats. Some small mammals of the Delta and Suisun Marsh (e.g., salt marsh harvest mouse (*Reithrodontomys raviventris*) and Suisun shrew (*Sorex ornatus sinuosus*)) forage mainly in saline emergent wetlands and use

adjacent upland habitat for cover from high tides as well as for reproduction and rearing of young.

Other Sensitive Habitats Other habitats that are found in the Delta–Suisun Marsh area but were not separately mapped in the data source for Table 3.6-1 or described above for the Sacramento and San Joaquin Valley and Foothills are inland dunes and alkali seasonal wetlands. Both of these habitats were likely mapped as annual grassland. Both habitats are tracked in the CNDDB.

Inland dune habitat is composed of vegetated, stabilized sand dunes associated with river and estuarine systems. This habitat type includes remnants of low-lying, ancient stabilized dunes related to the Antioch Dunes formation, located near the town of Antioch. The vegetation of these ancient interior dunes historically included perennial grassland, oak woodland, and local "blowout" areas (i.e., naturally disturbed, unstable, wind-eroded and depositional sites, or river-cut sand cliffs within stabilized dunes) that supported distinctive dune species. Those species have persisted at the Antioch Dunes National Wildlife Refuge. The Delta's other dune remnants are highly fragmented; many of them are dominated by nonnative weedy vegetation and trees, in contrast with the native vegetation characterizing the interior dune remnants at Antioch Dunes National Wildlife Refuge.

These remaining dunes are generally considered a sensitive habitat because of their limited distribution and the presence of sensitive species. Antioch Dunes evening primrose (*Oenothera deltoides* ssp. *howellii*) and Contra Costa wallflower (*Erysimum capitatum* ssp. *Angustatum)*, which are federally and State listed as endangered, are found in the inland dunes habitat at Antioch Dunes National Wildlife Refuge; in addition, rare invertebrates have been collected at this location since the 1930s. One of the more notable species found here is Lange's metalmark butterfly (*Apodemia mormo langei*), which is restricted to the Antioch Dunes and federally listed as endangered.

Alkali seasonal wetlands occur on alkaline soils that remain inundated or saturated for prolonged periods during the growing season. The vegetation of alkali seasonal wetlands is composed of plant species adapted to wetland conditions and high salinity levels.

Alkali seasonal wetlands occur within a surrounding matrix of annual grassland. This habitat type is typically found at the historical locations of lakes or ponds in the Yolo Basin, in and around the DFG Tule Ranch Preserve (Witham 2003), where salts accumulated through evaporation. It also is found in upland locations such as basin rims and seasonal drainages,

which receive salts in runoff from upslope salt-bearing rock (e.g., areas near Suisun Marsh and Clifton Court Forebay).

The composition of alkali seasonal wetlands can vary considerably from site to site and can support a rich flora, often providing suitable habitat for special-status plant species. Alkali seasonal wetlands are generally considered sensitive habitats because they provide suitable habitat for many special-status plants and animals, are of concern to DFG, and in many cases are considered jurisdictional wetlands regulated by USACE under Section 404 of the CWA.

Profiles of Selected Special-Status Species in the Extended Systemwide Planning Area As summarized in Tables 3.6-3 and 3.6-4, numerous special-status plant and wildlife species have the potential to occur in the Extended SPA. Species associated with riparian habitats and remaining freshwater emergent wetlands in the Sacramento and San Joaquin Valley and foothills could experience greater and more varied effects from the proposed program than other sensitive habitats because of their location in channels and on streambanks and floodplains. Selected special-status plant and wildlife species associated with these habitats and that are often considered in flood control projects in the Extended SPA are briefly described here.

Plants

Heartscale Heartscale (*Atriplex cordulata*) has a California Rare Plant Rank of 1B.2, which indicates that it is a California endemic considered by CNPS to be fairly endangered because 20–80 percent of known occurrences are threatened. Heartscale is distributed throughout the Great Valley region up to 1,250 feet in elevation; however, it may be extirpated from some counties, including San Joaquin, Stanislaus, and Yolo. This species has also been reported to occur in Great Valley Grasslands State Park (McBain & Trush 2002) and in San Luis National Wildlife Refuge (NWR) near Bear Slough.

Heartscale is an annual herb in the goosefoot family (Chenopodiaceae). It has erect stems that are typically 4–20 inches long. This species blooms between May and October. Heartscale is found in chenopod scrub, desert scrub, and grassland habitats in sandy soils that are moderately alkaline or saline. Development and conversion of habitat to agricultural uses appear to be the predominant threats to the survival of heartscale (CNPS 2010). Grazing and trampling are frequently mentioned as disturbances to known populations, but these do not seem to be serious threats.

Delta Button-Celery Delta button-celery (*Eryngium racemosum*) is federally listed as endangered. This species also has a California Rare Plant Rank of 1B.1, which indicates that it is a California endemic considered by CNPS to be seriously endangered because greater than 80 percent of occurrences are threatened. Of approximately 26 occurrences of Delta button-celery recorded in the CNDDB, several have been extirpated, including all occurrences in San Joaquin County and most in Stanislaus County. Most of the extant occurrences are in Merced County along the San Joaquin River, including four in the West Bear Creek Unit and several in Great Valley Grasslands State Park. The species' elevation range is 10–100 feet.

Delta button-celery, a perennial herbaceous member of the carrot family (Apiaceae), has tiny flowers that bloom between June and September. This species is found on clay soils in seasonally inundated floodplain depressions in riparian scrub habitat. Disturbance also may be important in creating and maintaining, or conversely in eliminating, habitat for this species. Much of the occupied habitat is inundated periodically, and recently deposited fine sediment has been observed at several occupied sites (CNDDB 2010). Several occupied sites also experience grazing and various anthropogenic disturbances (e.g., from off-road vehicles, road maintenance). Delta button-celery is threatened by agricultural conversion and flood control activities (CNPS 2010).

Boggs Lake Hedge-Hyssop Bogg's Lake hedge-hyssop (*Gratiola heterosepala*) has a California Rare Plant Rank of 1B.2. The geographic range of Bogg's Lake hedge-hyssop includes portions of several different regions: the inner north Coast Ranges, the central Sierra Nevada foothills, the Sacramento Valley, and the Modoc Plateau (Hickman 1993). Within this range, it is known from 87 locations (i.e., CNDDB occurrences); at 85 of these locations, the species is presumed to be extant (and more than 90 percent of the occurrences that are presumed extant have been visited in the last 20 years) (CNDDB 2010).

A semiaquatic annual in the snapdragon family (Scrophulariaceae), Bogg's Lake hedge-hyssop is typically less than 4 inches tall (Hickman 1993). It grows at elevations of 30–7,800 feet in marshes, vernal pools, and margins of lakes in clay soils. Populations of Bogg's Lake hedge-hyssop, like those of many vernal pool species, fluctuate in abundance from year to year depending on the amount of rainfall (Corbin et al. 1994 and Kaye et al. 1990, both cited in USFWS 2005, CNDDB 2010). Estimates of some populations have fluctuated from no plants in a dry year to thousands in a wet year. The plants complete a rapid life cycle during the period when vernal pools have begun to dry but still contain shallow water (Corbin 1994 and Kaye et al. 1990, both cited in USFWS 2005). They bloom between

April and August (CNPS 2010). Seeds may remain dormant for more than 1 year (USFWS 2005).

Bogg's Lake hedge-hyssop is threatened primarily by conversion of its habitat to agricultural or developed land uses, and by incompatible grazing practices (CNPS 2010). It also is threatened by disturbance of habitat by use of off-road vehicles, and by competition from nonnative plants. Although Bogg's Lake hedge-hyssop is not federally listed, it was considered in the *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon* (USFWS 2005) and may benefit from some of the recovery actions directed at listed species. Because most occurrences of Bogg's Lake hedge-hyssop are on public land or on preserves (USFWS 2005), management actions are particularly important for the conservation of this species.

Sanford's Arrowhead Sanford's arrowhead (*Sagittaria sanfordii*) has a California Rare Plant Rank of 1B.2. The distribution of Sanford's arrowhead is disjunct across many regions—the Sacramento and San Joaquin valleys, northwestern California, and the south coast—at elevations between 950 and 7,050 feet. Sanford's arrowhead is an emergent (i.e., rooted in water but emerging above the water surface) perennial herb species in the water plantain family (Alismataceae). The flowers have three white petals each and the blooming period is between May and October. This species grows in shallow freshwater marsh habitat in ponds, ditches, and other standing or slow-moving waters. The primary threats to Sanford's arrowhead are hydrologic modifications and development (CNPS 2010.

Wildlife

Valley Elderberry Longhorn Beetle The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is federally listed as threatened, and critical habitat has been designated for the species. In 2006, the U.S. Fish and Wildlife Service (USFWS) recommended delisting this species (USFWS 2006a), which is endemic to the Central Valley. The valley elderberry longhorn beetle is found only in association with its host plant, the elderberry shrub (*Sambucus* spp.). In the Central Valley the elderberry shrub is found primarily in riparian vegetation.

This species has experienced substantial loss of riparian habitat containing its host plant, and damage and loss of host plants in remaining habitat. However, the greatest current threat to the valley elderberry longhorn beetle may be predation and displacement by the invasive Argentine ant (*Linepithema humile*) (Huxel 2000). A recovery plan was prepared for the valley elderberry longhorn beetle during the 1980s (USFWS 1984);

regularly implemented conservation measures have included avoidance and minimization of effects on occupied habitat, elderberry transplantation and replacement plantings, and habitat preservation. In part as a result of these measures, extensive areas of habitat have been preserved (USFWS 2006a). As noted above, the species has been recommended for delisting.

Giant Garter Snake The giant garter snake (*Thamnophis gigas*) is federally and State listed as threatened. The giant garter snake historically occurred throughout California's Central Valley, but the species' current range is confined to the Sacramento Valley, and isolated sites in the San Joaquin Valley and potentially in the Delta (Hansen and Brode 1980; USFWS 2006b). Many of the populations of giant garter snake in the northern part of the range from Stockton (San Joaquin County) to Chico (Butte County) are relatively stable; however, the southernmost populations at the Mendota Wildlife Area (Fresno County) and the Grassland Wetlands (Merced County) are small, fragmented, unstable, and probably decreasing (USFWS 2006b). No sightings of giant garter snakes south of the Mendota Wildlife Area, within the historic range of the species, have occurred since the time of listing (Hansen 2002).

The giant garter snake is a large (up to 5 feet long), aquatic snake. It inhabits sloughs, low-gradient streams, marshes, ponds, agricultural wetlands (e.g., rice fields), irrigation canals and drainage ditches, and adjacent uplands. It feeds primarily on small fish, tadpoles, and frogs. Snakes use emergent vegetation and crevasses and burrows in adjacent uplands for cover (USFWS 2006b). They also use adjacent uplands for foraging, basking, refuge from flood waters, and hibernation. Giant garter snakes may hibernate up to 800 feet from water, and along waterways, they may move considerable distances (e.g., up to 2 miles in a single day) (Hansen 1988; USFWS 2006b). Giant garter snakes are less active or dormant from October until April, when they emerge to breed and forage (Wylie et al. 1997).

Giant garter snakes are vulnerable to predation from both native species (e.g., raccoons, egrets, and herons) and nonnative species (e.g., bullfrogs, feral cats) (58 *Federal Register* (FR) 54053–54065, October 20, 1993; Carpenter et al. 2002). Predation may be the reason that giant garter snakes tend to be absent from larger rivers that support predatory fish (Hansen 1980). They are also affected by parasites and contaminants. Giant garter snake is threatened primarily by habitat conversion, fragmentation, and degradation resulting from urban development (58 FR 54053–54065, October 20, 1993; Dickert 2005). (Human disturbance contributes to habitat degradation because giant garter snakes are diurnal predators that are disturbed by human activities.) It is also threatened by incompatible

agricultural practices such as intensive vegetation control along canal banks and changes in crop composition.

Swainson's Hawk The Swainson's hawk (*Buteo swainsoni*) is State listed as a threatened species. The Swainson's hawk breeds in North America and winters in southern South America and parts of Mexico (with the exception of a small population that overwinters in the Delta). It occurs throughout the lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. It nests in riparian forest and woodlands, or in isolated trees, and forages in grassland and agricultural vegetation.

Swainson's hawks arrive at nesting areas in the Central Valley in late February and early March. Their breeding season extends from late March to late July, and then they begin departing for wintering areas in early September. Swainson's hawks feed primarily on small mammals during the breeding season, but also feed on insects (more so during the nonbreeding season). Swainson's hawk foraging ranges during the breeding season have been estimated at approximately 1,000–7,000 acres (Bechard 1982; Estep 1989), and Swainson's hawks may forage considerable distances (up to 18 miles) from their nests (Estep 1989). Prey abundance and accessibility (for capture) are the most important features determining the suitability of hawk foraging habitat. In addition, agricultural operations (e.g., mowing, flood irrigation) have a substantial influence on the accessibility of prey and thus create important foraging opportunities for Swainson's hawk (Estep 1989).

Threats to Swainson's hawk include loss and fragmentation of foraging habitat, loss of nesting habitat, disturbance of nests, and pesticide poisoning in wintering habitat (DFG 2005). Swainson's hawk is a focal species in the *Riparian Bird Conservation Plan* (RHJV 2004), which includes recommendations for improving riparian nesting habitat and adjacent agricultural foraging habitat for this species and other riparian obligate bird species.

Western Yellow-Billed Cuckoo The western yellow-billed cuckoo (*Coccyzus americanus occidentalis*) is a candidate species for federal listing and is State listed as endangered. Yellow-billed cuckoo breeds throughout much of North America and winters in South America (Hughes 1999). The California breeding range of western yellow-billed cuckoo is restricted to the Sacramento Valley, the South Fork of the Kern River, the lower Colorado River Valley, and sometimes the Prado Basin in Riverside and San Bernardino counties (Gaines and Laymon 1984).

Yellow-billed cuckoos are occasional brood parasites; they will lay eggs in nests of other cuckoos or in nests of other species. In the western United States, yellow-billed cuckoos breed in broad, well-developed, low-

elevation riparian woodlands composed primarily of mature cottonwoods (*Populus* spp.) and willows (*Salix* spp.). Typical nest sites in California have moderately high canopy closure and low total ground cover, and are close to water (Laymon and Halterman 1987). In spring, yellow-billed cuckoos arrive in California from late May to until late June.

In California, yellow-billed cuckoo is threatened by the loss or degradation of suitable large tracts of riparian habitat, pesticide poisoning, and possibly also reduced prey abundance resulting from widespread application of pesticides (Gaines and Laymon 1984). Conservation projects of the CVP have preserved habitat for yellow-billed cuckoo (DFG 2005). This species also has been included in habitat conservation and multispecies conservation planning efforts in Southern California. These efforts have focused on conserving suitable breeding habitat by preserving and restoring large patches of riparian vegetation.

Burrowing Owl Burrowing owl (*Athene cunicularia*) is a California species of special concern. Burrowing owls usually inhabit desert and grassland vegetation, and in some cases, urban and agricultural landscapes. Their habitats are flat, open areas characterized by low-stature vegetation (Gervais et al. 2008). Because burrowing owls require underground burrows or artificial structures for shelter and nesting, they are associated with other burrowing animals such as ground squirrels, badgers, and some smaller canids. These habitat components are required year round.

This species breeds throughout North America. In California, the burrowing owl occurs in the Central Valley, the inner and outer coastal regions, portions of the San Francisco Bay Area, the Southern California coast, from Southern California to the Mexico border, the Imperial Valley, and in portions of the desert and high desert habitats in southeastern and northeastern California. Burrowing owls are opportunistic feeders (Gervais et al. 2008), feeding on large arthropods (e.g., beetles and grasshoppers) and small mammals.

Burrowing owls often form loose colonies, with nest burrows 50–3,000 feet apart (Ross 1974, cited in Poulin et al. 2011; Gleason 1978, cited in Poulin et al. 2011). The breeding season for burrowing owl is March to late August; the season tends to last longer in the northern part of the range (Gervais et al. 2008). Burrowing owls tend to be resident where food sources are stable and available year round. They are year-round residents in the San Joaquin Valley (and in winter, the population increases with the addition of individuals that breed in northern portions of the continent) (Gervais et al. 2008). They disperse or migrate south in areas where food becomes seasonally scarce. In resident populations, nest-site fidelity is common, with many adults renesting each year in their previous year's

burrow; young from the previous year often establish nest sites near their natal sites (Gervais et al. 2008).

The primary threat to burrowing owl is loss of wintering and breeding habitat as a result of development and other land use changes. Poisoning of ground squirrels has also contributed to population reductions.

Least Bell's Vireo The least Bell's vireo (*Vireo bellii pusillus*) is federally and State listed as endangered. Critical habitat for least Bell's vireo was designated in 1994 (59 FR 4845–4867, February 2, 1994). This critical habitat is located in Southern California and does not include areas in the San Joaquin Valley. A neotropical migrant species, least Bell's vireo is found in California and other states in the Southwest and west-central United States during its breeding season and migration period. This species nests in dense, low, shrubby vegetation, generally early successional stages in riparian areas, particularly cottonwood-willow forest but also brushy fields, young second-growth forest or woodland, scrub oak, coastal chaparral, and mesquite brushlands, often near water in arid regions (Brown 1993).

Formerly, the vireo was known to breed from throughout the Sacramento and San Joaquin valleys, the Sierra Nevada foothills, and in the Coast Ranges. It historically nested throughout riparian areas in the Central Valley and in other low-elevation riparian zones in California. The species was characterized as abundant at one time, but it is now absent from most of its historical range, and by 1980, was extirpated from the entire Central Valley. However, recent observations indicate that the species' range is expanding northward and individuals are currently recolonizing areas that have been unoccupied for decades (RHJV 2004). Least Bell's vireos successfully nested at the San Joaquin River NWR in 2005 and 2006 (USFWS 2006c).

Least Bell's vireo is a small insectivorous bird. It feeds on a wide variety of insects by gleaning them from foliage and by catching them while hovering. Least bell's vireos arrive in breeding habitats in California from mid-March to April (USFWS 1998a).

The primary threats to the least Bell's vireo are habitat loss and brood parasitism by the brown-headed cowbird (which is greater in areas with livestock) (RHJV 2004; USFWS 2006c). Threats also include habitat degradation that results from trampling of vegetation and nests by livestock and recreationists, or from the spread of invasive plants, particularly giant reed (*Arundo donax*). USFWS has prepared a draft recovery plan for least Bell's vireo (USFWS 1998a). This species is also addressed in most habitat conservation and multiple-species planning efforts in Southern California

(DFG 2005). These plans include the *Coachella Valley Multi-Species Habitat Conservation Plan* (MSHCP), the Western Riverside MSHCP, the *Camp Pendleton Resource Management Plan*, and the *Orange County Natural Community Conservation Plan*. Recovery and management recommendations in these plans include continuing programs to remove cowbirds, monitoring nests for cowbird parasitism, and restoring riparian vegetation. Additional planning and management actions are necessary to resolve land use conflicts, such as from livestock grazing within riparian corridors, water diversion, and development of parks adjacent to suitable vireo habitat.

Bank Swallow The bank swallow (*Riparia riparia*) is State listed as threatened. A neotropical migrant that winters in South America, the species forages over a wide range of land cover types and nests in bluffs or banks, usually adjacent to water.

During the breeding season the bank swallow occurs throughout the northern two-thirds of the United States, most of Canada, and northern Alaska (Garrison 1999). Bank swallows historically occurred along the larger lowland rivers throughout California, with the exception of Southern California, where the species occurred principally along the coast and at the mouths of large rivers such as the Los Angeles River (Grinnell and Miller 1944). The current breeding range (about 50 percent of the historical range) is primarily confined to parts of the Sacramento Valley and northeastern California, including the banks of the Sacramento and Feather rivers; a few scattered colonies persist along the central and northern coast (DFG 2005). Its main stronghold is along the banks of the Sacramento River and its major tributaries (DFG 2005).

Foraging bank swallows take insects on the wing from over a variety of land cover types (Garrison 1999; DFG 2005). They use holes dug in cliffs and river banks for cover. Bank swallows also nest in burrows that they dig in nearly vertical banks and cliff faces. For bank swallows to dig these burrows, they require substrates composed of soft soils such as fine sandy loam, loam, silt loam, and sand. Suitable banks for nesting also must be more than 3 feet above the ground or water to avoid predators. Suitable nest sites are few and are scattered throughout the species' remaining California range; they are most often found at coastal river mouths, large rivers (primarily in the Sacramento Valley), and occasionally in gravel and sand mines that provide and maintain nesting habitat (Grinnell and Miller 1944).

The greatest threat to the bank swallow has been loss of breeding sites along rivers and natural waterways resulting from conversion to concrete-lined flood control channels (in Southern California), and the application of

riprap to natural riverbanks in the Central Valley (DFG 2000, 2005). Other threats come from predators that have access to colonies, changes in gravel and sand mining operations that destroy or no longer create nesting habitat, and high spring floods that can scour out colonies along riverbanks (Garrison 1999). A State recovery plan for the bank swallow was completed and adopted by the California Fish and Game Commission in 1992. The recovery plan identifies habitat preserves and a return to a natural, meandering riverine ecosystem as the two primary strategies for recovering the bank swallow. Also, California Partners in Flight has written a bird conservation plan that addresses riparian-associated birds, including bank swallow (RHJV 2004).

Riparian Brush Rabbit The riparian brush rabbit (*Sylvilagus bachmani riparius*) is federally and State listed as endangered. The species inhabits riparian vegetation along the lower portions of the San Joaquin and Stanislaus rivers in the northern San Joaquin Valley. It apparently has been extirpated from the Delta and most of the lower San Joaquin River and its tributaries, the Stanislaus, Tuolumne, and Merced rivers (Williams 1986). The species' range probably extended farther upstream than the Merced River, assuming that suitable habitat historically occurred along the length of the San Joaquin River system (Williams and Basey 1986).

The riparian brush rabbit is restricted to several populations at Caswell Memorial State Park, along the Stanislaus River near Manteca in San Joaquin County; and along Paradise Cut, a channel of the San Joaquin River in the southern part of the Delta. In addition, the species was recently reintroduced on private lands adjacent to the San Joaquin River NWR (Williams 1993; Williams and Basey 1986).

Habitat for the riparian brush rabbit consists of riparian forests with a dense understory shrub layer. Brush rabbits have small home ranges that usually conform to the size of available brushy habitat (DFG 1993). This species rarely moves more than 1 meter from cover. Riparian brush rabbits will not cross large open areas, limiting their dispersal capabilities (USFWS 1998b). Brush rabbits breed from January to May, but they have lower reproductive rates than other cottontail species. Five out of six rabbits do not survive to the next breeding season (USFWS 1998b).

Potential threats to this species are habitat conversion to agriculture, wildfire, disease, predation, flooding, clearing of riparian vegetation, and use of rodenticides. The species also is at risk from the lack of elevated mounds with protective cover to serve as flood refuges within remaining riparian habitat. A draft recovery plan has been prepared for upland and riparian species in the San Joaquin Valley, including the riparian brush rabbit (USFWS 1998b).

San Joaquin Kit Fox The San Joaquin kit fox (*Vulpes macrotis mutica*) is federally listed as endangered and State listed as threatened. Although the precise historical range of the San Joaquin kit fox is unknown, it is believed to have extended from Contra Costa and San Joaquin counties in the north to Kern County in the south, and along the coast in Monterey, Santa Clara, and Santa Barbara counties. Within portions of this geographic range, the San Joaquin kit fox still occurs in seasonal wetland, alkali desert scrub, grassland, and valley-foothill hardwood vegetation.

The San Joaquin kit fox is a carnivore with a varied diet (USFWS 1998b, Ahlborn 2000). Prey include mice, ground squirrels, hares, cottontails, ground-nesting birds, and insects; these foxes also consume plant matter. The San Joaquin kit fox is active year round and primarily nocturnal. Its home range may be from 1 to several square miles, and home ranges may overlap among individuals. Dens are used for cover. Kit foxes either dig their own dens, use those constructed by other animals, or use human-made structures (culverts, abandoned pipelines, or banks in sumps or roadbeds) (USFWS 2010a).

Loss and degradation of habitat by agricultural, industrial, and urban developments and associated practices continue, decreasing the carrying capacity of remaining habitat and threatening kit fox survival (USFWS 2007). Such losses contribute to kit fox declines by causing displacement and direct and indirect mortalities, creating barriers to movement, and reducing prey populations. The San Joaquin kit fox is also threatened by rodenticide use, and by competitive displacement or predation by other species, such as the nonnative red fox (*Vulpes vulpes*), coyote (*Canis latrans*), domestic dog (*C. familiaris*), bobcat (*Felis rufus*), and large raptors. A recovery strategy for San Joaquin kit fox has been developed by USFWS and is included in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998b).

Sacramento and San Joaquin Valley Watersheds

The Sacramento and San Joaquin Valley watersheds cover a large and diverse geographic area supporting a wide range of topography, climates, soil types, and geology. For this reason, there is enormous biological diversity within this area. The Sacramento and San Joaquin Valley watersheds extend from the Sierra Nevada and Cascade Range foothills to the highlands and into the Trinity Mountains to the northwest and northeast to the Modoc Plateau. On the west side of the Central Valley, the watersheds extend into the northern and southern interior Coast Ranges.

This section describes the habitats of the watersheds located outside of the Sacramento and San Joaquin Valley and foothills, generally at higher elevations. (The portions of the watersheds located within the valley and

foothills were discussed under "Sacramento and San Joaquin Valley and Foothills," above.) The watersheds support the same habitats as the Sacramento and San Joaquin Valley and foothills—valley and foothill riparian, freshwater emergent wetland, annual grassland, chaparral, scrub, woodland, and coniferous forest habitats. They also support several higher elevation habitats and habitats of the Great Basin that are not found in the valley and foothills (Table 3.6-5):

- Coniferous forest types—Jeffrey pine, red fir, and subalpine conifer
- Shrub-dominated habitats—alpine-dwarf shrub and desert scrub
- Aspen forest

In addition, coastal scrub habitat is present in portions of the watersheds located within the Coast Ranges.

Many of the habitats that occur to a minor degree in the Sacramento and San Joaquin Valley and foothills are more extensive in the watersheds, such as bitterbrush scrub, low sage, juniper woodland, coastal oak woodland, montane riparian, wet-meadow habitats, and all conifer forest habitat types.

Of the habitats found in the watersheds, eastside pine forest, closed-cone pine-cypress forest, aspen forest, montane riparian, freshwater emergent wetlands, and montane wet meadow are considered sensitive. Bogs, fens, and seeps are also present in the watersheds; however, these sensitive habitat types are not represented in the regional mapping summarized in Table 3.6-5 because they are not included in the WHR classification system used by FRAP. These habitats are typically smaller than the minimum units used by regional habitat mapping and are difficult to identify without site-specific, ground-level investigations.

Table 3.6-5. Habitats and Acreage of Habitat Types Mapped in the Sacramento and San Joaquin Valley (Upper) Watersheds[1]

Habitat	Acreage[2]
Riparian Habitats	
Valley and Foothill Riparian[3]	12,800
Montane Riparian[3]	25
Aspen Forest	7,600
Perennial Wetland Habitats	
Freshwater Emergent Wetland[3]	165,300
Wet Meadow[3]	115,400
Grassland Habitats	
Annual Grassland	2,765,400
Anthropogenic (Human-Made) Habitats	
Agriculture	2,100,400
Pasture	6,900
Urban	314,300
Barren	597,200
Eucalyptus Plantation	1,000
Chaparral and Scrub Habitats	
Coastal Scrub	5,000
Alkali Desert Scrub	200
Desert Scrub	842,500
Bitterbrush Scrub	35,900
Sagebrush Scrub	864,700
Low Sage Scrub	946,400
Chamise Chaparral	233,200
Mixed Chaparral	767,600
Montane Chaparral	607,400
Woodland and Hardwood Forest Habitats	
Blue Oak Woodland[3]	1,286,700
Blue Oak Foothill Pine Woodland[3]	425,300
Coastal Oak Woodland[3]	12,000
Juniper Woodland	336,900
Valley Oak Woodland[3]	28,000
Montane Hardwood	58,300
Montane Hardwood-Conifer	1,423,400
Coniferous Forest Habitats	
Sierran Mixed Conifer Forest	3,556,000
White Fir Forest	478,500
Jeffrey Pine Forest	338,300
Red Fir Forest	733,200
Closed-Cone Pine-Cypress Forest[3]	63,900
Eastside Pine Forest[3]	11,400
Lodgepole Pine Forest	16,600
Douglas Fir Forest	609,700
Ponderosa Pine Forest	627,800

Sources: CAL FIRE 2002, DFG 2010

Notes:

[1] Acreage is rounded to the nearest hundred acres.

[2] Habitats comprising less than 100 acres are not included unless they are sensitive habitat types. The minimum mapping unit used by the California Department of Forestry and Fire Protection is 0.025 acre.

[3] Sensitive habitat type.

Riparian and wetland habitats that are present in the Sacramento and San Joaquin Valley watersheds but were not discussed in the "Sacramento and San Joaquin Valley and Foothills" section above consist primarily of montane riparian and wet-meadow habitats. These habitats are distributed throughout the higher elevations of the Coast, Klamath, and Cascade ranges, and the Sierra Nevada up to about 8,000 feet. Montane riparian habitat generally exists as a narrow corridor around mountain lakes, ponds, seeps, streams, and springs. The structure of this habitat varies from dense, shrubby thickets to tall, open woodlands or dense forests, with scrub being the predominant type at the highest elevations. The tree and shrub layers are typically dominated by any one or a combination of willows, mountain alder (*Alnus incana* ssp. *tenuifolia*), and black cottonwood (*Populus balsamifera* ssp. *trichocarpa*). Aspen riparian forest is also found along creeks and near springs or other moist sites on mountain slopes. Aspen riparian forests are characterized by a tall, dense, deciduous tree canopy consisting exclusively of quaking aspen (*Populus tremuloides*).

Wet meadows occur on finely textured soils of intermittent and perennial stream terraces where the water table is at or near the surface. Soil in the root zone (i.e., the upper 12 inches of soil) of wet-meadow habitat is more or less continuously saturated. Wet-meadow vegetation is characterized by dense cover of perennial plants up to 5 feet tall. Characteristic species include rushes (*Juncus* spp.), sedges (*Carex* spp.), bulrushes (*Schoenoplectus* spp.), and several types of perennial grasses. However, wet meadows are extremely diverse and generally support numerous plant species in multiple herbaceous layers. Wet meadows in the high Sierra and Great Basin typically include narrow willow corridors along stream channels. This habitat type has been used extensively for livestock grazing and is often manipulated to encourage predominance of grasses over sedges (California Gap Analysis Project 2007).

In addition to providing important habitat values to common and special-status species, riparian and wetland vegetation assists physical processes such as water movement and water table retention. The roots of riparian vegetation bind soil on streambanks, stabilizing the bank against the cutting action of flowing water. Riparian and wet-meadow vegetation also dissipate stream energy during high flows, reducing erosion and improving water quality; filter and deposit sediment and capture bedload to aid in floodplain development; promote prolonged base flows; and improve floodwater retention and groundwater recharge (BLM 1998; Manci 1989). When the physical processes of riparian and wetland ecosystems are not functioning properly, these systems cannot sustain desired habitat values (BLM 1998).

As discussed under "Sacramento and San Joaquin Valley and Foothills," above, the extent of riparian habitat has been drastically reduced statewide. Losses of wetland and riparian habitat in the Sacramento and San Joaquin Valley watersheds are attributable primarily to livestock grazing, agriculture, urbanization, timber harvest, and stream modifications for water storage and supply and flood control. Modifications to many of the region's mountain streams have reduced the frequency of overbank flows and lowered the water table. These changes, in turn, have caused transitions from riparian and wet-meadow habitats to dry-meadow and sagebrush scrub habitats on the former floodplains. They have also constricted the remaining wet-meadow and riparian zones to very narrow corridors along downcut stream systems. The reduction and degradation of these habitats makes the remaining wet-meadow and riparian habitats all the more valuable to the species that depend on them.

Many sensitive plant species have been documented in the upland, wetland, and riparian habitats of the watersheds. A total of 417 sensitive plant species have been documented in the Sacramento and San Joaquin Valley watersheds (Table 3.6-6). Of these species, 43 are federally or State listed as threatened or endangered, two are candidates for federal listing, and the remainder are listed as rare or endangered by CNPS. Most sensitive plant species are found in chaparral or woodland habitats, and many are associated with serpentine soils.

The large expanses of coniferous forests, woodlands, chaparral, and riparian habitats of the Sacramento and San Joaquin Valley watersheds support a wide variety of sensitive invertebrates, amphibians, reptiles, birds, and mammals (Table 3.6-6). Many wildlife species in this area use elements of multiple habitats. Nest sites or cover may be provided by the larger trees, fallen logs, and dense understory of older patches of forest, but food resources may be concentrated in younger patches of forest or habitats dominated by shrubs or herbaceous plants (DFG 2007). Many species in the watersheds have been adversely affected by two factors: timber harvesting has reduced the extent of older forests, and fire suppression has increased the density of younger trees across the landscape.

Table 3.6-6. Number of Sensitive Plant and Wildlife Species in the Study Area, by Geographic Area[1]

Geographic Area	Plants	Invertebrates	Amphibians	Reptiles	Birds	Mammals	Total
Extended Systemwide Planning Area:							
Sacramento and San Joaquin Valley and Foothills	125	7	8	5	23	13	181
Delta–Suisun Marsh	43	4	3	2	14	8	74
Sacramento and San Joaquin Valley Watersheds	417	6	14	6	29	23	495
SoCal/Coastal CVP/SWP Service Areas	528	16	14	16	49	54	677

Sources: CNDDB 2010, CNPS 2010

Notes:
[1] The species counts are a total for each geographic area. Species may use multiple geographic areas, and thus may be counted in one or all of the geographic areas in the table.

Key:
CVP = Central Valley Project
Delta = Sacramento–San Joaquin Delta
SWP = State Water Project

The montane riparian, aspen, and wet-meadow habitats have an exceptionally high value for many aquatic and riparian-associated wildlife species because they provide water, thermal cover, migration corridors, and diverse nesting and feeding opportunities (Grenfell 1988; Ratliff 1988). In addition, some raptors and numerous songbirds live primarily in drier plant communities, but rely on these nearby aquatic and riparian habitats for hunting, foraging, cover, and resting (DFG 2007). Several aquatic, riparian, and meadow-dependent species are at risk as a result of impacts from livestock grazing, operation of dams and water diversions, erosion of forest roads, timber harvest activities, development, and recreational activities occurring in the Sacramento and San Joaquin Valley watersheds (DFG 2007).

The Sacramento and San Joaquin Valley watersheds are also important for wildlife movement, including for migratory birds, deer herds, and other wildlife species. Preserving connectivity among the habitat patches in this geographic area is also important to facilitating local daily and seasonal movements (particularly by species with larger home ranges) and maintaining genetic connectivity among populations threatened with isolation. Many of the areas in this region that provide connectivity are in forested, woodland, and shrub habitats that connect high-elevation areas to natural landscapes at lower elevations (Spencer et al. 2010). The western

slope of the Sierra Nevada generally lacks north-south connectivity (Spencer et al. 2010), and many of the remaining areas that provide connections are concentrated around numerous riparian corridors, including major rivers. These riparian corridors and their associated vegetation serve as some of the most important remaining functional wildlife corridors connecting natural lands throughout the Sacramento and San Joaquin Valley watersheds.

SoCal/Coastal CVP/SWP Service Areas

As stated previously, because the proposed program is not expected to affect terrestrial biological resources within the SoCal/coastal CVP/SWP service areas, these resources are not discussed in detail.

The SoCal/coastal CVP/SWP service areas (i.e., portions of the service areas located outside of the Sacramento and San Joaquin Valley and foothills and the valley's watersheds) cover a vast area spread across portions of 10 biogeographic regions: the northern, central, and southern coast; the central Coast Ranges; the southern mountains and valleys; the Central Valley; the Sierra Nevada mountains and foothills; and the Mojave and Sonoran deserts. These areas range in elevation from sea level to more than 10,000 feet and vary from very wet coastal areas receiving up to 60 inches of annual rainfall to the dry deserts where annual precipitation is 3–6 inches. The high mountain areas can receive up to 50 inches of precipitation a year, mostly in the form of snow. The coastal areas experience a cool climate with a long growing season, whereas the high mountain areas have a very cold climate and a short growing season. The deserts have a hot climate and a long growing season. Therefore, this portion of the study area has even greater topographic, climatic, edaphic, and geologic variation than the Sacramento and San Joaquin Valley and foothills and the Sacramento and San Joaquin Valley watersheds; even greater diversity of habitat types (Table 3.6-7); and structure and species composition that vary widely.

Table 3.6-7. Habitats and Acreage of Habitat Types Mapped in the SoCal/Coastal CVP/SWP Service Areas

Habitat	Acreage[1]
Riparian Habitats	
Valley Foothill Riparian [2]	41,200
Desert Riparian [2]	7,400
Montane Riparian [2]	37,600
Palm Oasis [2]	100
Perennial Wetland Habitats	
Freshwater Emergent Wetland [2]	24,900
Saline Emergent Wetland [2]	32,000
Wet Meadow	4,800
Grassland Habitats	
Annual Grassland	3,978,600
Perennial Grassland [2]	34,500
Anthropogenic (Human-Made) Habitats	
Agriculture	4,050,800
Pasture	1,400
Urban	3,321,600
Barren	178,200
Chaparral and Scrub Habitats	
Bitterbrush Scrub	3,000
Sagebrush Scrub	122,000
Chamise Chaparral	468,800
Coastal Scrub	1,109,000
Desert Succulent Shrub	80,400
Desert Wash [2]	51,000
Desert Scrub	4,171,800
Mixed Chaparral	1,644,000
Montane Chaparral	37,700
Alkali Desert Scrub	750,700

Table 3.6-7. Habitats and Acreage of Habitat Types Mapped in the SoCal/Coastal CVP/SWP Service Areas (contd.)

Habitat	Acreage[1]
Woodland and Hardwood Forest Habitats	
Blue Oak Woodland [2]	576,200
Blue Oak Foothill Pine Woodland [2]	244,400
Coastal Oak Woodland [2]	654,000
Juniper	96,900
Woodland and Hardwood Forest Habitats (contd.)	
Pinyon-Juniper	396,400
Montane Hardwood	281,700
Montane Hardwood-Conifer	88,000
Valley Oak Woodland [2]	89,100
Joshua Tree [2]	39,800
Coniferous Forest Habitats	
Sierran Mixed Conifer Forest	87,000
Closed-Cone Pine-Cypress [2]	6,000
Eastside Pine [2]	500
Redwood	14,500
Subalpine Conifer	100
Jeffrey Pine	118,200
Lodgepole Pine	<100
White Fir	1,000
Red Fir	600
Douglas Fir Forest	7,800
Ponderosa Pine Forest	15,900

Sources: CAL FIRE 2002, DFG 2010

Notes:
[1] Acreages have been rounded to the nearest 100 acres.
[2] Sensitive habitat.

Key:
CVP = Central Valley Project
SWP = State Water Project

The most dramatic difference between historical and existing conditions in the SoCal/coastal CVP/SWP service areas is the loss and fragmentation of what were once large contiguous blocks of habitat. The area's natural landscape changed substantially in the late 1800s and early 1900s as lands were converted to agriculture. However, in southern coastal California, that pattern shifted dramatically compared to the pattern in the Central Valley, as urban growth (which started in the 1900s) began to convert large areas

of agricultural lands and remaining natural vegetation to developed land uses. Although agricultural and urban land uses have substantially reduced the area and connectivity of natural vegetation along the coast, the SoCal/coastal CVP/SWP service areas still contain a large diversity of both lowland and upland habitats, including sensitive habitats. Consequently, many sensitive species have the potential to occur in the remaining natural vegetation. For example, 532 special-status plant species have been documented in the remaining natural vegetation in the SoCal/coastal CVP/SWP service areas (Table 3.6-6). Several unique and sensitive habitat types can be found there: desert riparian, desert wash, palm oasis, and Joshua tree woodland.

Because the SoCal/coastal CVP/SWP service areas encompass broad geographic areas, habitats vary by topography and climatic conditions; hence, wildlife community composition varies as well (Table 3.6-6). Much of the land in the SoCal/coastal CVP/SWP service areas has been converted to agriculture and urban land uses, which can support wildlife species adapted to these disturbed environments. However, agricultural and urban growth has adversely affected many wildlife species that, as a result, are threatened with extinction.

In addition to habitat loss, remaining habitat is particularly fragmented in the central and south coast areas by numerous roads, agriculture, and expanding urban areas (Spencer et al. 2010). For example, in the south coast region, most of the conserved natural lands are in mountainous areas that are often separated by densely urbanized and agricultural lands on the gentler terrain between them (Spencer et al. 2010). This fragmentation limits wildlife movement and reduces the ability of wildlife populations to persist. Consequently, regional and local planning efforts have focused on maintaining and enhancing functional connectivity across these urbanized areas (Spencer et al. 2010). This connectivity can be partially achieved through road-crossing improvements, but will probably be more successful with the preservation of existing natural habitat that traverses some of these regions.

Even in portions of the SoCal/coastal CVP/SWP service areas where extensive areas of natural habitats remain, habitat loss and fragmentation is a concern because of ongoing changes. For example, in the western Mojave Desert, large areas have been converted to developed uses in recent decades. Thus, sustaining and enhancing habitat connectivity is a major conservation concern in all of the varied ecoregions within the SoCal/coastal CVP/SWP service areas.

3.6.2 Regulatory Setting

The following text summarizes federal, State, and regional and local laws and regulations pertinent to evaluation of the proposed program's impacts on terrestrial biological resources. Much of the regulatory setting for the resources described below is equally relevant to aquatic biological resources. See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

Federal

Clean Water Act (Section 404) USACE regulates discharges of dredged or fill materials into waters of the United States under Section 404 of the CWA. "Waters of the United States" are lakes, rivers, streams, and relatively permanent tributaries and adjacent wetlands. Wetlands are defined in Section 404 as "areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Activities that require a permit under Section 404 include but are not limited to placing fill or riprap, grading, mechanized land clearing, and dredging. Any activity that would result in the deposit of dredged or fill material below the ordinary high-water mark of waters of the United States or within a jurisdictional wetland usually requires a Section 404 permit, even if the area is dry at the time the activity takes place.

Endangered Species Act of 1973, as Amended The federal Endangered Species Act (ESA) protects and promotes recovery of threatened and endangered species, many of which are terrestrial and present in the Extended SPA. Under the ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." Under federal regulation, take is further defined to include habitat modification or degradation where it would be expected to result in death or injury to listed wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

The ESA includes the following provisions:

- Section 4 outlines a process to list species in danger of becoming extinct.

- Section 7 outlines procedures for cooperation among federal agencies to conserve federally listed species and designated critical habitat. Section 7(a)(2) requires federal agencies to consult with USFWS for terrestrial and nonanadromous fish species, and with the National Marine Fisheries Service (NMFS) for anadromous fish and other

marine fish and mammal species, to ensure that federal agencies do not undertake, fund, permit, or authorize actions likely to jeopardize the continued existence of listed species.

- Section 9 prohibits take of any threatened or endangered species, including harm associated with habitat modifications.

- Section 10 outlines the use of habitat conservation plans (HCPs) when there is no federal involvement in a project and the project is likely to result in take of listed species.

As defined in the ESA, critical habitat is a specific geographic area that is essential for the conservation of a threatened or endangered species and that may require special management and protection. It may include an area that is not currently occupied by the species but that will be needed for its recovery. Critical habitats are designated to ensure that actions authorized by federal agencies will not destroy or adversely modify critical habitat, thereby protecting areas necessary for the conservation of the species.

Fish and Wildlife Coordination Act of 1934, as Amended The Fish and Wildlife Coordination Act was enacted in 1934, then amended in 1946, to protect fish and wildlife when federal actions result in the control or modification of a natural stream or body of water. The statute requires federal agencies to consider the effect that water-related projects would have on fish and wildlife resources. The agencies must consult and coordinate with USFWS and state fish and game agencies to address ways to conserve wildlife resources by preventing loss of and damage to fish and wildlife resources, and to further develop and improve these resources.

Bald and Golden Eagle Protection Act of 1940 With the delisting of the bald eagle in 2007, the Bald and Golden Eagle Protection Act is the primary federal law protecting bald eagles. This law prohibits, except under certain specified conditions, the taking, possession, and commerce of bald and golden eagles. The Bald and Golden Eagle Protection Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" (16 U.S. Code (USC) 668–668d). USFWS has defined "disturb" under the act as follows (72 FR 31132–31140, June 5, 2007):

> *Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, (1) injury to an eagle; (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior; or (3) nest*

> *abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.*

In addition to immediate effects, this definition of "disturb" covers effects caused by human-induced alterations around a previously used nest site when bald or golden eagles are not present. Thus, an eagle has been disturbed if such an alteration sufficiently agitates or bothers a returning eagle to injure it or substantially interfere with normal breeding, feeding, or sheltering habits, and to cause (or be likely to cause) loss of productivity or nest abandonment. USFWS has proposed new permit regulations to authorize the take of bald and golden eagles under the Bald and Golden Eagle Protection Act, generally when the take to be authorized is associated with otherwise lawful activities (72 FR 31141–31155, June 5, 2007).

Migratory Bird Treaty Act Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (16 USC 703–711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 Code of Federal Regulations (CFR) Part 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR 21). Both direct and indirect actions are prohibited, although harassment and habitat modifications are not prohibited unless they result in direct loss of birds, nests, or eggs. The current list of species protected by the MBTA, which can be found in 50 CFR 10.13, includes several hundred species, essentially all native birds. Loss of nonnative species, such as house sparrows, European starlings, and rock pigeons, is not covered by this statute.

Management Plans for Federal Land Throughout the study area, management plans for federal land generally include goals and objectives for conserving biological resources. In addition, a portion of these public lands are designated as conservation areas for the primary purpose of conserving plants, wildlife, fish, and habitats (e.g., national wildlife refuges). Conservation areas and federal lands in the study area are illustrated in Figure 3.6-3.

State

Section 401 Water Quality Certification and Porter-Cologne Water Quality Control Act See Subsection 3.5.2, "Regulatory Setting," in Section 3.5, "Biological Resources—Aquatic."

California Endangered Species Act Under the California Endangered Species Act (CESA), DFG has the responsibility for maintaining a list of endangered and threatened species (California Fish and Game Code, Section 2070). In addition, DFG maintains a list of "candidate species," for which it has issued formal notice that the species are under review for

possible addition to the list of endangered or threatened species. DFG also maintains lists of "species of special concern," which serve as species watch lists.

Pursuant to CESA requirements, an agency reviewing a proposed project within its jurisdiction must determine whether any State-listed endangered or threatened species may be present in the project study area and, if so, whether the proposed project would have a potentially significant impact on any of these species. DFG also encourages informal consultation on any proposed project that may affect a species that is a candidate for State listing.

Take of protected species incidental to otherwise lawful management activities may be authorized through issuance of either an incidental take permit under Section 2081 of the California Fish and Game Code, or a consistency determination under Section 2080.1(a). Section 2080.1(a) authorizes DFG to accept a federal biological opinion as the take authorization for a State-listed species when a species is listed under both the ESA and the CESA. Under the CESA, "take" is defined as an activity that would directly or indirectly kill an individual of a species, but the definition does not include "harm" or "harass," as the federal act does.

California Fish and Game Code Sections 1600–1616—Streambed Alteration Agreement Diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports fish or wildlife resources are subject to regulation by DFG, as required by Sections 1600–1616 of the California Fish and Game Code. The regulatory definition of a stream is a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports wildlife, fish, or other aquatic life. This includes watercourses that have a surface or subsurface flow that supports or has supported riparian vegetation. DFG's jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife. A DFG streambed alteration agreement must be obtained for a project that would result in an impact on a river, stream, or lake.

California Fish and Game Code Sections 1900–1913—Native Plant Protection Act Sections 1900–1913 of the California Fish and Game Code codify the Native Plant Protection Act, which is intended to preserve, protect, and enhance endangered or rare native plants in California. The act directs DFG to establish criteria for determining which native plants are rare or endangered. Under Section 1901, a species is endangered when its prospects for survival and reproduction are in immediate jeopardy from one or more causes. A species is rare when, although not threatened with immediate extinction, it is in such small numbers throughout its range that

it may become endangered if its present environment worsens. Under the act, the California Fish and Game Commission may adopt regulations governing the taking, possessing, propagation, or sale of any endangered or rare native plant.

With DFG participation, CNPS has developed and maintains lists of plants of special concern in California. See the discussion of "California Fish and Game Species Designations" below for more information on DFG and CNPS coordination.

Sections 3503 and 3513 of the California Fish and Game Code—Protection of Birds of Prey Under Section 3503 of the California Fish and Game Code, it is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird. Section 3503.5 specifically states that it is unlawful to take, possess, or destroy any raptors (birds in the order of Falconiformes or Strigiformes (birds of prey—i.e., eagles, hawks, owls, and falcons)), including their nests or eggs. Section 3513 provides for adoption of the MBTA's provisions. It states that it is unlawful to take or possess any migratory nongame bird as designated in the MBTA or any part of such migratory nongame bird. These State codes offer no statutory or regulatory mechanism for obtaining an incidental take permit for the loss of nongame, migratory birds. Typical violations include destruction of active raptor nests resulting from removal of vegetation in which the nests are located. Violation of Sections 3503.5 and 3513 could also include disturbance of nesting pairs that results in failure of an active raptor nest.

California Fish and Game Code—Fully Protected Species Protection of fully protected species is described in four sections of the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515) that list 37 fully protected species. These statutes prohibit take or possession at any time of fully protected species.

California Department of Fish and Game Species Designations DFG maintains an informal list of species called "species of special concern." These are broadly defined as wildlife species that are of concern to DFG because their populations have declined and distributions have become restricted, and/or because they are associated with habitats that are declining in California. These species are inventoried in the CNDDB regardless of their legal status. Impacts on species of special concern may be considered significant.

DFG also maintains a list of sensitive plant species. California native plants meeting the rarity or endangerment criteria are assigned a California Rare Plant Rank and inventoried in the CNDDB. DFG and CNPS assign California Rare Plant Ranks through the collaborative efforts of the Rare

Plant Status Review Group composed of more than 300 botanical experts from government, academia, nongovernmental organizations, and the private sector. Species with a California Rare Plant Rank of 1A, 1B, or 2 (formerly known as CNPS Lists 1A, 1B, and 2) generally qualify as endangered, rare, or threatened within the definition of the CEQA Guidelines (California Code of Regulations, Section 15380). In general, species with a California Rare Plant Rank of 3 or 4 do not meet the definition of endangered, rare, or threatened pursuant to CEQA Section 15380; however, these species may be evaluated by the lead agency on a case-by-case basis to determine significance criteria under CEQA.

State Management Plans for Public Lands Throughout the study area, management plans for State lands generally include goals and objectives for the conservation of biological resources. A portion of these public lands are designated as conservation areas for the primary purpose of conserving plants, wildlife, fish, and habitats (e.g., DFG wildlife areas). Conservation areas and State lands in the study area are illustrated in Figure 3.6-3.

Central Valley Flood Protection Board In accordance with Title 23 of the California Code of Regulations, the Central Valley Flood Protection Board (Board) addresses flood protection along the Sacramento and San Joaquin rivers and their tributaries in cooperation with USACE under 33 CFR 208.10 and 33 USC 408. By using its regulatory authority to issue permits for encroachments, the Board cooperates with federal, State, and local agencies to establish, plan, construct, operate, and maintain flood control works to maintain the integrity of the existing flood control system and designated floodways.

Regional and Local

Habitat Conservation Plans and Natural Community Conservation Plans Regional HCPs and natural community conservation plans (NCCPs) are being implemented in several portions of the study area (Figure 3.6-4). These plans integrate land-use activities with conservation goals to reduce conflicts between sensitive species and economic development. They also create a regional, multispecies approach to planning for the protection and perpetuation of biological diversity.

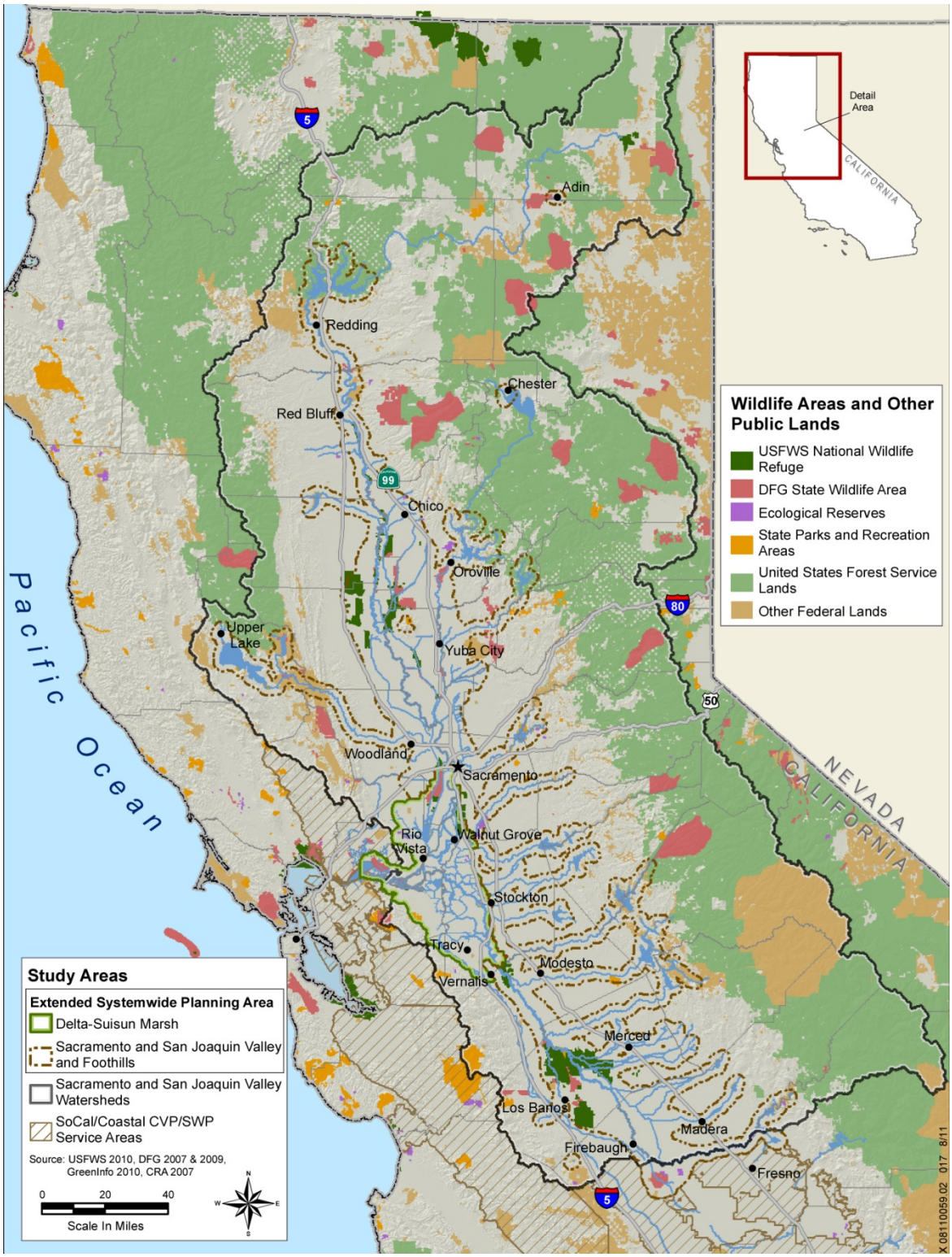

Figure 3.6-3. Public Lands that Provide Biological Resources Conservation Wildlife

Figure 3.6-4. Habitat Conservation Plans and Natural Community Conservation Plans in the Study Area

General Plans Numerous local regulations have been established to support conservation of terrestrial biological resources. County and city general plans set forth the long-term goals, objectives, and policies that guide local land use decisions, including decisions about development and preservation of natural resources. Often, specific policies or ordinances, such as tree preservation ordinances, are aimed at protecting the biological resources that are considered locally important. Policies related to terrestrial biological resources are usually found in the agriculture, open space, conservation, and natural resources elements of general plans. These policies often provide general guidance for avoiding and minimizing impacts on these resources when engaging in ground-disturbing activities associated with development.

Should a place-based project be defined and pursued as part of the proposed program, and should the CEQA lead agency be subject to the authority of local jurisdictions, the applicable county and city policies and ordinances would be addressed in a project-level CEQA document as necessary.

3.6.3 Analysis Methodology and Thresholds of Significance

This section provides a program-level evaluation of the direct and indirect effects on terrestrial biological resources of implementing management actions included in the proposed program. These proposed management actions are expressed as NTMAs and LTMAs. Information on the methodology used to assess impacts of different categories of NTMAs and LTMAs on terrestrial biological resources is provided in "Analysis Methodology"; thresholds for evaluating the significance of potential impacts are listed in "Thresholds of Significance." Potential effects related to each significance threshold are discussed in Section 3.6.4, "Environmental Impacts and Mitigation Measures for NTMAs," and Section 3.6.5, "Environmental Impacts, Mitigation Measures, and Mitigation Strategies for LTMAs."

Analysis Methodology

Impact evaluations were based on a review of the management actions proposed under the CVFPP, expressed as NTMAs and LTMAs in this PEIR, to determine whether these actions could potentially result in impacts on terrestrial biological resources. NTMAs and LTMAs are described in more detail in Section 2.4, "Proposed Management Activities." The overall approach to analyzing the impacts of NTMAs and LTMAs and providing mitigation is summarized below and described in detail in Section 3.1, "Approach to Environmental Analysis"; analysis

methodology specific to terrestrial biological resources is described below. NTMAs can consist of any of the following types of activities:

- Improvement, remediation, repair, reconstruction, and operation and maintenance of existing facilities
- Construction, operation, and maintenance of small setback levees
- Purchase of easements and/or other interests in land
- Operational criteria changes to existing reservoirs that stay within existing storage allocations
- Implementation of the vegetation management strategy (VMS) included in the CVFPP
- Initiation of conservation elements included in the proposed program
- Implementation of various changes to DWR and Statewide policies that could result in alteration of the physical environment

All other types of CVFPP activities fall within the LTMA category. NTMAs are evaluated using a typical "impact/mitigation" approach. Where impact descriptions and mitigation measures identified for NTMAs also apply to LTMAs, they are also attributed to LTMAs, with modifications or expansions as needed. However, because many LTMAs are more general and conceptual, additional impacts are described in a broader narrative format. Impacts of LTMAs that are addressed in this narrative format are those considered too speculative for detailed evaluation, consistent with Section 15145 of the CEQA Guidelines. Following the narrative description of these additional LTMA impacts is a list of suggested mitigation strategies that could be employed, indicating the character and scope of mitigation actions that might be implemented if a future project-specific CEQA analysis were to find these impacts to be significant.

Implementation of the proposed program would result in construction-related, operational, and maintenance-related impacts on terrestrial biological resources. This analysis focuses on management actions that have the potential to substantially affect sensitive terrestrial biological resources—special-status plant and wildlife species and sensitive habitats. Special-status species fit into the following categories:

- Plants and wildlife species that are listed under the federal ESA, the CESA, or both

- Plant and wildlife species considered candidates for listing or proposed for listing

- Wildlife species identified by DFG as either fully protected or California species of special concern, or both

- Plants considered by DFG to be rare, threatened, or endangered (plants assigned a ranking in the California Rare Plant Rank system, formerly known as the CNPS Lists)

Sensitive habitats are habitats that are of special concern to resource agencies and are specifically considered in CEQA, the California Fish and Game Code, the ESA, and/or Sections 401 and 404 of the federal CWA. Sensitive habitats may be listed under Sections 401 and 404 of the CWA as wetlands and other waters of the United States, which are subject to USACE jurisdiction. Riparian and aquatic habitats may also receive protection under Section 1602 of the California Fish and Game Code and the Porter-Cologne Water Quality Control Act. See Section 3.5, "Biological Resources—Aquatic," for a discussion of aquatic biological resources.

Thresholds of Significance

For the purpose of this analysis, the following applicable thresholds of significance have been used to determine whether implementing the proposed program would result in a significant impact. These thresholds of significance are based on Appendix G of the CEQA Guidelines, as amended. An impact on terrestrial biological resources is considered significant if implementation of the proposed program would do any of the following when compared against existing conditions:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by DFG or USFWS

- 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 adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means

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

- Substantially conflict with any applicable local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance

- Substantially conflict with the provisions of an adopted HCP, NCCP, or other approved local, regional, or State HCP

- Substantially reduce the habitat of a wildlife species; cause a wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; or substantially reduce the number or restrict the range of an endangered, rare, or threatened species

3.6.4 Environmental Impacts and Mitigation Measures for NTMAs

This section describes the physical effects of NTMAs on terrestrial biological resources. For each impact discussion, the environmental effect is determined to be either less than significant, significant, potentially significant, or beneficial compared to existing conditions and relative to the thresholds of significance described above. These significance categories are described in more detail in Section 3.1, "Approach to Environmental Analysis." Feasible mitigation measures are identified to address any significant or potentially significant impacts. Actual implementation, monitoring, and reporting of the PEIR mitigation measures would be the responsibility of the project proponent for each site-specific project. For those projects not undertaken by, or otherwise subject to the jurisdiction of, DWR or the Board, the project proponent generally can and should implement all applicable and appropriate mitigation measures. The project proponent is the entity with primary responsibility for implementing specific future projects and may include DWR; the Board; reclamation districts; local flood control agencies; and other federal, State, or local agencies. Because various agencies may ultimately be responsible for implementing (or ensuring implementation of) mitigation measures identified in this PEIR, the text describing mitigation measures below does not refer directly to DWR but instead refers to the "project proponent." This term is used to represent all potential future entities responsible for implementing, or ensuring implementation of, mitigation measures.

Impact BIO-T-1 (NTMA): ***Construction-Related Effects of NTMAs on Sensitive Natural Communities and Habitats***

Construction activities along haul routes, in staging areas, and in project footprints could temporarily or permanently adversely affect sensitive habitats. Construction activities associated with levee remediation, repair, reconstruction, and construction, which would include building necessary haul roads and staging areas, could result in the removal of vegetation in riparian, scrub, and woodland habitats and the fill of emergent wetlands or other aquatic habitats. Raising and strengthening levees and placing levee armoring could affect both waterside and landside habitats. Constructing seepage and stability berms and setback levees would affect primarily landside habitats. Construction activities may result in the direct removal of riparian vegetation. Among the sensitive habitats in the study area, the magnitude of effects generally would be greatest in riparian, emergent wetland, and other aquatic habitat types.

In addition, construction activities could adversely modify areas of USFWS-designated critical habitat. Critical habitat for 29 federally listed plant and wildlife species is designated in the program study area, with much of this habitat adjacent to areas where NTMAs could occur (Figure 3.6-5). Not all areas of designated critical habitat contain the primary constituent elements necessary to support breeding, feeding, growth, and sheltering for the species for which the critical habitat was designated. Nonetheless, construction effects of NTMAs and associated support facilities such as haul routes and staging areas could result in the direct loss of primary constituent elements in areas of designated critical habitat.

Construction activities may also encroach on or take place adjacent to protected areas managed by federal, State, and local governments or agencies and private entities. National wildlife refuges, State wildlife areas and ecological reserves, and habitat mitigation banks could all be affected. As a result, sensitive habitats may be directly removed in these areas.

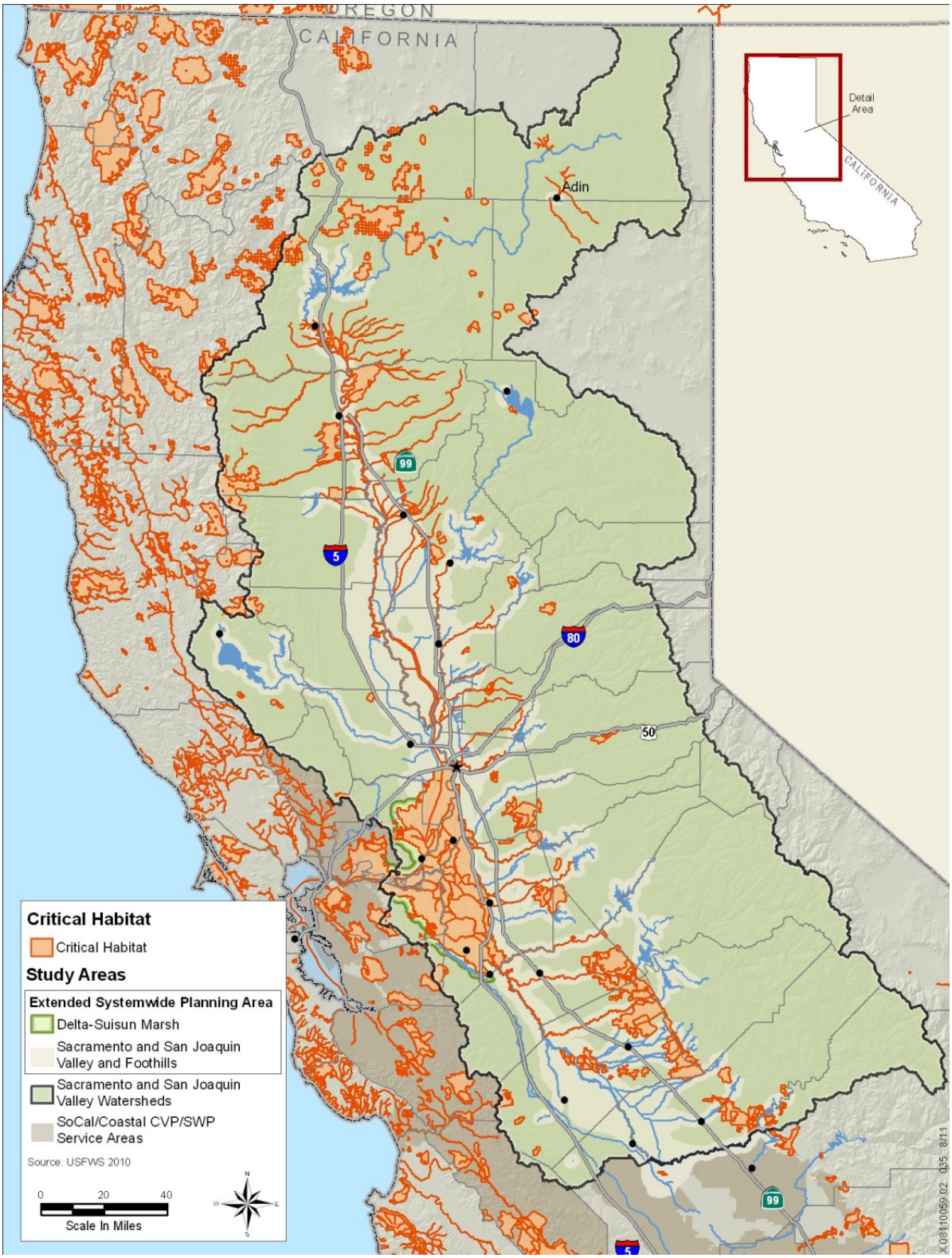

Figure 3.6-5. Critical Habitat in the Study Area

Construction during levee repairs, remediation, reconstruction, and improvements could generate several types of indirect effects on sensitive natural communities:

- Changes in vegetation caused by changes to management practices
- Altered hydrology from construction of new levees, haul roads, new or modified channels, or other projects
- Habitat fragmentation
- Introduction or spread of invasive species

Nearby grading and other construction activities could also indirectly affect remaining vegetation if such activities would alter the immediate environment in a manner that would threaten the health and/or survival of the vegetation (e.g., by causing soil compaction or changing drainage patterns).

Levee work could result in the disturbance and loss of sensitive natural communities, particularly aquatic and riparian habitats. Construction activities could also cause the direct removal and filling of wetlands and waterways. If the scale of these activities were sufficiently substantial, the resulting impact would be **significant**.

Mitigation Measure BIO-T-1a (NTMA): ***Conduct Biological Resources Surveys to Quantify Sensitive Natural Communities in Project Areas, and Avoid, Minimize, and, Where Appropriate, Compensate for Construction-Related Effects***

Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action.

The project proponent will ensure that applicable elements of the following measures are implemented to reduce construction-related effects of proposed NTMAs on sensitive natural communities. Where measures below call for field surveys, the project proponent may be able to rely on previous surveys that were conducted for the project area if these surveys meet the applicable agency guidelines.

- Before an NTMA is implemented, the CNDDB will be searched and other sources (which may include species experts, species recovery

plans, and other monitoring or research studies) will be consulted to determine whether sensitive communities, habitats, and species observation records may be present in or near the project area. These communities, habitats, and species occurrences will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that implementation of NTMAs minimizes direct and indirect disturbance of sensitive communities, habitats, and species to the extent feasible. In consultation with USFWS and DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for construction-related effects on sensitive communities, habitats, and species.

- Before an NTMA is implemented and if the project so warrants, waters of the United States will be delineated according to methods established in the USACE wetlands delineation manual and Arid West Supplement (Environmental Laboratory 1987, 2008). The delineation will map and quantify the acreage of wetland habitats in the area, and will be submitted to USACE for verification. Not all projects involving construction activities may require a delineation of waters.

- If wetlands are found within the proposed construction site or any other area to be disturbed, a wetland delineation report will be prepared and submitted to USACE. After USACE verifies the acreage of waters and wetlands, the project proponent will determine how many acres of waters of the United States and waters of the State would be affected by the NTMA. The verified wetland delineation, field observation, and as needed, hydraulic modeling will be used to make this determination. Where feasible, impacts will be avoided and minimized by establishing a buffer around wetlands and waterways.

- The project proponent will replace, restore, or enhance the acreage of all wetlands, other waters of the United States, and waters of the State that cannot be avoided and will be removed and/or degraded. Thus, the project will achieve “no net loss” of wetland functions and values, in accordance with the requirements of USACE and the Central Valley RWQCB. Wetland habitat will be restored, enhanced, and/or replaced at an acreage and location agreed upon by the project proponent, USACE, and the Central Valley RWQCB, as appropriate. The acreage, location, and methods will be determined during the Section 401 and Section 404 permitting processes, and will be based on a USACE-verified wetland delineation. Methods to be used will be approved by the agency with jurisdiction over the area.

- In consultation with the appropriate resource agency (typically DFG), native woodland areas will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that construction activities of NTMAs minimize disturbance of native woodlands, including riparian habitats, to the extent feasible. Temporary fencing will be installed during construction to prevent avoidable disturbance of native trees that are located adjacent to construction areas. In consultation with DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for effects on native woodlands.

- Protected areas that are managed by federal, State, and local governments or agencies and private entities will be identified, mapped, and quantified as deemed appropriate. The project proponent will coordinate with the appropriate government or agency manager to minimize disturbance of the protected habitats, to the extent feasible.

All construction-related activities will be subject to all applicable permitting requirements. The mitigation measures described above, when combined with applicable permit requirements, must, at a minimum, meet the following basic performance standard:

- Authorized losses of habitat will not exceed the function and value of available compensation habitat.

DWR will also track habitat compensation efforts as part of the MMRP for this PEIR.

Mitigation Measure BIO-T-1b (NTMA): ***Minimize Construction-Related Effects on Critical Habitat and Compensate for Unavoidable Adverse Effects***

Before an NTMA is implemented, USFWS-designated critical habitat in the project area will be identified, mapped, and quantified by a qualified biologist. The project proponent will consult with USFWS to develop and implement measures to avoid, minimize, and, where necessary, compensate for construction-related effects on primary constituent elements and potential adverse modification of critical habitat. Compensation would likely consist of enhancement, restoration, and/or creation of habitat types and vegetation communities that serve as primary constituent elements for the critical habitat affected. Compensation habitat would be enhanced/restored/created within the geographic range of critical habitat for the species in question.

Implementing Mitigation Measures BIO-T-1a (NTMA) and BIO-T-1b (NTMA) would reduce Impact BIO-T-1 (NTMA) to a **less-than-significant** level.

Impact BIO-T-2 (NTMA): ***Construction-Related Effects of NTMAs on Water Quality in Sensitive Natural Communities and Special-Status Species' Habitats***

As discussed previously in Impact BIO-A-1 (NTMA) in Section 3.5, "Biological Resources—Aquatic," and summarized below, construction activities could indirectly cause pollutants and sediment to be transported in runoff to adjacent sensitive habitats. For terrestrial biological resources, the magnitude of effects would be greatest in riparian, emergent wetland, and other aquatic habitat types in the Extended SPA. These natural communities may support potential habitat for sensitive species such as California red-legged frog, giant garter snake, western pond turtle, riparian woodrat, and riparian brush rabbit.

Constructing slurry and cutoff walls, seepage berms, setback levees, and other features may result in erosion, which could temporarily increase turbidity and sedimentation in nearby wetlands and waterways if soils were to be transported in river flows or stormwater runoff. In addition, contaminants such as bentonite slurry, fuels, and oils could be introduced into the waterway directly or through surface runoff. These contaminants may be toxic to special-status species. They also may alter oxygen diffusion rates and cause acute and chronic toxicity to aquatic organisms, thereby reducing the growth and survival of such potential prey for terrestrial special-status wildlife.

As discussed in Impact BIO-A-1 (NTMA), when construction activities exceed 1 acre in size, the project proponent must file with the Central Valley RWQCB a notice of intent to discharge stormwater associated with construction activity. Final design and construction specifications would require the project proponent to implement standard best management practices (BMPs) related to erosion, siltation, and "good housekeeping." Before implementing NTMAs, project proponents and/or construction contractors must prepare and implement a storm water pollution prevention plan (SWPPP) and comply with the conditions of the National Pollutant Discharge Elimination System general stormwater permit for construction activity (Order No. 2009-0009-DWQ). SWPPP components and example BMPs are described in greater detail in Impact BIO-A-1 (NTMA) in Section 3.5.

As required, the project proponent and/or construction contractor would develop and implement a SWPPP to avoid increased sedimentation and

turbidity and/or release of contaminants that could degrade the quality of sensitive habitats. Therefore, this impact would be **less than significant**. No mitigation is required.

Impact BIO-T-3 (NTMA): ***Construction-Related Effects of NTMAs on Special-Status Plants and Wildlife***

Construction activities along haul routes, in staging areas, and in project footprints could harm, kill, or temporarily or permanently eliminate habitat for a variety of special-status plants and wildlife. The effects may be greater for species associated with riparian, wetland, and other aquatic communities along waterways. A total of 35 special-status plant species and 33 wildlife species have the potential to occur in aquatic and riparian habitats associated with the Extended SPA (see habitat information provided for each species in Tables 3.6-3 and 3.6-4). Among these plant species are slough thistle, Delta button celery, Delta tule pea, Mason's lilaeopsis, Suisun marsh aster, and Wright's trichocoronis. The potentially affected wildlife species are valley elderberry longhorn beetle, western pond turtle, giant garter snake, five frog species, 18 bird species (such as Swainson's hawk, western yellow-billed cuckoo, and least Bell's vireo), riparian woodrat, salt marsh harvest mouse, riparian brush rabbit, and four bat species.

Construction-related activities of NTMAs may also affect special-status species that are associated with grassland and agriculture. These include 12 species of special-status plants (such as Red Hills vervain and heartscale) and seven species of birds (among them northern harrier and white-tailed kite). Some special-status species associated with grasslands and agriculture—such as western pond turtle, giant garter snake, and Swainson's hawk—are also associated with wetland and riparian habitats. These species could also be affected by the construction of levee improvements, particularly landside seepage and stability berms.

NTMA construction activities that could affect special-status plants and wildlife include raising or improving existing levees; constructing floodwalls, seepage and stability berms, and slurry cutoff walls; and installing relief wells, toe drains, and landside slope armoring. Construction may occur for periods of months and sometimes in several consecutive years. However, levee-related activities would generally move sequentially across an area as structures are built. Therefore, the effects of construction activities on specific locations in the project area may be temporary (one construction season) and short term (ranging from several days to several months), with no specific area being affected in consecutive years. Construction activities could occur within or close to the habitats of

special-status plants and wildlife, resulting in direct and indirect effects on these species, if present.

Direct effects of NTMA construction on special-status species may include noise generation, vibration, and loss and removal of habitat. Levee improvements that involve removing vegetation and disturbing the ground surface may result in direct removal or alteration of habitat for special-status plants and wildlife. Altering the site may cause suitable habitat to be removed or degraded. Furthermore, these construction activities may result in direct mortality of special-status plant and animal species, if they are present.

Construction activities and associated elevated noise levels may disturb wildlife, interrupting their behavioral cycles and causing them to move out of the area. Some species, such as western pond turtle, giant garter snake, and San Joaquin kit fox, could become trapped in trenches or excavated areas that are associated with construction activities. Habitat for special-status plant and wildlife species could be removed or altered during construction of levee improvements, including haul roads and staging areas. For example, construction activities may result in removal of vegetation in riparian, scrub, and woodland habitats; fill of emergent wetlands or other aquatic habitats; and disturbance to adjacent grassland and agricultural lands. Raising and strengthening levees and placing levee armoring may affect both waterside and landside habitats. Constructing seepage and stability berms would affect primarily landside habitats. Construction activities may result in the direct removal of riparian vegetation, including elderberry shrubs. Nearby grading and other construction activities may also indirectly affect remaining habitats for these species if such activities were to alter the immediate environment in a manner that threatens the health and/or survival of the vegetation (e.g., by causing soil compaction or changing drainage patterns).

The disturbance and loss of aquatic and riparian habitats may result in the loss of special-status plants and wildlife, and may potentially reduce the populations(s) of federally listed and State-listed species, if present. Therefore, this impact would be **significant**.

Mitigation Measure BIO-T-3a (NTMA): ***Conduct Focused Surveys for Special-Status Plants and Wildlife, and Avoid Impacts***

Not all measures listed below may be applicable to each management action. Rather, these measures serve as an overlying mitigation framework to be used for specific management actions. The applicability of measures listed below would vary based on the lead agency, location, timing, and nature of each management action.

The project proponent will verify whether species survey and avoidance protocols have been established for species that might be affected by the specific project, or will coordinate with the appropriate regulatory agency (e.g., USFWS or DFG) to determine an acceptable alternative method for surveying and avoiding effects on a species. To avoid effects of proposed construction activities of NTMAs on special-status plants and wildlife, the project proponent will ensure that the following measures are implemented before commencement of ground-disturbing activities associated with NTMAs. Where measures below call for field surveys, the project proponent may rely on previous surveys that were conducted for the project area if these surveys meet the applicable agency guidelines. If avoidance consistent with these measures cannot be achieved, the project proponent will implement the minimization and compensation measures included in Mitigation Measure BIO-T-3b (NTMA) described below. Where surveys for special-status species may be necessary, the project proponent may be able to rely on previous surveys that were conducted for the project area if these surveys meet the applicable agency guidelines.

- The CNNDB will be searched to determine whether any records describe species observations and indicate the presence of habitat for those species in or near the project area. These habitats and species occurrences will be identified, mapped, and quantified as deemed appropriate. The project proponent, assisted by the primary engineering and construction contractors, will coordinate with a qualified biologist to ensure that disturbance of sensitive communities, habitats, and species is minimized during construction of NTMAs, to the extent feasible. In consultation with USFWS and DFG, the project proponent will develop measures to minimize and, where appropriate, compensate for construction-related effects on sensitive habitats and special-status species.

- A qualified botanist will conduct surveys for special-status plants (as listed in Table 3.6-3) with potential to occur in appropriate habitat within the project area. The surveys will follow applicable guidelines established by USFWS and/or DFG, and will be conducted at the appropriate time of year when the target species would be clearly identifiable. If no special-status plants have the potential to occur in the project area or none are found during focused surveys, no further action is required. If special-status plants are found, areas of occupied habitat will be identified. The construction contractor will avoid these areas where feasible. Temporary fencing will be installed to protect all occupied habitat that is located adjacent to construction areas but can be avoided.

- A qualified biologist will conduct a survey in areas where elderberry shrubs could occur within 100 feet of construction and inundation areas. Surveys and stem counts will follow the USFWS conservation guidelines for the valley elderberry longhorn beetle (USFWS 1999). If elderberry shrubs are found, the project proponent will implement avoidance measures that are consistent with the USFWS conservation guidelines for this species (USFWS 1999). Where feasible, effects will be avoided by establishing and maintaining a 100-foot-wide buffer around elderberry plants. Where a 100-foot buffer is not feasible, effects may be minimized by providing a minimum setback, with a buffer around elderberry plants measuring at least 20 feet wide.

- Protocol surveys of all potential nesting trees and habitat in the area will be completed during the raptor nesting season (generally February 15–September 15 but may be adjusted for individual species), particularly if any construction activity is to occur during that season. Potential nesting trees and other nesting habitats (e.g., grasslands for northern harriers and burrowing owls) that are within one-half mile of proposed activity will be surveyed. To avoid the loss of active raptor nests, if the project proponent elects to remove trees suitable for nesting, the trees will be removed during the non-nesting season (generally between September 15 and February 15), to the extent practicable. Where feasible and depending on the species (particularly for Swainson's hawk), construction activities within one-quarter mile of active nests will be avoided during the raptor nesting season. Other nesting raptors may tolerate a much smaller buffer (e.g., one-tenth mile).

- Surveys for other special-status wildlife listed in Table 3.6-4 with potential to occur in the project area will be conducted by a qualified biologist at the appropriate time of year when the target species would be clearly identifiable. Not all wildlife species require surveys, because their presence may be assumed based on habitat components and known locality records or they clearly will not be present in the area. USFWS and DFG will be consulted to determine for which species surveys should be conducted; appropriate species protocols will be followed. Occupied and potentially suitable habitat will be avoided where feasible by installing temporary exclusionary fencing.

- If potentially suitable aquatic habitat for giant garter snake is identified, a buffer area of 200 feet will be established around the aquatic habitat, where feasible. These buffers will be indicated by temporary fencing, high-visibility flagging, or other equally effective means.

- If nesting areas for pond turtles are identified, a buffer area of 300 feet will be established between the nesting site and nearby wetlands, where feasible. (The nesting site may be adjacent to wetlands or extend up to 400 feet away from wetland areas in uplands.) These buffers will be indicated by temporary fencing if construction has begun or will be established before nesting periods are ended (the period from egg laying to emergence of hatchlings is normally April to November).

- Preconstruction surveys for special-status bat species will be conducted to determine the presence of roosts. When colonial roosting sites located in trees or structures must be removed, removal will occur outside of the nursery and/or hibernation seasons. Unless otherwise approved by DFG, such removal will occur during dusk and/or evening hours after bats have left the roosting site. When hibernation sites are identified on the project site, nursery and hibernation sites will be sealed before the hibernation season (November–March). Additional measures, such as monitoring and on-site mitigation roosts, will be implemented, as feasible (see H. T. Harvey & Associates 2004).

Participation in and compliance with an existing approved HCP, NCCP, or similar plan applicable to an NTMA may replace the specific survey and avoidance actions listed above if all of the following conditions are met:

- The existing approved HCP, NCCP, or similar plan is applicable to the NTMA.

- The NTMA is within the permit area.

- The NTMA is a covered activity under the existing plan.

- The plan addresses methods to identify, avoid, minimize, and compensate for effects on special-status species.

Mitigation Measure BIO-T-3b (NTMA): ***If Avoiding Construction-Related Effects on Special-Status Plants and Wildlife is Infeasible, Minimize and, Where Appropriate, Compensate for Effects on Special-Status Species and Loss of Habitat***

If the focused surveys described above in Mitigation Measure BIO-T-3a have been completed and avoiding effects on special-status species is infeasible, the project proponent will coordinate with the appropriate regulatory agency (e.g., USFWS or DFG) to determine acceptable methods for minimizing or compensating for effects on a species. Various minimization and compensation measures are described below. The CVFPP Conservation Strategy Framework may be a suitable source of

compensation habitat. The project proponent will ensure that the following measures are implemented to minimize and compensate for effects of proposed levee improvements on special-status plants and wildlife:

- If special-status plants cannot be avoided, the project proponent will coordinate with USFWS and/or DFG (depending on which agency has jurisdiction over the particular species) to determine appropriate minimization and compensation measures. Some local plans and policies, if applicable to the project being implemented, may require that the project proponent completely avoid effects on a special-status plant species or pay a fee to mitigate impacts. Where feasible and applicable, the project proponent will consult and/or coordinate with local agencies on these plans and policies. In some instances, sensitive plants may be relocated to an area approved by DFG or USFWS.

- If ground-disturbing activities are to occur within 20 feet of the dripline of an elderberry shrub, minimization and compensation measures consistent with the USFWS conservation guidelines (USFWS 1999) will be implemented. These measures include transplanting elderberry shrubs and planting compensatory elderberry seedlings and associated native plantings.

- If an active raptor nest is found, a biologist, in coordination with DFG, will determine an appropriate buffer that minimizes the potential for disturbing the nest. Setbacks will be marked by brightly colored temporary fencing. Based on the coordination with DFG, no construction activities will begin in the buffer area until a qualified biologist has confirmed that the nest is no longer active or that the birds are not dependent on it. A qualified biologist will monitor construction to ensure that project activities will not substantially adversely affect the nesting pair or their young. The size of the buffer may vary, depending on the nest location, nest stage, construction activity, and monitoring results. If establishing the buffer becomes infeasible or construction activities result in an unanticipated nest disturbance, DFG will be consulted to determine the appropriate course of action.

- Minimization and compensation measures for other special-status wildlife species will be developed in consultation with DFG and/or USFWS. DFG and USFWS provide standardized minimization measures for several species; for example, the giant garter snake has specific minimization measures, such as restrictions on the construction season and a requirement for biological surveys and monitoring.

Participation in and compliance with an existing approved HCP, NCCP, or similar plan applicable to an NTMA may replace the specific minimization

and compensation actions listed above if all of the following conditions are met:

- The existing approved HCP, NCCP, or similar plan is applicable to the NTMA.
- The NTMA is within the permit area.
- The NTMA is a covered activity under the existing plan.
- The plan addresses methods to identify, avoid, minimize, and compensate for effects on special-status species.

All construction-related activities will be subject to all applicable permitting requirements. The mitigation measures described above, when combined with applicable permit requirements, must, at a minimum, meet the following basic performance standard:

- Authorized losses of habitat will not exceed the function and value of available compensation habitat.

DWR will also track these habitat compensation efforts as part of the MMRP for this PEIR. These measures will be designed to ensure that construction activities of NTMAs will not result in a substantial reduction in the population size or range of any special-status plants or wildlife.

Mitigation Measure BIO-T-3c (NTMA): *Secure Applicable State and/or Federal Permits and Implement Permit Requirements*

The project proponent will ensure that the following measures are implemented to reduce construction-related effects of proposed levee or other repairs, remediation, and improvements on trees and shrubs within stream zones, listed plant and wildlife species, and wetlands:

- A streambed alteration agreement, as required under Section 1602 of the California Fish and Game Code, will be obtained from DFG before any vegetation is removed from a stream zone under DFG jurisdiction unless the activity is being implemented by USACE. The project proponent will comply with all terms and conditions of the streambed alteration agreement, including measures to protect habitat or to restore, replace, or rehabilitate any habitat.
- The project proponent will consult or coordinate with USFWS under the federal ESA and DFG under the CESA regarding potential impacts on listed plant and wildlife species and associated critical habitat. The

project proponent will implement any additional measures developed through the ESA and CESA consultation processes, including conditions of Section 7 biological opinions and Section 2081 permits.

- Before ground-disturbing activities begin on a project reach that contains waters of the United States, authorization for fill of such waters will be secured from USACE through the Section 404 permitting process. This permitting process will include providing compensatory mitigation for affected wetlands to ensure no net loss of wetland functions and values.

Participation in and compliance with an existing approved HCP, NCCP, or similar plan applicable to an NTMA may be used to achieve the permit compliance measures listed above if all of the following conditions are met:

- The existing approved HCP, NCCP, or similar plan is applicable to the NTMA.
- The NTMA is within the permit area.
- The NTMA is a covered activity under the existing plan.
- The plan provides for compliance with applicable State or federal regulations.

Implementing Mitigation Measures BIO-T-3a (NTMA), BIO-T3b (NTMA), and BIO-T-3c (NTMA) would reduce Impact BIO-T-3 (NTMA) to a **less-than-significant** level.

Impact BIO-T-4 (NTMA): ***Construction-Related Effects of NTMAs on Wildlife Movement***

Constructing levee and other repairs, remediation, and improvements could adversely affect the movement of special-status species by causing the loss of habitat corridors or the reduction in the function of habitat corridors. These effects would be similar to those already described above in Impact BIO-T-1 (NTMA), "Construction-Related Effects of NTMAs on Sensitive Natural Communities and Habitats," and Impact BIO-T-3 (NTMA), "Construction-Related Effects of NTMAs on Special-Status Plants and Wildlife." Levee improvements would remove or disturb riparian, emergent wetland, and other aquatic communities. Removal of these habitats, particularly the riparian habitat, could result in habitat fragmentation and the loss of primary movement corridors, or the reduction in the function of existing movement corridors, for many special-status and non-special-status wildlife species.

The existing riparian cover along many waterways in the study area is limited because a natural floodplain is often narrow or absent. When present, such riparian cover is disturbed by ongoing maintenance and associated levee activities (e.g., vegetation removal, erosion repair) that are necessary to preserve levee integrity. However, the remnant vegetation is often the only refuge for species associated with these habitats. For example, many migratory birds and several resident mammal species (e.g., riparian brush rabbit) use riparian vegetation as movement corridors. These habitats often provide the only protective cover and foraging and nesting opportunities in the Extended SPA. Where waterside riparian vegetation would be removed, the effect on wildlife movement would be greater because waterside vegetation provides most of the habitat corridor values in the Extended SPA. Therefore, construction on and along levees may result in the removal of riparian habitat, particularly waterside vegetation that supports wildlife corridor values. This impact would be **potentially significant**.

Mitigation Measure BIO-T-4 (NTMA): ***Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA)***

Implementing this mitigation measure would reduce Impact BIO-T-4 (NTMA) to a **less-than-significant** level.

Impact BIO-T-5 (NTMA): ***Potential for Construction-Related Effects of NTMAs to Conflict with Local Plans and Policies***

Constructing levee and other repairs, remediation, and improvements may conflict with strategies, goals, policies, or specific ordinances in local plans, including HCPs. Such a potential conflict is particularly likely in areas where adopted conservation plans emphasize the conservation of riparian, wetland, and other aquatic habitats. State agencies such as DWR are not generally subject to local land use regulation; however, DWR would consider how project implementation may affect these local plans, particularly HCPs. Where construction-related NTMAs would occur within the permit areas of such plans, construction on and along levees could adversely affect these plans. In particular, construction may reduce the viability of special-status species, reduce habitat value or interfere with the management of conserved lands, or eliminate opportunities for conservation actions. As described in Impact BIO-T-1 (NTMA), "Construction-Related Effects of NTMAs on Sensitive Natural Communities and Habitats," and Impact BIO-T-3 (NTMA), "Construction-Related Effects of NTMAs on Special-Status Plants and Wildlife," terrestrial biological resources—including sensitive natural communities

and special-status species—may be affected. Therefore, the impact would be **potentially significant**.

Mitigation Measure BIO-T-5a (NTMA): ***Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA)***

Mitigation Measure BIO-T-5b (NTMA): ***Identify Local Plans and Policies and Develop Strategy to Maintain Plan Consistency, Minimize Effects, or Compensate for Construction-Related Effects on Local Plans***

Before an NTMA is implemented, the project proponent will identify applicable local conservation plans in the area and evaluate the plans to determine whether the NTMA is within the plan area. As feasible, the project proponent will consider developing a strategy to maintain plan consistency and will consult and/or coordinate with the appropriate entity or plan administrator to develop and implement measures to avoid, minimize, and where necessary, compensate for effects on local plans. In some instances, the NTMA may be a covered activity under the plan.

Implementing Mitigation Measures BIO-T-5a (NTMA) and BIO-T-5b (NTMA) would reduce Impact BIO-T-5 (NTMA) to a **less-than-significant** level.

Impact BIO-T-6 (NTMA): ***Effects of Reservoir Operational Criteria Changes on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, Wildlife Movement, and Local Plans and Policies***

Reoperating water storage facilities (changing the operations of reservoirs) to allow more flexibility in the timing, magnitude, and frequency of flood releases to downstream channels would periodically alter reservoir volumes and elevations, as well as downstream river stages and flow volumes during releases. These operational changes may affect special-status plant and wildlife species, particularly those associated with riparian and aquatic habitats along rivers below reoperated reservoirs. As summarized above in Impact BIO-T-3 (NTMA), approximately 35 special-status plant species and 33 special-status wildlife species have the potential to occur in aquatic and riparian habitats associated with the Extended SPA.

Surface water levels in reservoirs would fluctuate if water storage facilities were reoperated. Although surface water fluctuation could change from existing conditions at specific times of the year, it would not be likely to vary substantially under the NTMAs. Surface water fluctuations are expected to remain within historical reservoir fluctuation levels. Water levels in reservoir fluctuation zones already vary drastically from year to

year, and the riparian and aquatic habitats and special-status plants and wildlife present at these reservoirs experience these fluctuations under current conditions. Additional flood releases would generally lower reservoir elevations temporarily for only a few days or weeks during winter, so there would be a greater distance from vegetation around the reservoir to the reoperated water surface. The amount of fluctuation from reservoir reoperation, however, would be minor relative to the annual fluctuations in these reservoirs on both a seasonal and annual basis.

In downstream rivers affected by reservoir reoperations, the frequency and length of time that some patches of riparian vegetation are inundated may increase slightly, depending on location, should water storage facilities be reoperated under the NTMAs. This may, in turn, alter the availability of certain habitats and vegetation, plant growth, and wildlife movements, to a degree.

In some locations, the shoots and leaves of existing riparian and wetland plants that already may be submerged for weeks or months during each growing season could be submerged for a slightly longer period, but at less depth. The growth of submerged plants could be reduced and some plant parts would be damaged (Coops et al. 1996; Keddy 2000). Successive years of extended periodic submergence may result in mortality of some trees, shrubs, and perennial forbs that are dominant in these areas. However, riparian and wetland plants can respond in numerous ways to reduce physiological stress and damage when partially or completely submerged (Braendle and Crawford 1999; Karrenberg et al. 2002; Keddy 2000; Kozlowski et al. 1991). Also, the riparian and willow scrub and wetland vegetation types that could be submerged are resistant to damage from prolonged inundation (Karrenberg et al. 2002; Keddy 2000; Vaghti and Greco 2007). Thus, mortality would be expected only in riparian and wetland vegetation that is completely and continually submerged for several weeks or months every year, which likely would not occur because reservoir reoperations would not be necessary every year. Implementing NTMAs would not induce vegetation mortality either on a large scale or frequently relative to existing mortality levels, nor would it substantially reduce the extent of existing riparian or wetland vegetation. Because the extent or diversity of existing riparian or wetland vegetation would not be reduced as a result of NTMA-related reoperation of water storage facilities, important wildlife movement corridors would also not be substantially reduced or affected.

Reoperating water storage facilities is unlikely to cause a substantial adverse effect on special-status species associated with riparian and aquatic communities, especially plants such as Bogg’s Lake hedge-hyssop. These species currently experience substantial interannual variation in inundation

and hydrology. Other plant species that may be associated with riparian habitats, such as Madera leptosiphon (*Leptosiphon serrulatus*) and the elderberry shrub (obligate host plant to the valley elderberry longhorn beetle), grow in vegetation above the immediate shoreline and would not be substantially affected. Wildlife species that are associated with riparian habitats, such as riparian brush rabbit, are able to actively move in response to small changes in their habitat, and would not be substantially affected. Species such as bank swallow may be adversely affected because their habitats tend to be localized and nest sites are typically in fixed locations.

The water fluctuations that would result from reoperation of water storage facilities under the NTMAs would not substantially reduce the viability of special-status species, reduce habitat value or interfere with management of conserved lands, or eliminate opportunities for conservation actions. Therefore, reoperation of these facilities would not adversely affect local plans and policies.

Overall, a substantial adverse effect on sensitive natural communities, special-status plant and wildlife species, wildlife movement, and local plans and policies is not expected. For the reasons described above, this impact would be **less than significant**. No mitigation is required.

Impact BIO-T-7 (NTMA): ***Effects of the Vegetation Management Strategy on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, and Wildlife Movement***

Implementing the VMS would result in a gradual reduction of existing riparian habitats in some locations on and along existing levees, as dead or diseased trees are removed and not replaced by either natural recruitment or planting. Trees and other woody vegetation would be removed over an extended period—and eventually eliminated entirely—from the designated vegetation management zone, an area typically extending 15 feet beyond the landside levee toe to 20 feet below the waterside levee crown. Immature trees and woody vegetation would be removed, existing mature trees either would be lost eventually to natural mortality or would be removed if they posed an unacceptable threat, and new trees and woody vegetation would not be reestablished. However, vegetation would generally be retained on the water side of levees more than 20 feet below the levee crown.

Specifically, under the VMS, immature trees and woody vegetation in the vegetation management zone that measure less than 4 inches in diameter at breast height (dbh) would be removed in an authorized manner as part of levee maintenance. Larger trees and woody vegetation greater than 4 inches dbh would be subject to a long-term life-cycle management (LCM) plan to

be implemented by levee maintenance agencies. These larger trees would be allowed to live out their normal life cycles if they do not pose an unacceptable threat, but would not be replaced in the vegetation management zone after their death or removal. (The LCM plan allows the immediate removal of trees that pose an unacceptable threat.) Removal of woody vegetation in both size categories would be conducted in consultation with the appropriate resource agencies.

Over time, a net loss in the extent and quality of riparian habitat would occur in the vegetation management zone on existing levees as the lost vegetation is not replaced. Vegetation less than 4 inches in diameter would be removed relatively quickly after plan adoption. Larger riparian vegetation (e.g., mature cottonwoods and black willows) is expected to gradually decline, and the vegetation management zone would ultimately consist almost exclusively of smaller, nonwoody vegetation.

The effects of vegetation removal under the VMS would vary substantially depending on the existing conditions along a particular levee segment:

- In locations where little to no woody vegetation grows in the vegetation management zone, and existing levee maintenance practices prevent this vegetation from establishing, the VMS would result in little change from existing conditions.

- If the ordinary water level approaches the waterside edge of the vegetation management zone, and the only woody riparian vegetation on the waterside of the levee is a thin strip in the management zone (20 feet or less below the crown), much of the woody riparian vegetation on this side of the levee would be removed over time.

- If woody riparian vegetation grows on the levee's waterside both in and below the vegetation management zone, riparian vegetation would be lost in the management zone but retained below it. As a result, the strip of waterside riparian habitat would be thinner than under existing conditions.

- In situations where woody riparian vegetation grows on both sides of a levee, and with some vegetation in the vegetation management zone, the current nonriparian corridor between the landside and waterside riparian vegetation (likely a levee crown patrol road and portions of the levee slope) would become wider as vegetation in the management zone on both sides of the levee moves toward more of the smaller and nonwoody vegetation.

Numerous other vegetation removal scenarios could be described here. However, the key point is that as the VMS is implemented, adverse effects on riparian vegetation and associated terrestrial resources could range from minimal to substantial, depending on factors such as the location, amount, and quality of vegetation affected; its proximity to water; and the continuity with other riparian vegetation. Where adverse effects are found, they would result primarily from one of three scenarios:

1. Thin strips of riparian vegetation that grow entirely within the vegetation management zone would be substantially or entirely removed.

2. Riparian vegetation grows both inside and outside of the vegetation management zone, and habitat in the management zone ultimately would be removed. As a result, thinner corridors of riparian habitat would remain outside of the management zone.

3. Woody riparian habitat exists on both sides of the levee, separated by a nonriparian zone along the levee (likely, at a minimum, along a crown patrol road). If some riparian habitat occurs within the vegetation management zone, this habitat would be removed over time, causing the nonriparian zone between the landside and waterside habitat to become wider.

The effects of these losses of riparian vegetation on terrestrial biological resources would be similar to those already described in Impact BIO-T-1 (NTMA), “Construction-Related Effects of NTMAs on Sensitive Natural Communities and Habitats”; Impact BIO-T-3 (NTMA), “Construction-Related Effects of NTMAs on Special-Status Plants and Wildlife”; and Impact BIO-T-4 (NTMA), “Construction-Related Effects of NTMAs on Wildlife Movement.” However, where construction activities would cause riparian vegetation to be lost relatively rapidly as described in these impacts, implementing the VMS would typically result in the near-term removal of smaller woody vegetation (to the extent that current routine levee maintenance operations do not already prevent this class of vegetation from being present) and a gradual reduction over time in the density and extent of larger woody vegetation.

As described in Impact BIO-T-3 (NTMA), numerous special-status wildlife species may be affected by degradation or loss of riparian vegetation: valley elderberry longhorn beetle, western pond turtle, giant garter snake, five frog species, 18 bird species (such as Swainson’s hawk, western yellow-billed cuckoo, and least Bell’s vireo), riparian woodrat, riparian brush rabbit, and four bat species.

Beyond the effects of potential direct loss of occupied habitat for these species, the degradation, removal, or corridor narrowing of riparian habitat could result in habitat fragmentation and loss or degradation of primary movement corridors for many special-status and non-special-status wildlife species. As described above, in some locations the separation between landside and waterside riparian habitat would expand. Where this change would occur, species closely associated with dense riparian vegetation, such as riparian woodrat or riparian brush rabbit, may no longer cross the nonriparian area and may be prevented from using substantial portions of available riparian habitat. In addition, the predation risk for these species increases as the nonriparian area becomes wider, resulting in increased mortality.

A component of both the VMS and the CVFPP Conservation Framework is the enhancement of existing riparian habitats and restoration and creation of riparian habitat in various locations. Riparian forest corridors would be established, as appropriate, in areas outside the vegetation management zone along both the waterside and landside of existing levees. The greatest opportunities to increase the extent of riparian vegetation would be on the landside because of space limitations often found between levees and the water bodies they are designed to contain. It is most likely that restoration and creation of riparian forest corridors would be in proximity to levees in rural areas where undeveloped land is available and human disturbance would be minimized.

The VMS would also inform the design of new setback levees by recommending an expanded floodway that would accommodate both vegetation and water conveyance. Under this approach, woody vegetation may be permitted on the waterside slopes and berms of new levees where a specifically designed waterside planting berm is incorporated into the levee design. In some cases woody vegetation provides environmental and engineering benefits to levee integrity (e.g., erosion protection, soil reinforcement, sediment recruitment). In these cases, the vegetation could remain on existing levees that are repaired or improved, particularly where the levee prism is widened or a root or seepage barrier is installed. With these efforts, existing riparian habitat would be retained or expanded along levees where feasible.

The combined elements of the VMS would result in the removal of riparian vegetation in some areas and the enhancement, restoration, or creation of riparian vegetation in other areas. The final result would be a gradual change in the location of riparian vegetation, with habitat lost in some areas but gained in other areas. There is the potential that ultimately a net gain in riparian vegetation could result; the recovery and restoration of native habitats is a supporting goal of the CVFPP, and increasing and improving

the quantity, diversity, quality, and connectivity of riverine habitats (including riparian habitat) is a goal of the Conservation Framework. However, there is currently insufficient detail in these plans to ensure that, in all time periods and in all areas, there would be a balance between habitat losses and gains, resulting in no net overall loss in the extent and quality of riparian vegetation in the program area relative to existing conditions.

In addition, the values provided to water-dependent terrestrial wildlife species (e.g., western pond turtle, special-status frog species) by waterside riparian habitat differ substantially from those provided by riparian habitat on the landside of the levee. Because the ability to provide waterside riparian habitat is often complicated by space limitations, it is unknown whether a balance would exist in all time periods between losses and gains of waterside riparian habitat.

Changes in the locations of available riparian habitat over time can also result in the disruption of movement corridors where riparian habitat is lost in one location but compensated for in another location that may be less critical to wildlife movement.

Also, for species with very limited ranges, such as riparian brush rabbit, losses of riparian habitat at the edge of the known distribution of the species could restrict the species' range.

Because implementing the VMS could result in substantial adverse effects on sensitive habitats, special-status species, and wildlife movement corridors, this impact would be **potentially significant**.

Mitigation Measure BIO-T-7a (NTMA): ***Implement Applicable Elements of Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA) to Minimize Impacts during Vegetation Removal***

Implementing this mitigation measure would reduce elements of Impact BIO-T-7 (NTMA). In particular, this measure includes actions that would avoid and minimize impacts on sensitive biological resources caused by direct removal of woody vegetation as part of the VMS. For example, where mature trees must be removed, elements of Mitigation Measure BIO-T-3a (NTMA) would minimize adverse effects on nesting raptors and special-status bat roost sites because trees that might support these resources would be identified and guidance regarding timing of tree removal would be implemented to minimize adverse effects. However, these measures that compose Mitigation Measure BIO-T-7a (NTMA) do not ensure the full replacement of riparian habitat functions and values to

compensate for losses of riparian vegetation associated with implementation of the VMS. Therefore, this mitigation measure would not reduce the entirety of the impact to a less-than-significant level. Also see Mitigation Measure BIO-T-7b below.

Mitigation Measure BIO-T-7b (NTMA): ***Implement Mitigation Measure BIO-A-2b (NTMA), "Ensure Full Compensation for Losses of Riparian Habitat Functions and Values Caused by Implementing the Vegetation Management Strategy Along Levees"***

In many cases, implementing Mitigation Measure BIO-A-2b (NTMA) and meeting the performance criteria in the measure for riparian vegetation compensation would reduce impacts associated with the removal of riparian vegetation to an overall less-than-significant level. The extent, type, quality, and function of any riparian habitat removed would be fully compensated for through the enhancement, restoration, and creation of riparian habitat elsewhere. However, removing riparian habitat in some locations and enhancing, restoring, or creating habitat elsewhere would result in overall relocation of riparian habitat within the Extended SPA. It is possible that although some areas may benefit from compensatory habitat, habitat values in other locations could be substantially reduced. It cannot be assured that wildlife movement corridors can be maintained in all instances or that relocation of riparian habitat would not restrict the range of some species. In addition, planting vegetation in the floodway may not be authorized by the Board, USACE, or other agencies if the vegetation would impede flood flows sufficiently that a rise in water surface elevation would cause a significant increase in risk to public safety. Therefore, it cannot be assured that in all instances impacts on sensitive terrestrial biological resources would be mitigated to a less-than-significant level. Therefore, Impact BIO-T-7 (NTMA) would be **potentially significant and unavoidable**.

Impact BIO-T-8 (NTMA): ***Effects of Other Management Activities on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, Wildlife Movement, and Local Plans and Policies***

Other management activities of NTMAs may result in beneficial effects on sensitive natural communities and habitats, special-status plant and wildlife species, and wildlife movement, and would not affect local plans and policies. For example, DWR would consult with local governments and agencies in making land management decisions in regard to flood easements. Purchasing floodplain easements may prevent development from occurring in sensitive habitats, such as riparian and emergent wetland communities. Integrating conservation strategies into all implementation actions would improve the sustainability of, and ecosystem benefits

provided by, the flood management system. Therefore, this impact would be **beneficial**. No mitigation is required.

3.6.5 Environmental Impacts, Mitigation Measures, and Mitigation Strategies for LTMAs

This section describes the physical effects of LTMAs on terrestrial biological resources. LTMAs include a continuation of activities described as part of NTMAs and all other actions included in the proposed program, and consist of all of the following types of activities:

- Widening floodways (through setback levees and/or purchase of easements)
- Constructing weirs and bypasses
- Constructing new levees
- Changing operation of existing reservoirs
- Achieving protection of urban areas from a flood event with 0.5 percent risk of occurrence
- Changing policies, guidance, standards, and institutional structures
- Implementing additional and ongoing conservation elements

Actions included in LTMAs are described in more detail in Section 2.4, “Proposed Management Activities.”

Impacts and mitigation measures identified above for NTMAs would also be applicable to many LTMAs and are identified below. The NTMA impact discussions and mitigation measures are modified or expanded where appropriate, or new impacts and mitigation measures are included if needed, to address conditions unique to LTMAs. The same approach to future implementation of mitigation measures described above for NTMAs and the use of the term “project proponent” to identify the entity responsible for implementing mitigation measures also apply to LTMAs.

In addition, as described previously and in Section 3.1.2, “Analysis Methodology,” because many LTMAs are more general and conceptual, additional impacts of those LTMAs are also described below in a broader narrative format, along with a list of suggested mitigation strategies that could be applied to these impacts. This more general analysis is provided in the subsection titled “LTMA Impact Discussions and Mitigation Strategies.”

LTMA Impacts and Mitigation Measures

Impact BIO-T-1 (LTMA): *Construction-Related Effects of LTMAs on Sensitive Natural Communities and Habitats*

Where the LTMAs would continue activities included in the NTMAs, this impact would be the same as Impact BIO-T-1 (NTMA). However, the scale and magnitude of effects would be greater for LTMAs, and the LTMAs would also occur across a broader geographic setting. The LTMAs include larger activities that could result in greater direct effects on sensitive natural communities and habitats, such as constructing large setback levees or removing existing levees to widen floodways, widening or expanding existing weirs and bypasses, and constructing new levees and new bypasses. The opportunity for habitat restoration and enhancement would be considered during the evaluation of these LTMAs. However, the specific locations, designs, and scale of LTMAs are unknown at this time, and the effects on sensitive natural communities and habitats cannot be quantified. It is reasonable to assume that implementation of some LTMAs could have substantial effects on sensitive natural communities and habitats both directly and indirectly. Therefore, this impact would be **significant**.

Mitigation Measure BIO-T-1(LTMA): *Implement Mitigation Measures BIO-T-1a (NTMA) and BIO-T-1b (NTMA)*

Implementing this mitigation measure would reduce Impact BIO-T-1 (LTMA) to a **less-than-significant** level.

Impact BIO-T-2 (LTMA): *Construction-Related Effects of LTMAs on Water Quality in Sensitive Natural Communities and Special-Status Species' Habitats*

Where the LTMAs would continue activities included in the NTMAs, this impact would be the same as Impact BIO-T-2 (NTMA). However, as mentioned in the discussion of Impact BIO-T-1 (LTMA), the LTMAs also include activities that could result in greater effects on sensitive natural communities and habitats across a broader geographic setting. The project proponent and/or construction contractors must file with the Central Valley RWQCB a notice of intent to discharge stormwater associated with construction activity; implement standard BMPs; prepare and implement SWPPPs; and comply with the conditions of the National Pollutant Discharge Elimination System general stormwater permit for construction activity (Order No. 2009-0009-DWQ). Because the project proponent and/or construction contractor is required to develop and implement a SWPPP to avoid increased sedimentation and turbidity and/or release of contaminants that could degrade the quality of sensitive habitats, this impact would be **less than significant**. No mitigation is required.

Impact BIO-T-3 (LTMA): ***Construction-Related Effects of LTMAs on Special-Status Plants and Wildlife***

Where the LTMAs would continue activities included in the NTMAs, this impact would be the same as Impact BIO-T-3 (NTMA). However, as mentioned in the discussion of Impact BIO-T-1 (LTMA), the LTMAs also include activities that could result in greater effects on special-status plants and wildlife across a broader geographic setting. Construction activities associated with the LTMAs could also disturb larger areas of existing habitats for special-status species. However, the specific locations, designs, and scale of LTMAs are unknown at this time, and the effects on special-status plants and wildlife cannot be quantified. It is reasonable to assume that implementation of some LTMAs could have substantial effects on special-status plants and wildlife both directly and indirectly. Therefore, this impact would be **significant**.

Mitigation Measure BIO-T-3 (LTMA): ***Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA)***

Implementing this mitigation measure would reduce Impact BIO-T-3 (LTMA) to a **less-than-significant** level.

Impact BIO-T-4 (LTMA): ***Construction-Related Effects of LTMAs on Wildlife Movement***

Where the LTMAs would continue activities included in the NTMAs, this impact would be the same as Impact BIO-T-4 (NTMA). However, the scale and magnitude of the effects would be greater for LTMAs, and the LTMAs would also occur across a broader geographic setting. The LTMAs include larger activities, such as constructing setback levees or removing existing levees to widen floodways, widening or expanding existing weirs and bypasses, and constructing new levees and new bypasses. Therefore, it is reasonable to assume that implementation of some LTMAs could affect wildlife movement.

The specific locations, designs, and scale of LTMAs are unknown at this time, and the effects on wildlife movement cannot be quantified. However, it is reasonable to assume that implementation of some LTMAs could have substantial adverse effects on wildlife movement. Therefore, this impact would be **significant**.

Mitigation Measure BIO-T-4 (LTMA): ***Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA)***

As described previously for the NTMAs, implementing Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), and BIO-T-3c (NTMA) would reduce this impact to a less-than-significant level. The same result is expected to occur for LTMA projects; thus, Impact BIO-T-4 (LTMA) would be reduced to a **less-than-significant** level.

Impact BIO-T-5 (LTMA): ***Potential for Construction-Related Effects of LTMAs to Conflict with Local Plans and Policies***

Where the LTMAs would continue activities included in the NTMAs, this impact would be the same as Impact BIO-T-5 (NTMA). However, as mentioned in the discussion of Impact BIO-T-1 (LTMA), the LTMAs also include activities that could result in greater effects across a broader geographic setting, and therefore have a greater potential to conflict with local plans and policies. The specific locations, designs, and scale of LTMAs are unknown at this time. However, it is reasonable to assume that implementation of some LTMAs could potentially conflict with local plans and policies. Therefore, this impact would be **potentially significant**.

Mitigation Measure BIO-T-5 (LTMA): ***Implement Mitigation Measures BIO-T-1a (NTMA), BIO-T-3a (NTMA), BIO-T-3b (NTMA), BIO-T-3c (NTMA), and BIO-T-5b (NTMA)***

Implementing this mitigation measure would reduce Impact BIO-T-5 (LTMA) to a **less-than-significant** level.

Impact BIO-T-6 (LTMA): ***Effects of Reservoir Operational Criteria Changes on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, Wildlife Movement, and Local Plans and Policies***

As described in Impact BIO-T-6 (NTMA), surface water levels in reservoirs would fluctuate if water storage facilities were reoperated. Although surface water fluctuation could change from existing conditions at specific times of the year, it would not be likely to vary substantially under the NTMAs. Surface water fluctuations are expected to remain within historical reservoir fluctuation levels. Water levels in reservoir fluctuation zones already vary drastically from year to year, and the riparian and aquatic habitats and special-status plants and wildlife present at these reservoirs experience these fluctuations under existing conditions. Additional flood releases would generally lower reservoir elevations

temporarily for only a few days or weeks during winter so there would be a greater distance from vegetation around the reservoir to the reoperated water surface. The amount of fluctuation from reservoir reoperation, however, would be minor relative to the annual fluctuations in these reservoirs on both a seasonal and annual basis. Even with potentially additional reservoirs reoperated under LTMAs compared to NTMAs, effects from reservoir reoperations would be minimal.

The downstream rivers affected by reservoir reoperations, the frequency and length of time that some patches of riparian vegetation are inundated may increase slightly, depending on location, should water storage facilities be reoperated under the LTMAs. This is particularly true for LTMAs where there is an increased likelihood that reoperation of several reservoirs in adjacent watersheds could have combined effects downstream from where the affected rivers converge. However, riparian and wetland plants can respond in numerous ways to reduce physiological stress and damage when partially or completely submerged. Thus, mortality would be expected only in riparian and wetland vegetation that is completely and continually submerged for several weeks or months every year, which would likely not occur because reservoir reoperations would not be necessary every year. Implementing LTMAs would not induce vegetation mortality either on a large scale or frequently relative to existing mortality levels, nor would it substantially reduce the extent of existing riparian or wetland vegetation. Because the extent or diversity of existing riparian or wetland vegetation would not be reduced as a result of LTMA-related reoperation of water storage facilities, important wildlife movement corridors would also not be substantially reduced or affected.

Reoperating water storage facilities is also unlikely to cause a substantial adverse effect on special-status species associated with riparian and aquatic communities as these species currently experience substantial interannual and annual variation in inundation and hydrology.

Reservoir reoperations under the LTMAs would not substantially reduce the viability of special-status species, reduce habitat value or interfere with management of conserved lands, or eliminate opportunities for conservation actions. Therefore, reoperation of these facilities would not adversely affect local plans and policies.

Overall, a substantial adverse effect from reservoir reoperations on sensitive natural communities, special-status plant and wildlife species, wildlife movement, and local plans and policies is not expected. For the reasons described above, this impact would be **less than significant**. No mitigation is required.

Impact BIO-T-7 (LTMA): ***Effects of the Vegetation Management Strategy on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, and Wildlife Movement***

This impact would be the same as Impact BIO-T-7 (NTMA) and would be **potentially significant**.

Mitigation Measure BIO-T-7 (LTMA): ***Implement Mitigation Measure BIO-T-7a (NTMA)***

Implementing this mitigation measure would reduce Impact BIO-T-7 (LTMA) to a less-than-significant level in many instances. However, it cannot be assured that this result can be achieved in all cases; therefore, this impact would be **potentially significant and unavoidable**.

Impact BIO-T-8 (LTMA): ***Effects of Other Management Activities on Sensitive Natural Communities and Habitats, Special-Status Plants and Wildlife, Wildlife Movement, and Local Plans and Policies***

Where the LTMAs would continue activities included in the NTMAs, this impact would be the same as Impact BIO-T-8 (NTMA), with largely beneficial effects. The same is true for the category of "other management actions" in the LTMAs. This impact would be **beneficial**. No mitigation is required.

LTMA Impact Discussions and Mitigation Strategies

The impacts of the proposed program's NTMAs and LTMAs related to terrestrial biological resources and the associated mitigation measures are thoroughly described and evaluated above. The general narrative descriptions of additional LTMA impacts and mitigation strategies for those impacts that are included in other sections of this draft PEIR are not required for terrestrial biological resources.