Appendix P Terrestrial Biological Resources Technical Appendix

This appendix documents the biological resources technical analysis to support the impact analysis in the environmental impact statement (EIS).

P.1 Background Information

P.1.1 Vegetation and Wildlife

P.1.1.1 *Trinity River*

The Trinity River region includes the area along the Trinity River from Trinity Lake to the confluence with the Klamath River; and along the lower Klamath River from the confluence with the Trinity River to the Pacific Ocean. The Trinity River region includes Trinity Lake, Lewiston Reservoir, the Trinity River between Lewiston Reservoir and the confluence with the Klamath River, and along the lower Klamath River. The study area only includes the aquatic areas and associated margins.

P.1.1.1.1 Trinity Lake and Lewiston Reservoir

Along the margins of Trinity Lake and Lewiston Reservoir, vegetation is consistent with species associated with a reservoir environment and standing water, including floating species, rooted aquatic species, and emergent wetland species. Emergent wetland and riparian vegetation is constrained by fluctuating water levels and steep banks (California North Coast Regional Water Quality Control Board [NCRWQCB] and Bureau of Reclamation [Reclamation] 2009; U.S. Fish and Wildlife Service [USFWS] et al. 1999).

The reservoirs attract resting and foraging waterfowl and other species that favor standing or slow-moving water. Impounded water in the reservoirs also provides foraging habitat for eagles and other raptors that prey on fish (e.g., ospreys) and waterfowl.

P.1.1.1.2 Trinity River from Lewiston Reservoir to Klamath River

Between the North Fork and the South Fork, the Trinity River channel is restricted by steep canyon walls that limit riparian vegetation to a narrow band (NCRWQCB and Reclamation 2009; USFWS et al. 1999). Between the South Fork and the confluence with the Klamath River, there are confined reaches with little riparian vegetation, alternating with vegetation similar to the pre-dam conditions in the upper reach below Lewiston dam.

Many wildlife species that inhabited river and riparian habitats prior to dam construction still occur along the Trinity River. Species that prefer early-successional stages or require greater riverine structural diversity are likely to be less abundant under current conditions (NCRWQCB and Reclamation 2009; USFWS et al. 1999). For example, western pond turtle declined since completion of the dams in response to diminishing instream habitat. In contrast, species such as northern goshawk and black salamander that

favor mature, late-successional riparian habitats increased with more upland habitat along the riparian corridor.

Current vegetation along the Trinity River includes annual grassland, fresh emergent wetland, montane riparian, valley-foothill riparian, and riverine habitats (NCRWQCB and Reclamation 2009; NCRWQCB et al. 2013). The annual grassland species include grasses (e.g., wild oat, soft brome, ripgut brome, cheatgrass, and barley); forbs (e.g., broadleaf filaree, California poppy, true clover, and bur clover); and native perennial species (e.g., creeping wildrye).

The annual grassland habitat supports mourning dove, savannah sparrow, white-crowned sparrow, American kestrel, red-tailed hawk, coyote, California ground squirrel, Botta's pocket gopher, California kangaroo rat, deer mouse, gopher snake, western fence lizard, western skink, western rattlesnake, and yellow-bellied racer.

The fresh emergent wetland species occur along the backwater areas, depressions, and along the river edges, including American tule, narrow-leaved cattail, dense sedge, perennial ryegrass, Himalayan blackberry, and narrow-leaved willow. Wildlife species along the fresh emergent wetland include western toad, Pacific chorus frog, bullfrog, green heron, mallard, and red-winged blackbird.

The montane riparian habitat adjacent to the river includes trees, including bigleaf maple, white alder, Oregon ash, black cottonwood, and Goodding's black willow; and understory species, including mugwort, virgin's bower, American dogwood, Oregon golden-aster, dalmatian toadflax, white sweet clover, musk monkeyflower, straggly gooseberry, California grape, and California blackberry. The valley-foothill riparian habitat occurs along alluvial fans, slightly dissected terraces, and floodplains and includes cottonwood, California sycamore, valley oak, white alder, boxelder, Oregon ash, wild grape, wild rose, California blackberry, blue elderberry, poison oak, buttonbush, willow, sedge, rushes, grasses, and miner's lettuce. Riparian woodlands along the montane riparian habitat support breeding, foraging, and roosting habitat for tree swallow, bushtit, white-breasted nuthatch, Nuttall's woodpecker, downy woodpecker, spotted towhee, and song sparrow; cover for amphibians, including western toad and Pacific chorus frog; and habitat for deer mouse, raccoon, and Virginia opossum. The riverine habitat supports amphibians and reptiles, including western toad, Pacific chorus frog, bullfrog, and western pond turtle; birds, including mallard, great blue heron, osprey, and belted kingfisher; and mammals, including river otter, beaver, big brown bat, and Yuma myotis (bat).

The lands upslope of the Trinity River are characterized by mixed chaparral, montane hardwood-conifer, blue oak-foothill pine, foothill pine, and Klamath mixed conifer (NCRWQCB and Reclamation 2009; NCRWQCB et al. 2013). The trees include Pacific madrone, bigleaf maple, canyon live oak, black oak, blue oak, ponderosa pine, Douglas fir, and incense cedar. Shrubs include greenleaf manzanita, buckbrush, cascara, snowberry, and poison oak. Underlying herbaceous vegetation includes ripgut brome, blue wild rye, silver bush lupine, purple sanicle, and false hedge-parsley. The habitats support numerous birds, including northern flicker, Steller's jay, hairy woodpecker, acorn woodpecker, wrentit, Bewick's wren, California quail, mountain quail, blue grouse, sharp-shinned hawk, red-tailed hawk, and great horned owl; mammals, including black-tailed deer, gray fox, coyote, black-tailed jackrabbit, raccoon, Virginia opossum, spotted skunk, gray squirrel, Allen's chipmunk, deer mouse, and pallid bat; and reptiles and amphibians, including California kingsnake, western rattlesnake, sharp-tailed snake, western fence lizard, southern alligator lizard, and ensatina.

Inundation of lands by Trinity Lake, Lewiston Reservoir, and Whiskeytown Lake removed approximately 20,500 acres of habitat for an estimated 8,500 black-tailed deer (USFWS 1975). The California

Department of Fish and Wildlife (CDFW) established a deer herd management plan for the Critical Winter Range for the Weaverville deer herd. A portion of the winter range is located along the Trinity River (NCRWQCB and Reclamation 2009).

P.1.1.1.3 Lower Klamath River Watershed from Trinity River to the Pacific Ocean

The Klamath River from the confluence with the Trinity River to the Pacific Ocean is characterized by a forested river canyon with riparian vegetation occurring along the channel. There is a greater diversity of riparian vegetation along the lower Klamath River below the mouth of the Trinity River, partly as a result of a more natural hydrograph on the Klamath River than exists on the Trinity River. Plant species composition changes as the Klamath River nears the Pacific Ocean; because the river slows, temperatures increase, and the tides affect salinity.

Grazing, timber harvest, and roads have degraded riparian conditions along the lower Klamath River (Yurok Tribe 2000). Riparian areas are dominated by deciduous trees including red alder. Red alder is a typical hardwood in riparian zones, tanoak is a typical hardwood on mid to upper slopes, and Pacific madrone occurs in small stands on drier sites (Green Diamond Resource Company 2006).

The broad lower Klamath River meanders within the floodplain and supports wetland habitats similar to those that existed pre-dam along the Trinity River. Wetland habitats along the lower Klamath River are dominated by cattails, tules, and a variety of rushes and sedges. As the river nears the ocean, salt-tolerant plants such as cord grass and pickleweed increase in abundance as the salinity increases (USFWS et al. 1999). Wildlife species in the lower Klamath River watershed are similar to those found in the Trinity River watershed.

P.1.1.2 *Sacramento River*

Much of the Sacramento River from Shasta Dam to Redding is deeply entrenched in bedrock, which precludes development of extensive areas of riparian vegetation (Reclamation 2013). The upper banks along these steep-sided, bedrock-constrained segments of the upper Sacramento River are characterized primarily by upland communities, including woodlands and chaparral. Outside the river corridor, other vegetation communities along the upper Sacramento River include riparian scrub, annual grassland, and agricultural lands.

The river corridor between Redding and Red Bluff once supported extensive areas of riparian vegetation (Reclamation 2013). Agricultural and residential development has permanently removed much of the native and natural habitat. Riparian vegetation now occupies only a small portion of floodplains. Willow and blackberry scrub and cottonwood- and willow-dominated riparian communities are still present along active channels and on the lower flood terraces, whereas valley oak-dominated communities occur on higher flood terraces. Although riparian woodlands along the upper Sacramento River typically occur in narrow or discontinuous patches, they provide value for wildlife and support both common and special-status species of birds, mammals, reptiles, amphibians, and invertebrates.

Portions of the adjacent land along the Sacramento River from Red Bluff to Hamilton City include substantial remnants of the pre-European Sacramento Valley historical riparian forest (Reclamation 2013). Along the Sacramento River below Red Bluff, riparian vegetation is characterized by narrow linear stands of trees and shrubs, in single- to multiple-story canopies. These patches of riparian vegetation may be on or at the toe of levees. Riparian communities in this region include woodlands and riparian scrub.

From Red Bluff to Colusa, the Sacramento River contains point bars, islands, high and low terraces, instream woody cover, and early-successional riparian plant growth, reflecting river meander and erosional processes (Reclamation 2013). Major physiographic features include floodplains, basins, terraces, active and remnant channels, and oxbow sloughs. These features sustain a diverse riparian community and support a wide range of wildlife species including raptors, waterfowl, and migratory and resident avian species, plus a variety of mammals, amphibians, and reptiles that inhabit both aquatic and upland habitats.

Downstream of Colusa, the Sacramento River channel changes from a dynamic and active meandering one to a confined, narrow channel (Reclamation 2013). Surrounding agricultural lands encroach directly adjacent to the levees, which have cut the river off from most of its riparian corridor, especially on the eastern side of the river. Most of the levees in this reach are lined with riprap, allowing the river no erodible substrate and limiting the extent of riparian vegetation and riparian wildlife habitat.

P.1.1.3 *Clear Creek*

Riparian communities within the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area, which includes Whiskeytown Reservoir, include the following species: grey pine, willow, white alder, dogwoods, Oregon ash, bigleaf maple, and Fremont and black cottonwood. Wild grape is also very common; other riparian shrubs include snowberry, California blackberry, toyon, buckeye, and button willow. Flowering herbaceous plants, cattails, sedges, rushes, and ferns make up the riparian understory. The riparian habitats are generally vigorous and well-vegetated, especially in the most favorable locations, such as canyons and stream bottoms (National Park Service [NPS] 1999).

Riparian vegetation is limited to a narrow band along the channel margins in the confined canyon reaches of Clear Creek between Whiskeytown Dam and Clear Creek Bridge, where the alluvial section of the creek begins. Downstream of Clear Creek Bridge, where the valley widens, the channel becomes predominately alluvial, and floodplains and terraces allow riparian vegetation to be more extensive (California Bay-Delta Authority 2004).

Fresh emergent wetlands occur throughout the entire reach of lower Clear Creek from Whiskeytown Dam to the Sacramento River. These wetlands are more prominent in the reach below Clear Creek Road Bridge where soils are deeper and the valley becomes wider and is subject to periodic flooding. Valley-foothill riparian is found primarily in the lower reaches of lower Clear Creek from Clear Creek Road Bridge to the Sacramento River. In addition, smaller linear patches occur scattered throughout the system up to Whiskeytown Dam (U.S. Bureau of Land Management [BLM] and NPS 2008).

Due to the diversity of habitats present within the watershed, the areas adjacent to Whiskeytown Lake and lower Clear Creek support a diverse assemblage of wildlife species. More than 200 vertebrate species are known to occur within the Whiskeytown Unit of the Whiskeytown-Shasta-Trinity National Recreation Area, including at least 35 mammal species, 150 bird species, and 25 reptile and amphibian species (NPS 2014).

P.1.1.4 *Feather River*

P.1.1.4.1 Upper Feather River Lakes

The Upper Feather River lakes, including Antelope Lake, Lake Davis, and Frenchman Lake, are State Water Project (SWP) facilities on the upper Feather River upstream of Lake Oroville. These lakes are part

of the Plumas National Forest and provide habitat for raptor nesting and wintering areas, waterfowl nesting area, and deer movement area (California Department of Water Resources [DWR] 2013; Plumas County 2012). Deer movement and fawning areas also occur around Lake Davis.

P.1.1.4.2 Lake Oroville and Thermalito Complex

Lake Oroville is situated in the foothills on the western slope of the Sierra Nevada Mountains, about a mile downstream of the confluence of its major tributaries. Below the dam, a portion of the river flow is diverted at the Thermalito Diversion Dam and routed to the Thermalito Forebay, which is an offstream reservoir with a surface area up to 630 acres (DWR 2007a, 2007b). Downstream of the forebay, water is stored in Thermalito Afterbay (up to 4,300 surface acres), which among other purposes serves as a warming basin for agricultural water.

The majority of vegetation around Lake Oroville consists of a variety of native vegetation associations, including mixed oak woodlands, foothill pine/mixed oak woodlands, and oak/pine woodlands with a mosaic of chaparral (DWR 2004, 2007a). Open areas within the woodlands consist of annual grassland species. Native riparian habitats are restricted to narrow strips along tributaries, consisting mostly of alder, willow, and occasional cottonwood and sycamore. There is minimum wetland vegetation around Lake Oroville, and most is associated with seeps and springs that are a natural part of the landscape above the high-water line. Emergent wetlands are generally absent within the drawdown zone of Lake Oroville.

Lack of vegetative cover within the drawdown zone severely limits wildlife use of this area. Thirty-six wildlife species were detected using habitats within the drawdown zone on at least one occasion during field surveys (DWR 2004). Several of these species may use habitats within the drawdown zone for reproduction including belted kingfisher, Canada goose, canyon wren, American dipper, killdeer, mallard, common merganser, and northern rough-winged swallow.

Riparian vegetation occurs around the north shore of Thermalito Forebay as a thin strip of mixed riparian species (mostly willows), with an understory of emergent wetland vegetation. Cottonwoods and willows occur in scattered areas around the high water surface elevation of Thermalito Afterbay shoreline (Federal Energy Regulatory Commission 2007). Emergent wetlands ranging from thin strips to more extensive areas are found around Thermalito Forebay and Thermalito Afterbay. Waterfowl brood ponds constructed in inlets of Thermalito Afterbay support emergent vegetation along much of their shores.

Species observed within the wetland margin of Thermalito Afterbay include barn swallow, black phoebe, white-tailed kite, black-tailed jackrabbit, brown-headed cowbird, bullfrog, common garter snake, common yellowthroat, gopher snake, northern harrier, Pacific tree frog, raccoon, red-winged blackbird, ring-necked pheasant, short-eared owl, striped skunk, tree swallow, Virginia opossum, and violet-green swallow (DWR 2004).

In contrast to the drawdown area around the margin of Lake Oroville, the drawdown zone of Thermalito Afterbay supports a richer wildlife community and greater habitat diversity. Survey data collected as part of the relicensing process indicate that exposed mudflats seasonally provide habitat for a variety of migratory waterbirds including black-necked stilt, black tern, California gull, Caspian tern, Forster’s tern, greater yellowlegs, least sandpiper, long-billed dowitcher, ring-billed gull, semipalmated sandpiper, spotted sandpiper, and white-faced ibis. Wading birds and other waterfowl have been observed on the mudflats as well as shallow flooded areas (DWR 2004). Potentially suitable giant garter snake habitat is present along portions of the afterbay and forebay margins. The existing waterfowl brood ponds provide a refuge for giant garter snakes during periods of afterbay drawdown.

Several invasive plant species are found around Lake Oroville and downstream in and around the Thermalito Complex. Invasive species associated with riparian and wetland areas include purple loosestrife, giant reed, tree-of-heaven, and red sesbania. About 85 of the roughly 900 acres of wetlands and riparian areas along the margin of Thermalito Afterbay contain varying densities of purple loosestrife (DWR 2007a). Purple loosestrife adversely affects native vegetation.

P.1.1.4.3 Feather River from Oroville Complex to the Sacramento River

The Feather River from Oroville Dam to the confluence with the Sacramento River supports stands of riparian vegetation, which have been restricted over time by flood control levees and land clearing for agriculture and urbanization. As a consequence, the vegetation generally occurs in a narrow zone along much of the river in this reach. However, remnant riparian forest exists in areas where wide meander bends persist, such as at Abbott Lake and O'Connor Lake near the Lake of the Woods State Recreation Area. This area contains mixed riparian forests, including Fremont cottonwood, willow, boxelder, alder, and Oregon ash. The riparian strip along the river is bordered mostly by agricultural fields. Downstream of Yuba City near the confluence with the Sacramento River, valley oak and cottonwood riparian stands becomes more common. Riparian areas provide value for wildlife and support a wide range of species of birds, mammals, reptiles, amphibians, and invertebrates.

P.1.1.5 *American River*

Downstream of Lake Natoma, the lower American River flows to the confluence with the Sacramento River. In the upper reaches of the lower American River, the river channel is controlled by natural bluffs and terraces. Levees have been constructed along the northern and southern banks for approximately 13 miles upstream of the confluence with the Sacramento River (Reclamation et al. 2006).

Most of the lower American River is encompassed by the American River Parkway, which preserves what remains of the historic riparian zone (Reclamation et al. 2006). Vegetation communities along the lower American River downstream of Nimbus Dam include freshwater emergent wetland, riparian forest, and scrub. Oak woodland and annual grassland are present in the upper, drier areas farther away from the river. The current distribution and structure of riparian communities along the river reflects the human-induced changes caused by activities such as gravel extraction, dam construction and operations, and levee construction and maintenance, as well as by both historical and ongoing streamflow and sediment regimes, and channel dynamics.

In general, willow and alder tend to occupy areas within the active channel of the river that are repeatedly disturbed by river flows, with cottonwood-willow thickets occupying the narrow belts along the active river channel (Reclamation et al. 2006). Typical species in these thickets include Fremont cottonwood, willow, poison oak, wild grape, blackberry, northern California black walnut, and white alder.

Cottonwood forest is found on the steep, moist banks along much of the river corridor (Reclamation et al. 2006). Valley oak woodlands occur on upper terraces where fine sediment and adequate soil moisture provide a long growing season. Live oak woodland occurs on the more arid and gravelly terraces that are isolated from the fluvial dynamics and moisture of the river. Annual grassland occurs in areas that have been disturbed by human activity and can be found in many areas within the river corridor.

The cottonwood-dominated riparian forest and areas associated with backwater and off-river ponds are highest in wildlife diversity and species richness relative to other river corridor habitats (Reclamation et al. 2006). More than 220 species of birds have been recorded along the lower American River and more

than 60 species are known to nest in the riparian habitats. Typical species that can be found along the river include great blue heron, mallard, red-tailed hawk, American kestrel, California quail, killdeer, belted kingfisher, western scrub jay, swallows, and American robin. Additionally, more than 30 species of mammals reside along the river, including skunk, rabbit, raccoon, squirrel, vole, muskrat, deer, fox, and coyote. Reptiles and amphibians that occupy riparian habitats along the river include western toad, Pacific tree frog, bullfrog, western pond turtle, western fence lizard, common garter snake, and gopher snake (Reclamation 2005).

Backwater areas and off-river ponds are located throughout the length of the river, but occur predominantly at the Sacramento Bar, Arden Bar, Rossmoor Bar, and between Watt Avenue and Howe Avenue (Reclamation 2005; Reclamation et al. 2006). Plant species that dominate these backwater areas include various species of willow, sedge, cattail, bulrush, and rush. Riparian vegetation around these ponded areas is composed of mixed-age willow, alder, and cottonwood. These backwater ponds may be connected to the river by surface water during high winter flood flows and by groundwater during other times of the year. Wildlife species typical of these areas include pied-billed grebe, American bittern, green heron, common merganser, white-tailed kite, wood duck, yellow warbler, warbling vireo, dusky-footed woodrat, western gray squirrel, Pacific tree frog, and western toad.

Several non-native weed populations are rapidly expanding in the riparian vegetation of the lower American River (County of Sacramento 2008). In particular, red sesbania is expanding along shorelines of streams and ponds, along with other invasive species such as Chinese tallowtree, giant reed, pampasgrass, Spanish broom, Himalayan blackberry, and tamarisk, which can rapidly colonize exposed bar surfaces and stream banks.

P.1.1.6 *Stanislaus River*

Near the Stanislaus River, vegetation is characterized by riparian woodland with cottonwood, willows, white alder, blue elderberry, and Himalayan berry. Some low-gradient areas along the shoreline of Goodwin Lake, especially in coves, support small patches of emergent aquatic vegetation such as bulrush and cattail (Goodwin Power 2013). Wildlife occurrences are similar to conditions near Tulloch Reservoir.

From Goodwin Dam to Knight's Ferry, the Stanislaus River flows through a bedrock canyon with nearly vertical walls and rock outcrops (California Department of Fish and Game [CDFG] 1995). The riparian edge includes valley foothill riparian vegetation in a very narrow band for the entire length of this reach. This habitat is characterized by a canopy layer of cottonwood, California sycamore, and valley oak. Subcanopy cover trees are white alder, boxelder, and Oregon ash. Typical understory shrub layer plants include wild grape, wild rose, California blackberry, elderberry, button brush, and willow. The herbaceous layer consists of sedges, rushes, grasses, miner's lettuce, poison-hemlock, and stinging nettle.

From Knight's Ferry to the Orange Blossom Bridge, located to the east of the City of Oakdale, the valley foothill riparian habitat continues along the river (CDFG 1995). Further away from the river, vegetation is dominated by blue oak-digger pine woodland and shrub, including California redbud, California buckeye, ceanothus, manzanita, poison oak, and grasslands. Vernal pools and vernal pool complexes are found within adjacent grasslands.

Downstream of the Orange Blossom Bridge, the riparian corridor is virtually nonexistent in some areas with agricultural land uses extending into the riparian corridor (CDFG 1995). In a few areas the riparian corridor is wide, such as within Caswell Memorial State Park. The major habitats include valley foothill

riparian along the Stanislaus River with annual grasslands and fresh emergent wetlands among the agricultural and urban developments.

P.1.1.7 *San Joaquin River*

A multilayered riparian forest dominated by cottonwoods occurs on the active low floodplain of the San Joaquin River along with older stands of cottonwood-dominated riparian forest in areas that were formerly active floodplains prior to the completion of Friant Dam and associated diversion channels, and the resulting reduction in river flow (DWR and Reclamation 2002; Reclamation and DWR 2011). Other areas on the low floodplain are dominated by willow, with occasional scattered cottonwood, ash, or white alder. California buttonbush is often present and may even dominate the river bank for stretches.

The intermediate terrace of the floodplain of the San Joaquin River is primarily a mixed-species riparian forest (DWR and Reclamation 2002; Reclamation and DWR 2011). Species dominance in this mixed riparian forest depends on site conditions, such as availability of groundwater and frequency of flooding. Typical dominant trees in the overstory and midstory include Fremont cottonwood, boxelder, Goodding's black willow, Oregon ash, and California sycamore. Immediately along the water's edge, white alder occurs in the upper reaches of the San Joaquin River. Typical shrubs include red willow, arroyo willow, and California buttonbush.

Tree-dominated habitats with an open-to-closed canopy are typically found on the higher portions of the floodplain (DWR and Reclamation 2002; Reclamation and DWR 2011). These areas are exposed to less flood-related disturbance than areas lower on the floodplain. Valley oak is the dominant tree species while California sycamore, Oregon ash, and Fremont cottonwood are present in small numbers. Typical understory species include creeping wild rye, California wild rose, Himalayan blackberry, California wild grape, and California blackberry.

Dense stands of willow shrubs frequently occur within the active floodplain of the river in areas subject to more frequent scouring flows and often occupy stable sand and gravel point bars immediately above the active channel (DWR and Reclamation 2002; Reclamation and DWR 2011). Dominant species include sandbar willow, arroyo willow, and red willow. Occasional emergent Fremont cottonwood may also be present.

Other areas have vegetation consisting of woody shrubs and herbaceous species dominated by different species depending on river reach. Some areas are dominated by mugwort, together with stinging nettle and various tall weedy herbs. Other areas are dominated either by blackberry (usually the introduced Himalayan blackberry) or wild rose in dense thickets, with or without scattered small emergent willows.

Areas with fine-textured, rich alluvium located outside the active channels but in areas that are subject to periodic flooding contain a shrub-dominated community characterized by widely spaced blue elderberry shrubs (DWR and Reclamation 2002; Reclamation and DWR 2011). The herbaceous understory is typically dominated by nonnative grasses and forbs that are characteristic of annual grassland communities, including ripgut brome, foxtail fescue, foxtail barley, red-stemmed filaree, and horseweed.

Emergent wetlands typically occur in the river bottom immediately adjacent to the low-flow channel (DWR and Reclamation 2002; Reclamation and DWR 2011). Backwaters and sloughs where water is present through much of the year support emergent marsh vegetation, such as tule and cattails. More ephemeral wetlands, especially along the margins of the river and in swales adjacent to the river, support native and nonnative herbaceous species.

Prevalent invasive species found in this portion of the San Joaquin River corridor include red sesbania, tamarisk, giant reed, Chinese tallow, tree-of-heaven, and perennial pepperweed (Reclamation and DWR 2011). Water hyacinth, water milfoil, parrot's feather, curly-leaf pondweed, and sponge plant occur within the streams, especially in areas with slow or ponded water.

The riparian forest trees and understory provide habitat for raptors, cavity-nesting birds, and songbirds, including red-tailed hawk, red-shouldered hawk, Swainson's hawk, white-tailed kite, downy woodpecker, wood duck, northern flicker, ash-throated flycatcher, Pacific-slope flycatcher, olive sided flycatcher, tree swallow, oak titmouse, white-breasted nuthatch, western wood-pewee, warbling vireo, orange-crowned warbler, yellow warbler, Bullock's oriole, and spotted towhee (DWR and Reclamation 2002; Reclamation and DWR 2011). Western wood-pewee, bushtit, Bewick's wren, lazuli bunting, blue grosbeak, and American goldfinch inhabit the riparian scrub vegetation. Song sparrow, common yellowthroat, marsh wren, and red-winged blackbird inhabit the emergent wetlands. Coyote, river otter, raccoon, desert cottontail, and striped skunk occur in the riparian forest and shrub communities. Killdeer, mallard duck, California vole, common muskrat, Norway rat, Pacific chorus frog, western pond turtle, and western terrestrial garter snake occur near the river.

The reach of the San Joaquin River immediately downstream of the Merced River is more incised than areas further downstream and has a less developed riparian area with less understory vegetation. Between the Merced River and the Delta, agricultural land use has encroached on the riparian areas, leaving only a narrow band of riparian habitat. Near the confluence with tributary rivers, in cutoff oxbows, and in the San Joaquin River National Wildlife Refuge (NWR), there are more extensive riparian habitat areas. Remnant cattail-dominated marshes and tules occur in these areas.

P.1.1.8 *Bay-Delta*

P.1.1.8.1 Delta and Suisun Marsh

The Delta overlies the western portions of the Sacramento River and San Joaquin River watersheds. The Delta is a network of islands, channels, and marshland at the confluence of the Sacramento and San Joaquin Rivers. Major rivers entering the Delta are the Sacramento River flowing from the north, the San Joaquin River flowing from the south, and eastside tributaries (Cosumnes, Mokelumne, and Calaveras Rivers). Suisun Marsh is a tidally influenced brackish marsh located about 35 miles northeast of San Francisco in southern Solano County. It is a critical part of the San Francisco Bay/Sacramento–San Joaquin Delta (Bay-Delta) estuary ecosystem. The Delta, together with Suisun Marsh and greater San Francisco Bay, make up the largest estuary on the west coast of North and South America (DWR 2009).

The Delta was once composed of extensive freshwater and brackish marshes, with tules and cattails, broad riparian thickets of scrub willows, buttonwillow, and native brambles. In addition, there were extensive riparian forests of Fremont cottonwood, valley oak, Oregon ash, boxelder, white alder, and Goodding's black willow. Upland, non-riparian stands of valley oak and coast live oak occurred in a mosaic with seasonally flooded herbaceous vegetation, including vernal pools and alkali wetlands (San Francisco Estuary Institute—Aquatic Science Center [SFEI] 2012).

Substantial areas of the Delta and Suisun Marsh have been modified by agricultural, urban and suburban, and recreational land uses (Reclamation et al. 2011; SFEI 2012). Over the past 150 years, levees were constructed in the Delta and Suisun Marsh to provide lands for agricultural, municipal, industrial, and recreational land uses. The remaining natural vegetation is fragmented, and largely restricted to the edges of waterways, flooded islands, and small protected areas such as parks, wildlife areas, and nature reserves

(Hickson and Keeler-Wolf 2007). A substantial portion of the emergent wetlands exists as thin strips along the margins of constructed levees (SFEI 2012). Current habitat along the Delta waterways includes seasonal wetlands, tidal wetlands, managed wetlands, riparian forests, and riparian scrub.

Seasonal wetlands historically had occurred along the riparian corridor at elevations that were inundated during high flow events. Many of the levees were constructed along the riparian corridor edges; therefore, historic seasonal wetlands were substantially modified (SFEI 2012). Adjacent areas of perennial wetlands on the water-side of the riparian corridor were modified as levees were constructed and channels enlarged. In many of these areas the perennial wetlands were replaced by seasonal wetlands. The vegetation of seasonal wetlands is typically composed of wetland generalist species that occur in frequently disturbed sites such as hyssop loosestrife, cocklebur, dallisgrass, Bermuda grass, barnyard grass, and Italian ryegrass.

Alkali-related habitats occur near salt-influenced seasonal and perennial wetlands. Alkali seasonal wetlands occur on fine-textured soils that contain relatively high concentrations of dissolved salts. These types of soils are typically found at the historical locations of seasonal ponds in the Yolo Basin in and around the CDFW Tule Ranch Preserve, and upland in seasonal drainages that receive salts in runoff from upslope salt-bearing bedrock such as areas near Suisun Marsh and the Clifton Court Forebay. Alkali wetlands include saltgrass, alkali weed, saltbush, alkali heath, and iodine bush. Small stands of alkali sink scrub (also known as valley sink scrub) are characterized by iodine bush.

Tidal wetlands consist of tidal brackish wetlands that occur either as relatively substantial tracts of complex tidal wetlands, or in narrow bands of fringing tidal wetlands (Siegel et al. 2010a). Fringing tidal marsh exists along the outboard side exterior levees and generally has formed since diking for managed wetlands began. Fringing tidal wetlands vary in size and vegetation composition, exhibit less geomorphic complexity, and have a low area-to-edge ratio. Fringing marshes lack connection with the upland transition, are often found in small, discontinuous segments, and can limit movement of terrestrial marsh species.

Plant zones in complex tidal wetlands are influenced by inundation regime and salinity. Tidal wetlands can be divided into three zones: low marsh, middle marsh, and high marsh (Reclamation et al. 2011). The low tidal wetland zone is tidally inundated once or twice per day. At the lowest elevations, vegetation is inhibited by frequent, prolonged, often deep inundation and by disturbance by waves or currents. The dominant plant species are bulrushes. Other species occurring in the low tidal wetland zone are pickleweed, lowclub rush, common reed, and cattails. The low tidal wetland zone provides foraging habitat for waterfowl and shorebirds, California Ridgway's rail, California black rail, and other wading birds.

The middle tidal wetland zone is tidally inundated at least once per day; there is relatively little cover and no refuge from higher tides, which completely flood the vegetation of the middle marsh. The dominant plant species are pickleweed, saltgrass, and bulrush. Other species occurring in the middle tidal marsh are fleshy jaumea, sea milkwort, rushes, salt marsh dodder, alkali heath, cattail, sneezeweed, and marsh gumplant (Siegel et al. 2010b). The middle tidal wetland zone provides foraging habitat for salt marsh harvest mouse and Suisun shrew, as well as common and special-status bird species, including waterfowl and shorebirds, California Ridgway's rail, California black rail, and other wading birds. This zone also provides nesting and foraging habitat for Suisun song sparrow and salt marsh common yellowthroat (Reclamation et al. 2011).

The high tidal wetland zone receives intermittent inundation during the monthly tidal cycle, with the higher elevations being inundated during only the highest tides. Historically, the high marsh was an expansive transitional zone between the tidal wetlands and adjacent uplands. The high marsh and associated upland transition zone have been affected by land use changes (e.g., managed wetlands, agriculture). The dominant plants are native species, such as saltgrass, pickleweed, and Baltic rush, and nonnative species, including perennial pepperweed, poison hemlock, and fennel. Other species occurring in the high tidal marsh are saltmarsh dodder, fleshy jaumea, seaside arrowgrass, alkali heath, brass button, and rabbitsfoot grass.

The high tidal marsh provides habitat for special-status plants, including Suisun marsh aster, soft bird's beak, and Suisun thistle (Siegel et al. 2010b). The high marsh zone provides foraging and nesting habitat for waterfowl, shorebirds, California Ridgway's rail, California black rail, and other birds. It also provides foraging and nesting habitat for special-status species such as salt marsh harvest mouse and Suisun shrew, and provides escape cover for salt marsh harvest mouse and Suisun shrew during periods when the middle and lower portions of the high tidal wetland zone are inundated (Reclamation et al. 2011).

Managed wetlands are primarily located within the Suisun Marsh, Cache Slough, and near the confluence of the Mokelumne and Sacramento Rivers within the historical limits of the high tidal marsh and adjacent uplands that were diked and leveled for agricultural purposes and later managed to enhance habitat values for specific wildlife species (CALFED Bay-Delta Program [CALFED] 2000). Diked managed wetlands and uplands are the most typical land cover type in the Suisun Marsh area. Managed wetlands are considered seasonal wetlands because they may be flooded and drained several times throughout the year. Watergrass and smartweed are typically the dominant species in managed wetlands that use fresher water. Bulrush, cattail, and tule are the dominant species in managed wetlands that employ late drawdown management. Pickleweed, fat hen, and brass buttons are typical in the higher elevations of the managed wetlands. In marshes with higher soil salinity, pickleweed, saltgrass, and other salt-tolerant species are dominant. Managed wetlands are managed specifically as habitat for wintering waterfowl species, including northern pintail, mallard, American wigeon, green-winged teal, northern shoveler, gadwall, cinnamon teal, ruddy duck, canvasback duck, white-fronted goose, and Canada goose. Some wetlands are also managed for breeding waterfowl, especially mallard.

Riparian forest areas are still present in some portions of the Delta along many of the major and minor waterways, oxbows, and levees (CALFED 2000). Riparian forest and woodland communities dominated by tree species are mostly limited to narrow bands along sloughs, channels, rivers, and other freshwater features throughout the Delta. Isolated patches of riparian vegetation are also found on the interior of reclaimed Delta islands, along drainage channels, along pond margins, and in abandoned, low-lying fields. Cottonwoods and willows, Oregon ash, boxelder, and California sycamore, are the most typical riparian trees in central California. Valley oak and black walnut are typical in riparian areas in the Delta. Riparian trees are used for nesting, foraging, and protective cover by many bird species and riparian canopies provide nesting and foraging habitat for a variety of mammals. Understory shrubs provide cover for ground-nesting birds that forage among the vegetation and leaf litter.

Riparian scrub in the Delta and Suisun Marsh consists of woody riparian shrubs in dense thickets (SFEI 2012). Riparian scrub thickets are usually associated with higher, sloping, better drained edges of marshes or topographic high areas, such as levee remnants and elevated flood deposits, and along shorelines of ponds or banks of channels in tidal or non-tidal freshwater habitats. Plant species may include willow, blackberry, buttonbush, mule fat, and other shrub species. Willow-dominated habitat types appear to be increasing in extent in recent years; willows line many miles of artificial levees where waterways

historically had flowed into freshwater emergent wetland. Nonnative Himalayan blackberry thickets are a typical element of riparian scrub communities along levees and throughout pastures in the levees. Willow thickets provide habitat for a wide range of wildlife species, including the song sparrow, lazuli bunting, and valley elderberry longhorn beetle.

P.1.1.8.2 Yolo Bypass

The Yolo Bypass is a 59,280-acre floodway through the natural-overflow of the Yolo Basin on the west side of the Sacramento River (DWR 2012). The Yolo Bypass generally extends north to south from Fremont Weir along the Sacramento River (near Verona) to upstream of Rio Vista along the Sacramento River in the Delta. The bypass, part of the Sacramento River Flood Control Project, conveys floodwaters around the Sacramento River near the cities of Sacramento and West Sacramento. The bypass is utilized as a flood bypass approximately once every 3 years, generally during the period from November to April. Land use in the Yolo Bypass is generally restricted to specific agriculture, managed wetlands, and vegetation communities to ensure that floodway function is maintained (CALFED et al. 2001; USFWS 2002). Agricultural crops include corn, tomatoes, melons, safflower, and rice within the northern bypass; and corn, milo, safflower, beans, tomatoes, and Sudan grass in the southern bypass. Waterfowl hunting areas are generally located in the southern bypass, and include rice fields, permanent open water, or a mixture of water and upland habitat. The U.S. Army Corps of Engineers (USACE) has developed criteria for managing emergent vegetation (e.g., cattails and bulrushes) in the Yolo Bypass to maintain flood capacity, including no more than 5% of the vegetation in seasonal wetlands can be emergent wetlands; no more than 50% of the vegetation in permanent wetlands can be emergent wetlands; and riparian vegetation can only occur in specified areas to maintain flood capacity (CDFG and Yolo Basin Foundation 2008).

The Yolo Bypass supports several major terrestrial vegetation types, including riparian woodland, valley oak woodland, open water, and wetland. Historically, riparian woodland and freshwater wetland were the dominant habitat types in the Yolo Basin (CALFED et al. 2001; USFWS 2002). Currently, riparian woodland and associated riparian scrub habitats are primarily found adjacent to Green's Lake, Putah Creek, and along the East Toe Drain within the Yolo Bypass Wildlife Area. Riparian woodland is a tree-dominated community found adjacent to riparian scrub on older river terraces which have lower flooding frequency and duration. Riparian woodlands include Fremont cottonwood, valley oak, sycamore, willow, eucalyptus, giant reed, and black oak. The understory is typically sparse in this community with limited areas of California grape, blackberry, poison oak, mugwort, grasses, and forbs. The woodland canopy provides habitat for hawks, owls, American crow, great egret, great blue heron, red-tailed kite, yellow-rumped warbler, black phoebe, various woodpecker species, wood duck, bat species, and raccoon. The Yolo Bypass also includes riparian scrub, a shrub-dominated community described above for the Delta/Suisun Marsh area.

Remnants of valley oak woodlands and savanna occur on floodplain terraces in fragmented areas, including downstream of Fremont Weir and along the southern portion of the Toe Drain (CALFED et al. 2001). The habitat also includes sycamore, black walnut, wild grape, poison oak, elderberry, blackberry, grass, and sedge.

Depending on the duration of inundation, local soil factors, site history, and other characteristics, seasonal wetlands typically are dominated by species characteristic of one of three natural wetland communities: freshwater marshes, alkali marshes, or freshwater seasonal (often disturbed) wetlands (CALFED et al. 2001). Freshwater marsh communities are typically found in areas subjected to prolonged flooding during the winter months, and frequently do not dry down until early summer. Permanent open water is found

throughout the Yolo Bypass, including Gray's Bend near Fremont Weir, Green's Lake near Interstate 80, ponds in the Yolo Bypass Wildlife Area, along Cache and Prospect sloughs, and within canals and drainage ditches. The wetlands support duck breeding habitat and habitat for many lifestages of grebe, ibis, heron, egret, bittern, coot, rails, raptors, muskrat, raccoon, opossum, beaver, ring-necked pheasant, garter snake, Pacific tree frog, and bullfrog.

Managed wetlands in the Yolo Bypass occur near Fremont Weir, in the 16,770 acre Yolo Bypass Wildlife Area, and within and near Cache Slough. The managed wetlands are generally flooded in the fall, with standing water maintained continuously throughout the winter until drawdown occurs in the following spring (CALFED et al. 2001; CDFG and Yolo Basin Foundation 2008). A primary objective of seasonal wetland management is to provide an abundance and diversity of seeds, aquatic invertebrates, and other foods for wintering waterfowl and other wildlife. The wetlands also are managed to control the extent of tules and cattails, and more recently, water hyacinth. A portion of the managed wetlands occur within rice fields which are flooded in the winter to provide waterfowl feeding and resting habitats. A variety of annual plants germinate on the exposed mudflats of seasonal wetlands during the spring draw down, including swamp timothy, watergrass, smartweed, and cocklebur. These plants are then managed through the timing, duration, or absence of summer irrigation. The mudflats support sandpiper, plover, avocet, stilt, and other shorebirds.

Managed semi-permanent wetlands, commonly referred to as "brood ponds," are flooded during the spring and summer, but may experience a 2- to 6-month dry period each year. These semi-permanent wetlands provide breeding ducks, ducklings, and other wetland wildlife with protection from predators and abundant invertebrate food supplies (CDFG and Yolo Basin Foundation 2008). Permanent wetlands remain flooded throughout the year. Due to year-round flooding, permanent wetlands support a diverse, but usually not abundant, population of invertebrates. Permanent managed wetlands provide deep water habitat for diving ducks, such as ruddy duck, scaup, and goldeneye, and other water birds, including pied-billed grebe, coot, and moorhen. They often have dense emergent cover on their edges that is the preferred breeding habitat for marsh wren and red-winged blackbird, and roosting habitat for black-crowned night heron, white-faced ibis, and egret.

The managed wetlands are operated by private hunting clubs; private conservation entities, including conservation banks; and the federal and state governments (CALFED et al. 2001). Some of the hunting clubs have implemented wetland management agreements with CDFW under the state Presley Program or Wetland Easement Program to coordinate the timing and patterns of flooding, drawdowns, irrigation, soil disturbance, and maintenance of brood habitat. The patterns may be adjusted annually to respond to specific wildlife and hydrologic needs. A similar program focused on providing spring habitat for breeding is provided by the federal Waterbank Program.

Habitat in the Yolo Bypass is affected by periodic flooding (CALFED et al. 2001). Following a flood, roads, canals, and ditches may need to be excavated; debris needs to be removed from habitat; and water delivery facilities may need to be repaired. Flooding also disrupts nesting and resting activities of birds.

P.1.1.8.3 Central Valley Project Reservoirs

The Central Valley Project (CVP) reservoirs in the Bay-Delta include Contra Loma and San Justo reservoirs.

Contra Loma Reservoir

The Contra Loma Reservoir is a CVP facility in Contra Costa County that provides offstream storage along the Contra Costa Canal. The 80-acre reservoir is part of 661-acre Contra Loma Regional Park and Antioch Community Park (Reclamation 2014). The Contra Loma Reservoir area includes open space and recreation facilities. In the open space, vegetative communities include grasslands, blue oak woodland, valley foothill riparian, fresh emergent wetlands, riverine, and open water communities. The annual grasslands include smooth brome, slender wild oats, Italian ryegrass, yellow star thistle, white-stem filaree, and mouse-ear chickweed. Valley foothill riparian occurs along intermittent streams and includes valley oaks, cottonwoods, red willows, Himalayan blackberry, poison oak, and mule fat. The riverine and fresh emergent wetland communities include ryegrass, curly dock, hyssop, loosestrife, Baltic rush, flowering quillwort, cattails, rushes, dallis grass, nutsedge, and cocklebur. Watermilfoil occurs along portions of the shoreline. Recreation areas include urban trees with Oregon ash, black walnut, Fremont cottonwood, blue oak, valley oak, interior live oak, fig, and eucalyptus. East Bay Regional Parks District has initiated restoration actions to improve native grasslands and riparian and provide habitat for quail.

Wildlife in the grasslands areas includes burrowing owl, horned lark, western meadowlark, turkey vulture, northern harrier, American kestrel, white-tailed kite, red-tailed hawk, Brewer's blackbird, mourning dove, western fence lizard, common garter snake, western rattlesnake, black-tailed jackrabbit, California ground squirrel, Botta's pocket gopher, western harvest mouse, California vole, American badger, mule deer, and coyote (Reclamation 2014). The valley foothill riparian and blue oak woodland vegetation support a wide range of birds including northern flicker, yellow warbler, acorn woodpeckers, western scrub jay, white-tailed kite, Cooper's hawk, red-shouldered hawk, American kestrel, great horned owl, song sparrow, black phoebe, European starling, western bluebird, and tree swallow. The valley foothill riparian and blue oak woodland vegetation also support Pacific tree frog, red-legged frog, sharp-tailed snake, California alligator lizard, common garter snake, mule deer, raccoon, coyote, striped skunk, deer mouse, harvest mouse, dusky-footed woodrat, and gray fox. Riverine, wetlands, and open water support Brewer's blackbird, red-winged blackbird, brown-headed cowbird, great blue heron, great egret, duck species, American coot, common merganser, double-crested cormorant, American wigeon, Canada goose, western grebe, and gull species; Pacific tree frog, red-legged frog, bullfrog, California tiger salamander, western pond turtle, western toad, and garter snakes; deer mouse, California vole, long-tailed weasel, and other mammals that use the adjacent woodlands and grasslands.

San Justo Reservoir

The San Justo Reservoir is a CVP facility in San Benito County that provides offstream storage as part of the San Felipe Division. The reservoir is surrounded by steep hills with recreational facilities on the northeast side reservoir and intermittent streams, wetlands, and open water downslope of the reservoir (San Benito County Water District 2012). Adjacent land uses are dominated by irrigated row crops, orchards, and rangeland. Vegetation and wildlife resources of the reservoir area are consistent with grasslands vegetation on uplands.

P.1.1.8.4 State Water Project Reservoirs

Bethany Reservoir, Patterson Reservoir, and Lake Del Valle are SWP facilities associated with the South Bay Aqueduct in Alameda County.

Vegetative communities around Bethany Reservoir are characterized by nonnative grasses with several areas of woodland habitat (DWR 2014). The grassland habitat includes slender oat, ripgut brome, soft

chess, wild barley, Italian ryegrass, black mustard, bull thistle, redstem filaree, dissected geranium, English plantain, tumble mustard, and forbs, including sweet fennel, Great Valley gumweed, Mediterranean linseed, and Ithuriel's spear. The woodland habitat includes white ironbark, casuarina, and Bishop pine. Coyote bush occurs along the water edge. The grasslands provide habitat for mourning dove, western scrub-jay, finch species, sparrow species, owl species, hawk species, California ground squirrel, black-tailed jackrabbit, Audubon's cottontail, Botta's pocket gopher, California vole, mice, and various species of frogs, toads, salamanders, snakes, lizards, and turtles. The woodlands support red-tailed hawk, osprey, owl species, black phoebe, Bullock's oriole, yellow warbler, coyote, and various species of amphibians and reptiles. Emergent vegetation does not occur along the shoreline at Bethany Reservoir (DWR 2005).

Patterson Reservoir is a small, 100-acre-foot, SWP reservoir located along the South Bay Aqueduct between Bethany Reservoir and Lake Del Valle. Vegetation around Patterson Reservoir is characterized by grasslands and upland habitat. Red-legged frog has been observed in the vicinity of Patterson Reservoir (DWR 2014).

Lake Del Valle is a 77,100 acre-foot SWP facility located along the South Bay Aqueduct (DWR 2016). Vegetation around Lake Del Valle includes grasslands, chaparral, shrub, oak woodland, and riparian and freshwater habitats (East Bay Regional Park District [EBRPD] 1996, 2001, 2012, 2013). The grasslands include nonnative grasses and native perennial bunchgrass. The nonnative grasslands include grasses, such as wild oats, bromes, ryegrass, wild barley, silver hairgrass, and dogtail grass; forbs, including filaree, clover, and plantain; and lupine, yarrow, and soap plant. Native grasses include annual and perennial fescues, needlegrass, wild ryes, junegrass, and California bromegrass. The coastal scrub and chaparral vegetation includes coyote brush-scrub, California sagebrush, manzanita, black sage, cream bush, California coffeeberry, yerba santa, blackberry, bush monkeyflower, and poison oak. The oak woodlands and riparian woodlands include coast live oak, black oak, valley oak, scrub oak, California bay, and California buckeye. Mixed deciduous riparian woodlands occur along perennial streams, including white alder, big-leaf maple, western sycamore, willow, and Fremont cottonwood. Along springs and seeps, the vegetation includes rabbitsfoot grass, saltgrass, bentgrasses, rushes, tules, sedges, horsetails, cattail, buttercup, brass-button, mint, duckweed, pondweed, and ferns.

Contra Costa Water District Los Vaqueros Reservoir

Los Vaqueros Reservoir is a Contra Costa Water District offstream storage facility in Contra Costa County. The area around the Los Vaqueros reservoir includes grasslands, upland scrub, valley and foothill woodlands, freshwater wetlands, and open water habitats (Reclamation et al. 2009). The grasslands include perennial and alkali habitats with wild oats, ripgut brome, yellow star thistle, fescue, filaree, mustard, fiddleneck, lupine, popcorn flower, and California poppy. The grasslands support northern harrier, burrowing owl, western meadowlark, California horned lark, turkey vulture, red-tailed hawk, American kestrel, white-tailed kite, western fence lizard, common garter snake, western rattlesnake, California tiger salamander, western harvest mouse, California ground squirrel, black-tailed jackrabbit, and black-tailed deer.

The upland scrub habitat is dominated by evergreen chaparral species and coastal scrub, including chamise, California sagebrush, black sage, poison oak, bush monkeyflower, and California buckwheat underlain by annual grasses and purple needlegrass (Reclamation et al. 2009). This habitat supports California quail, western scrub-jay, bushtit, California thrasher, spotted towhee, sage sparrow, western fence lizard, common garter snake, common king snake, western rattlesnake, deer mouse, and feral pig.

The valley and foothill woodlands and riparian woodlands includes willow, Fremont cottonwood, valley oak, sycamore, black walnut, California buckeye, Mexican elderberry, and Himalayan blackberry, which occurs along much of Kellogg Creek (Reclamation et al. 2009). This habitat supports many birds, reptiles, amphibians, and mammals, including red-legged frog. The freshwater emergent habitat includes meadows with wetland species and stream channels. The vegetation includes tules, bulrushes, and cattail. Wildlife that occurs in this area includes marsh wren, common yellowthroat, red-winged blackbird, red-legged frog, and western pond turtle. The open water habitat of the Los Vaqueros Reservoir provides forage, winter, and brood habitat for Canada goose, American wigeon, gadwall, mallard, northern shoveler, northern pintail, green-winged teal, canvasback, redhead, greater scaup, lesser scaup, bufflehead, common goldeneye, hooded merganser, common merganser, and ruddy ducks; and other habitat values for grebe, sandpiper, pelican, cormorant, egret, heron, and gull.

East Bay Municipal Utility District Reservoirs

The East Bay Municipal Utility District (EBMUD) reservoirs in Alameda and Contra Costa County used to store water within and near the East Bay Municipal Utility District service area include Briones Reservoir, San Pablo Reservoir, Lafayette Reservoir, Upper San Leandro Reservoir, and Lake Chabot. Water stored in these reservoirs includes water from local watersheds, the Mokelumne River watershed, and CVP water supplies.

The Briones Reservoir watershed is characterized by grasslands, chaparral, coastal scrub, oak and bay woodlands, riparian, and freshwater wetlands (EBMUD 1999; EBRPD 1996, 2001, 2013). The San Pablo Reservoir watershed is characterized by grasslands, hardwood forest, coastal scrub, Monterey pine planted along the reservoir shoreline, riparian woodland, and eucalyptus. The Lafayette Reservoir watershed is characterized by grasslands, oak and bay woodland, and coastal scrub. The Upper San Leandro Reservoir watershed includes grasslands, chamise-black sage chaparral, coastal scrub, oak and bay woodland, redwood forest, knobcone forest with a dense manzanita understory, and an 18-acre freshwater marsh. The Lake Chabot watershed includes grasslands, coastal scrub, oak and bay woodland, and riparian and freshwater vegetation.

The grasslands vegetative communities generally include nonnative grasses and native perennial bunchgrass (EBMUD 1999; EBRPD 1996, 2001). The nonnative grasslands include grasses such as wild oat, bromegrass, ryegrass, wild barley, bluegrass, silver hairgrass, and dogtail grass; forbs, including filaree, bur clover, clovers, owl’s clover, cat’s ear, and English plantain; and brodiaeas, lupine, mariposa lilies, mule’s ear, yarrow, farewell to spring, and soap plant. Native grasses include annual and perennial fescues, needlegrass, wild rye, California oatgrass, junegrass, bluegrass, squirreltail, meadow barley, and California bromegrass. Grasslands are used by wildlife similar to those described for other San Francisco Bay Area reservoirs, including hawks, owls, shrikes, swallows, turkey vulture, reptiles, coyote, fox, bobcat, and mice.

The coastal scrub and chaparral vegetation includes coyote brush-scrub, California sagebrush, bitter cherry scrub, manzanita, chamise-black sage, cream bush, California coffeeberry, wild lilac, yerba santa, blackberry, bush monkeyflower, and poison oak (EBMUD 1999; EBRPD 1996, 2001). The woodlands include native and nonnative plants. The native redwood and knobcone pine forests are located at Upper San Leandro Reservoir and provide unique habitat. Nonnative eucalyptus and Monterey pine forests occur at San Pablo Reservoir and Lake Chabot. The eucalyptus trees provide specific habitat for hummingbird, bald eagle, great blue heron, and great egret. The oak and bay woodlands and oak savannas include coast live oak, black oak, valley oak, blue oak, interior live oak, canyon live oak, California bay, California buckeye, and madrone.

Mixed deciduous riparian woodland occurs along perennial streams, including white alder, big-leaf maple, western sycamore, Fremont cottonwood, and black cottonwood that supports frogs, newts, and other amphibians; coast live oak, California bay, and willow woodlands on steep slopes along intermittent streams; and willow riparian scrub along perennial and intermittent streams (EBMUD 1999; EBRPD 1996, 2001). Along springs and seeps, the vegetation includes grasses, including rabbitsfoot grass, saltgrass, bentgrasses, rushes, tules, sedges, horsetails, and cattail; and forbs, including buttercup, watercress, stinging nettle, brass-buttons, mints, duckweed, and pondweed.

P.1.2 Special-Status Species

Species with special status are defined as species that are legally protected or otherwise considered sensitive by federal, state, or local resource agencies. Such species include the following:

- Species listed by the federal government as threatened or endangered.
- Species listed by the state of California as threatened, endangered, or rare (rare status is for plants only).
- Species that are formally proposed for federal listing or are candidates for federal listing as threatened or endangered.
- Species that are candidates for state listing as threatened or endangered.
- Species that meet the definitions of rare, threatened, or endangered under the California Environmental Quality Act.
- Species identified by USFWS as Birds of Conservation Concern.
- Species considered sensitive by BLM or U.S. Forest Service.
- Species identified by CDFW as species of special concern.
- Species designated by California statute as fully protected (e.g., California Fish and Game Code, sections 3511 [birds], 4700 [mammals], and 5050 [reptiles and amphibians] and 5515 [fish]).
- Species, subspecies, and varieties of plants considered by CDFW and California Native Plant Society (CNPS) to be rare, threatened, or endangered in California. The CNPS Inventory of Rare and Endangered Plants of California assigns California Rare Plant Ranks (CRPR) categories for plant species of concern. Only plant species in CRPR categories 1 and 2 are considered special-status plant species in this document.
    - CRPR 1A—Plants presumed to be extinct in California.
    - CRPR 1B—Plants that are rare, threatened, or endangered in California and elsewhere.
    - CRPR 2—Plants that are rare, threatened, or endangered in California but more common elsewhere.

Lists of wildlife and plant species with special status that occur or may occur in portions of the study area are provided in Table P.1-1, Special-Status Wildlife Species, and Table P.1-2, Special-Status Plant Species. These resource lists were assembled from resources that include USFWS's IPaC online service, which was used to identify species federally listed as endangered or threatened that occur in or may be affected by projects in the study area. To supplement the IPaC list, the California Natural Diversity Database (CNDDB) was queried (CDFW 2019) for species that are not federally listed.

Table P.1-1 Special-Status Wildlife Species

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Lange's metalmark butterfly	*Apodemia mormo langei*	FE/–/–	Endemic to Antioch Sand Dunes. Restricted to sand dunes along the southern bank of the Sacramento–San Joaquin River and is currently found only at Antioch Dunes NWR. Found in close association with larval host plant, naked-stem buckwheat (*Eriogonum numdum* ssp. *auriculatum*).	Bay-Delta	None. The Antioch sand dunes will not be affected by project activities.	
Conservancy fairy shrimp	*Branchinecta conservatio*	FE/–/–	Large vernal pools and seasonal wetlands, ~ 1 acre in size. Known to occur in suitable habitat on the San Luis NWR Complex, Eastside Bypass, and along the San Joaquin River. Currently found in disjunct and fragmented habitats across the Central Valley of California from Tehama County to Merced County and at two southern California locations on the Los Padres National Forest in Ventura County.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass San Joaquin River, Bay-Delta	Moderate. Some activities could occur in the vicinity of vernal pools.	
Longhorn fairy shrimp	*Branchinecta longiantenna*	FE/–/–	Vernal pool/seasonal wetlands. Known distribution extends from Contra Costa and Alameda Counties to San Luis Obispo County and also includes Merced County. Within this geographic range, it is extremely rare in vernal pools and swales. Known to occur in suitable habitat on the San Luis NWR Complex.	Bay-Delta, San Joaquin River	Moderate. Some activities could occur in the vicinity of vernal pools.	

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT/–/–	Typically inhabits vernal pools and seasonal wetlands smaller than 2,153 square feet (200 square meters) and less than 2 inches deep; may also occur in larger, deeper pools. Known to occur in suitable habitat on the San Luis NWR.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass American River, Bay-Delta, San Joaquin River	Moderate. Some activities could occur in the vicinity of vernal pools.	X
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	FT/–/–	Found only in association with its host plant, blue elderberry (*Sambucus nigra* ssp. *caerulea*). In the Central Valley, the elderberry shrub is found primarily in riparian vegetation. Known to occur in elderberry shrubs present in the riparian woodland and expected to occur in suitable habitat in other locations along the San Joaquin River. Recorded at Caswell Memorial State Park and other locations along the Stanislaus River.	Trinity River, Sacramento River, Feather River, American River, San Joaquin River, Stanislaus River, Bay-Delta, San Luis Reservoir	High. Elderberry shrubs are present along drainages where restoration projects are proposed.	X
Delta green ground beetle	*Elaphrus viridis*	FT/–/–	Associated with vernal pool habitats—seasonally wet pools that accumulate in low areas with poor drainage—that occur throughout the Central Valley. Presently known to occur only in Solano County northeast of the San Francisco Bay Area.	Bay-Delta	None. Highly unlikely for the species to occur where restoration projects are proposed.	
Bay checkerspot butterfly	*Euphydryas editha bayensis*	FT/–/–	Associated with specific host plants that typically grow on serpentine soils.	Bay-Delta	None. Suitable habitat for this species would not be affected.	

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Vernal pool tadpole shrimp	*Lepidurus packardi*	FE/–/–	Vernal pool/seasonal wetlands. Endemic to the Central Valley, with most populations located in the Sacramento Valley. This species has also been reported from the Delta to the east side of San Francisco Bay. Known to occur in suitable habitat on the San Luis NWR Complex and at the Great Valley Grasslands State Park.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass Bay-Delta, San Joaquin River	Moderate. Some activities could occur in the vicinity of vernal pools.	
Trinity bristle snail	*Monadenia infumata setosa*	–/ST/–	Entire range of the species is within the southern Klamath Mountains and within the Shasta-Trinity National Forest. Occurs along riparian corridors and uplands within Klamath mixed conifer forests with a deciduous hardwood understory. Found in moist, well-drained, well-shaded canyons or streamside benches covered with a layer of leaf mold at least 4 inches deep.	Trinity River, Clear Creek, Shasta Lake	Moderate. Flow changes and restoration activities could occur in areas where this species is present.	
Mission blue butterfly	*Plebejus icarioides missionensis*	FE/–/–	Inhabits coastal chaparral and grasslands of the San Francisco peninsula (Twin Peaks), Marin Headlands, Fort Baker in Marin County, and Sun Bruno Mountain in San Mateo County. Three larval host plants: *Lupinus albifrons, L. varicolor*, and *L. formosus*.	Bay-Delta	None. No activities are proposed in habitat for this species.	

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Callippe silverspot butterfly	*Speyeria callippe*	FE/–/–	Limited to these sites in the Bay-Delta region: eastern shore of San Francisco Bay, inner coast range of northwestern Contra Costa County south to Castro Valley, Alameda County, west side of the Bay from San Francisco to La Honda, San Mateo County. Found in native grassland and adjacent habitats where the larval host plant, Johnny jump-up (*Viola pedunculata*), is found.	Bay-Delta	None. No activities are proposed in habitat for this species.	
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	FE/–/–	Known from four populations in northwestern Marin County and southwestern Sonoma County. Found in coastal dune or prairie habitat. Known population inhabits coastal terrace prairie, costal bluff scrub, and associated nonnative grasslands. Usually found in wind-sheltered areas below 810 feet (250 meters) and within 3 miles of the coast. Larvae host plant is hookedspur violet (*Viola adunca*).	Bay-Delta	None. No activities are proposed in habitat for this species.	
California tiger salamander	*Ambystoma californiense*	FT/ST/–	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for breeding; rodent burrows, rock crevices, or fallen logs for upland cover during dry season.	Sacramento River, Feather River, American River, San Joaquin River, Stanislaus River, Bay-Delta, San Luis Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration and facility improvements.	X

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Western spadefoot toad	*Spea hammondii*	-/-/SSC	Primarily a species of lowland habitats such as washes, floodplains of rivers, alluvial fans, playas, alkali flats (Stebbins 1985), vernal pools, and vernal swales. However, occurs in the foothills and mountains. Prefers areas of open vegetation and short grasses, where the soil is sandy or gravelly. Found in the valley and foothill grasslands, open chaparral, and pine-oak woodlands (USFWS 2005).	Sacramento River, Feather River, American River, San Joaquin River, Stanislaus River, San Luis Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration and facility improvements.	
Shasta salamander	*Hydromantes shastae*	-/ ST/-	Uncommon in limestone areas in vicinity of Shasta Reservoir in Shasta County. Distribution is discontinuous, with numerous, small isolated populations occurring in limestone areas in valley-foothill hardwood-conifer, ponderosa pine and mixed conifer habitat. Found from 1,100 feet (330 meters) to 2,550 feet (773 meters).	Shasta Lake	None. No activities are proposed in habitat for this species.	
Cascades frog	*Rana cascadae*	–/CE/SSC	In California, found in two locations: Siskiyou County and south near Lassen Peak. Elevational range is 750–8,200 feet (230–2,500 meters). Found in water and surrounding vegetation in mountain lakes, small streams, and ponds in meadows up to timber line. Closely restricted to water.	Trinity River, Shasta Lake, upper reaches of Battle Creek, Paynes Creek, Mill Creek	None. No activities are proposed in habitat for this species.	

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Foothill yellow-legged frog	*Rana boylii*	–/CT/SSC	Streams in woodland, forest, mixed chaparral, and wet meadow habitats with rock and gravel substrate and low overhanging vegetation along the edge; usually found near riffles with rocks and sunny banks nearby.	Trinity River, Shasta Lake, upper reaches of Battle Creek, Paynes Creek, Mill Creek, Stanislaus River, Sacramento River, Bay-Delta	High. Restoration is proposed in areas that support habitat for this species.	
California red-legged frog	*Rana draytonii*	FT/–/SSC	Permanent and semipermanent aquatic habitats such as creeks and cold water ponds, with emergent and submergent vegetation; may aestivate in rodent burrows or cracks during dry periods.	Trinity River, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, San Joaquin River, Stanislaus River, Bay-Delta, San Luis Reservoir	High. Restoration is proposed in areas that support habitat for this species.	X
Western pond turtle	*Emmys marmorata*	–/–/SSC	Inhabits slow-moving streams, sloughs, ponds, irrigation and drainage ditches, and adjacent upland areas. Potentially occurs near New Melones Reservoir. Recorded within Whiskeytown Lake and Clear Creek and near Lewiston Reservoir. Known to occur in suitable habitat on the San Luis NWR Complex, in the Mendota Wildlife Area, and at Mendota Pool; expected to occur in suitable habitat in other locations in the San Joaquin River Restoration Area.	Trinity River, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, San Joaquin River, Stanislaus River, Bay-Delta, San Luis Reservoir	High. Restoration is proposed in areas that support habitat for this species.	

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Blunt-nosed leopard lizard	*Gambelia sila*	FE/SE/FP	Resident of sparsely vegetated grasslands, alkali flats, and washes. Prefers flat areas with open space for running, avoiding densely vegetated areas. Seeks cover in mammal burrows, under shrubs or structures such as fence posts; does not excavate its own burrows. Semiarid grasslands, alkali flats, and washes.	San Joaquin River	None. No activities are proposed in habitat for this species.	
Alameda whipsnake	*Masticophis lateralis euryxanthus*	FT/ST/–	Valleys, foothills, and low mountains associated with northern coastal scrub or chaparral habitat; requires rock outcrops for cover and foraging.	Bay-Delta	None. No activities are proposed in habitat for this species.	
San Francisco garter snake	*Thamnophis sirtalis tetrataenia*	FE/SE/FP	Sloughs, canals, low gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.	Bay-Delta	None. No activities are proposed in habitat for this species.	

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Giant garter snake	*Thamnophis gigas*	FT/ST/–	Marshes, ponds, sloughs, small lakes, low-gradient streams, and other waterways, and in agricultural wetlands, including irrigation and drainage canals, rice fields, and adjacent uplands. Current distribution extends from near Chico in Butte County south to the Mendota Wildlife Area in Fresno County. Known from White Slough/Caldoni Marsh and Yolo Basin/Willow Slough. Known to occur in suitable habitat on the San Luis NWR Complex and in the Mendota Wildlife Area; reported from Mendota Pool.	Sacramento River, Feather River, American River, Yolo Bypass, Sutter Bypass, Bay-Delta, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration and facility improvements.	X
Tricolored blackbird (nesting colony)	*Agelaius tricolor*	–/ST[1]/SSC	Nests colonially in tules, cattails, willows, thistles, blackberries, and other dense vegetation. Forages in grasslands and agricultural fields. Reclamation (2010) concluded this species occurs near New Melones Reservoir. Suitable nesting and foraging habitat is present in the upper Sacramento River area. Known to occur in suitable habitat on the San Luis NWR Complex and other sites in the Yolo Bypass.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, American River, Bay-Delta, Stanislaus River	Moderate. Suitable habitat is present in areas proposed for restoration and facility improvements.	

[1] Emergency protection under CESA granted on December 3, 2014, by the California Fish and Game Commission (FGC). FGC voted to list as Threatened on April 19, 2018, official notice pending.

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Tule greater white-fronted goose (wintering)	*Anser albifrons elgasi*	–/–/SSC	Winters in California. Associated with dense tule–cattail marsh habitat. Has been documented near Sherman Island and at various locations in the Suisun Marsh. Winters at Sacramento Valley wildlife refuges and surrounding rice fields, Suisun Marsh, and Grizzly Island Wildlife Area.	Sacramento River, Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	
Pallid bat	*Antrozous pallidus*	–/–/SSC	Occurs in a variety of habitats from desert to coniferous forest; most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California; relies heavily on trees for cavity roosts, but will use crevices in human-made structures including buildings.	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir, New Melones Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Long-eared owl	*Asio otis*	–/–/SSC	Conifer, oak, riparian, pinyon-juniper, and desert woodlands that are either open or are adjacent to grasslands, meadows, or shrublands (Shuford and Gardali 2008).	Sacramento River, Feather River, Yolo Bypass, Bay-Delta, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	

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Oak titmouse	*Baeolophus inornatus*	BCC/–/–	Oak woodlands, including scrub oak woodland, from southwest Oregon to northwest Baja California (Cornell Lab of Ornithology 2017).	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir, New Melones Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Northern harrier	*Circus cyaneus*	–/–/SSC	Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields.	Sacramento River, Feather River, Yolo Bypass, Bay-Delta, San Joaquin River	High. Suitable habitat is present in areas proposed for restoration.	

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Nuttall's woodpecker	*Picoides nuttalii*	BCC/–/–	Oak woodlands in California. Also uses wooded suburban areas and woodlands near streams farther south in its range where oak trees are scarcer.	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir, New Melones Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Short-eared owl (nesting)	*Asio flammeus*	–/–/SSC	Widespread winter migrant, found primarily in the Central Valley, in the western Sierra Nevada foothills, and along the coastline. Usually found in open areas with few trees, such as annual and perennial grasslands, prairies, dunes, meadows, irrigated lands, and saline and fresh emergent wetlands. Occasionally still breeds in northern California. Known to occur in suitable habitat on the San Luis NWR Complex, where it possibly also nests. Breeding range includes coastal areas in Del Norte and Humboldt Counties, the Bay-Delta, northeastern Modoc plateau, the east side of the Sierra from Lake Tahoe south to Inyo County, and the San Joaquin Valley.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, Bay-Delta, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	

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Burrowing owl (nesting and wintering sites)	*Athene cunicularia*	–/–/SSC	Nests and forages in grasslands, shrub lands, deserts, and agricultural fields, especially where ground squirrel burrows are present. Occurs near New Melones Reservoir. Unlikely to occur along the Sacramento River corridor due to a lack of suitable nesting habitat. Known to occur in suitable habitat in the Yolo Bypass, in the Chowchilla Bypass, on the San Luis NWR Complex, and at Mendota Pool.	Sacramento River, Feather River, American River, Yolo Bypass, Sutter Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration and facility improvements.	
Marbled murrelet	*Brachyramphus marmoratus*	FT/SE/–	Pacific Ocean, but nesting occurs in old growth forest.	Bay-Delta	None. No activities are proposed in suitable habitat for this species.	
Swainson's hawk (nesting)	*Buteo swainsoni*	BCC/ST/–	Nests in riparian woodlands, roadside trees, tree rows, isolated trees, woodlots, and trees in farmyards and rural residences. Forages in grasslands and agricultural fields in Central Valley. Occurs near New Melones Reservoir. Known to nest in suitable habitat on the San Luis NWR Complex and Great Valley Grasslands State Park and other areas along the San Joaquin River. Suitable nesting and foraging habitat is present along Sacramento River.	Sacramento River, Feather River, American River, Yolo Bypass, Sutter Bypass, San Joaquin River, Stanislaus River, Bay-Delta, San Luis Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration and facility improvements.	

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Western snowy plover	*Charadrius alexandrines nivosus*	FT/–/SSC	Coastal beaches above the normal high tide limit in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent.	Bay-Delta	None. No activities are proposed in suitable habitat for this species.	
Black tern	*Childonias niger*	–/–/SSC	Nests in freshwater marsh, forages for fish and insects in open water, rice fields, and marsh. Uncommon visitor in suitable habitat in the area of analysis; expected during the nonbreeding season along the San Joaquin River.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, San Joaquin River, Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	
Western yellow-billed cuckoo (nesting)	*Coccyzus americanus occidentalis*	BCC/FT/SE/–	Densely foliaged, deciduous trees and shrubs, especially willows, required for roosting sites. An uncommon to rare summer resident of valley foothill and desert riparian habitats in scattered locations in California. Breeding pairs known from Sacramento Valley. Reclamation (2010) concluded this species could potentially occur near New Melones Reservoir. Detected by BDCP surveys in 2009 near Walnut Grove. Likely to nest and forage in the upper Sacramento River area.	Trinity River, Clear Creek, Sacramento River, Feather River, Bay-Delta, New Melones Reservoir, San Joaquin Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	X

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Townsend's big-eared bat	*Corynorhinus townsendii*	–/–/SSC	Roosts in caves, tunnels, mines, and dark attics of abandoned buildings; very sensitive to disturbances and may abandon a roost after one onsite visit.	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir, New Melones Reservoir	Low. Suitable foraging habitat is present in areas proposed for restoration.	
Western mastiff bat	*Eumops perotis*	–/–/SSC	Primarily a cliff-dwelling species. Roosts generally under exfoliating rock slabs (e.g., granite, sandstone or columnar basalt). Also been found in similar crevices in large boulders and buildings. Forages in broad open areas, including desert washes, flood plains, chaparral, oak woodland, open ponderosa pine forest, grassland, and agricultural areas (Western Bat Working Group 2017).	Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta	Low. Suitable foraging habitat is present in areas	

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Western red bat	*Lasiurus blossevillii*	–/–/SSC	Roosts in the foliage of trees or shrubs. Day roosts are commonly in edge habitats adjacent to streams or open fields, in orchards, and urban areas. May be associated with intact riparian habitat (particularly willows, cottonwoods, and sycamores). This species may also occasionally use caves (Western Bat Working Group 2017).	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir, New Melones Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Yellow warbler (nesting)	*Dendroica petechia brewsteri*	BCC/–/SSC	Nests in riparian woodland and riparian scrub habitats. Forages in a variety of wooded and shrub habitats during migration. Reclamation (2010) concluded this species occurs near New Melones Reservoir. No recent nesting records, but potential nesting habitat present; known to occur during migration in suitable habitat on the San Luis NWR. Could nest and forage in the upper Sacramento River area. Likely to use riparian woodlands during migration.	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, New Melones Reservoir, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	

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White-tailed kite (nesting)	*Elanus leucurus*	–/–/FP	Nests in woodlands and isolated trees; forages in grasslands, shrub lands, and agricultural fields. Common to uncommon and a year-round resident in the Central Valley, in other lowland valleys, and along the entire length of the coast. Recent surveys in Yolo and Sacramento Counties have documented active nest sites in riparian habitats in the Yolo Bypass and along Steamboat and Georgiana Sloughs and along the Sacramento River. Suitable nesting and foraging habitat is present along the upper Sacramento River. Expected to occur in suitable habitat along San Joaquin River and in Yolo Bypass.	Shasta River/Shasta Lake, Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, American River, San Joaquin River, Bay-Delta, San Luis Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	BCC/–/SSC	Primarily brackish marsh, but also brackish and fresh woody swamps and riparian areas. Ranges generally in the San Francisco Bay Area.	Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	
Greater sandhill crane (nesting and wintering)	*Grus canadensis tabida*	–/ST/FP	Eight distinct wintering locations in the Central Valley from Chico/Butte Sink on the north to Pixley NWR near Delano on the south, with more than 95% occurring within the Sacramento Valley between Butte Sink and the Delta. Unlikely to breed in the upper Sacramento River area. Known to occur during winter in suitable habitat on the San Luis NWR Complex, along the San Joaquin River, and in the Delta.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	

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Bald eagle (nesting and wintering)	*Haliaeetus leucocephalus*	BCC/FD/SE/FP	Requires large bodies of water or free-flowing rivers with abundant fish and adjacent snags or other perches for foraging. Occurs near New Melones Reservoir, Whiskeytown Lake, Trinity Lake, and Lewiston Reservoir. Known to nest in suitable habitat around Lake Millerton and in the Chowchilla Bypass.	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Sutter Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Least bittern (nesting)	*Ixobrychus exilis*	BCC/–/SSC	Rare to uncommon April to September nester in large, fresh emergent wetlands of cattails and tules in the Sacramento and San Joaquin Valleys. Occurs in freshwater marsh habitats in the Yolo Bypass, east of the Sacramento River, and in the western Delta. Uncommon but regular breeder in suitable habitat in the San Joaquin Valley.	Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, Bay-Delta, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	
California black rail	*Laterallus jamaicensis coturniculus*	BCC/ST/FP	Tidal marshes in the northern San Francisco Bay estuary, Tomales Bay, Bolinas Lagoon, the Delta, Morro Bay, the Salton Sea, and the lower Colorado River. Found recently at several inland freshwater sites in the Sierra Nevada foothills in Butte, Yuba, and Nevada Counties, the Cosumnes River Preserve in south Sacramento County, and Bidwell Park in Chico, Butte County.	Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	

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Least tern	*Sternula antillarum*	FE/SE/FP	Sandy or gravelly areas along bays, estuaries, lagoons, within the Bay-Delta.	Bay-Delta	Low. Suitable habitat is present in areas proposed for restoration.	X
Yellow-breasted Chat	*Icteria virens*	–/–/SSC	Breeds in areas with dense shrubbery, including agricultural areas, forest edges, swamps, and edges of streams and ponds. Breeding habitat is often blackberry bushes (Cornell Lab of Ornithology 2017).	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, American River, Yolo Bypass, Stanislaus River, San Joaquin River, Bay-Delta, San Luis Reservoir, New Melones Reservoir	Moderate. Suitable habitat is present in areas proposed for restoration.	
Suisun song sparrow	*Melospiza melodia maxillaris*	BCC/–/SSC	Brackish marshes around Suisun Bay.	Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	

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Osprey (nesting)	*Pandion haliaetus*	–/–/WL	Nests on platform of sticks at the top of large snags, dead-topped trees, on cliffs, or on human-made structures. Requires open, clear waters for foraging. Uses rivers, lakes, reservoirs, bays, estuaries, and surf zones. Reclamation (2010) concluded this species occurs near New Melones Reservoir. Known to nest along the Sacramento River.	Trinity River, Clear Creek, Shasta River/Shasta Lake, Sacramento River, Feather River, Yolo Bypass, Sutter Bypass, American River, New Melones Reservoir	High. Suitable habitat is present in areas proposed for restoration.	
White-faced ibis (nesting colony)	*Plegadis chihi*	–/–/WL	Forages in wetlands and irrigated or flooded croplands and pastures. Breeds colonially in dense freshwater marsh. Known to occur in suitable habitat on the San Luis NWR Complex and other sites in the Restoration Area and Yolo Bypass.	Feather River, Yolo Bypass, Sutter Bypass, American River, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	
California Ridgway's rail	*Rallus obsoletus*	FE/SE/FP	Dense marshy areas of the Bay-Delta region.	Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	X

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Bank swallow (nesting)	*Riparia riparia*	–/ST/–	Neotropical migrant found primarily in riparian and other lowland habitats in California west of the deserts during the spring-fall period. In summer, restricted to riparian, lacustrine, and coastal areas with vertical banks, bluffs, and cliffs with fine-textured or sandy soils, into which it digs nesting holes. Approximately 75% of the current breeding population in California occurs along banks of the Sacramento and Feather Rivers in the northern Central Valley.	Trinity River, Clear Creek, Sacramento River, Feather River, American River, Yolo Bypass, Sutter Bypass, New Melones Reservoir, San Joaquin River, Bay-Delta	Moderate. Suitable habitat may be present in areas proposed for restoration. This species is also vulnerable to changes in flow regimes.	
Least bell's vireo (nesting)	*Vireo bellii pusillus*	FE/SE/–	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 brush lands, often near water in arid regions. Observed in Yolo Bypass Wildlife Area. Successfully nested at the San Joaquin River NWR in 2005 and 2006.	Sacramento River, Yolo Bypass, Sutter Bypass, Bay-Delta, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	X
Nelson's antelope squirrel	*Ammospermophilus nelsoni*	–/ST/–	Dry sparsely vegetated loam soils and needs widely scattered shrubs, forbs, and grasses in broken terrain with gullies and washes.	San Joaquin River	None. No activities are proposed in suitable habitat for this species.	

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Ring-tailed cat	*Bassariscus astutus*	–/–/FP	Wooded and brushy areas, especially near water courses. Species distribution not well known. Potentially suitable habitat is present along the Sacramento River corridor.	Shasta River/Shasta Lake, Sacramento River, Feather River, Bay-Delta, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	FE/SE/–	Nearly level, light, friable soils in chenopod scrub and grassland communities.	San Joaquin River	None. No activities are proposed in suitable habitat for this species.	
Southern sea otter	*Enhydra lutris nereis*	FT/–/FP	Found in nearshore marine environments with large giant kelp and bull kelp sea beds from Ano Nuevo, San Mateo County to Point Sal, Santa Barbara County. Uses nearshore waters adjacent to rock coasts, near points of land, or large bays for cover, sleeping, foraging. Also rafts in open water off sandy beaches.	Bay-Delta	None. No activities are proposed in suitable habitat for this species.	

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
California wolverine	*Gulo gulo*	PT/ST/FP	Scarce resident of North Coast mountains and Sierra Nevada. Ranges from Del Norte and Trinity Counties east through Siskiyou and Shasta Counties, and south through Tulare County. Utilizes Douglas-fir and mixed conifer habitats, red fir, lodgepole, wet meadow, and montane riparian habitats. Elevation in coastal ranges from 1,600 to 4,800 feet (500 to 1,500 meters), and elevation in the Sierra Nevada ranges from 4,300 to 7,300 feet (1,300–2,300 meters).	Trinity River, Shasta River/Shasta Lake, Battle Creek, Paynes Creek, Mill Creek, Butte Creek	None. No activities are proposed in suitable habitat for this species.	
Humboldt marten	*Martes caurina humboldtensis*	–/CE/SSC	Known from coastal northwestern California. Optimal habitats ae mixed evergreen forests with more than 40% crown closure, with large trees and snags. Important habitats include red fir, lodgepole pine, subalpine conifer, mixed conifer, Jeffrey pine, and eastside pine.	Trinity River	None. No activities are proposed in suitable habitat for this species.	
Riparian (= San Joaquin Valley) woodrat	*Neotoma fuscipes riparia*	FE/–/SSC	Historically found in riparian habitat along the San Joaquin, Stanislaus, and Tuolumne Rivers. Now known only from Caswell Memorial State Park on the Stanislaus River near its confluence with the San Joaquin River in very low gradient portion of river. No actions proposed that could affect this species in this area. Last reported at Caswell Memorial State Park in 2002. Likely still extant.	Bay-Delta, Stanislaus River, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	X

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Fisher	*Pekania pennanti*	–/ST/SSC	Resident of Sierra Nevada, Cascades, and Klamath Mountains. Also found in a few areas in North Coast Ranges. Occurs in intermediate to large-tree stages of coniferous forests and deciduous-riparian habitats with a high percentage of canopy closure.	Trinity River, tributaries to upper Sacramento, Battle, Paynes, Mill, and Deer Creeks	None. No activities are proposed in suitable habitat for this species.	
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE/SE/FP	Found only in saline emergent wetlands of San Francisco Bay and its tributaries. Pickleweed saline emergent wetland is preferred habitat, where it may be locally common. Grasslands adjacent to pickleweed marsh are used, but only when new grass growth affords suitable cover in spring and summer. Reported occurrences of the salt marsh harvest mouse from within the Delta are restricted to salt and brackish tidal marshes along the northern edge of the Sacramento River and the southern edge of the San Joaquin River as far east as the vicinity of Collinsville and Antioch, west of Sherman Island.	Bay-Delta	High. Suitable, occupied habitat is present in areas proposed for restoration.	X
Suisun shrew	*Sorex ornatus sinuosus*	–/–/SSC	Historically known from tidal wetlands of Solano, Napa, and eastern Sonoma Counties. Currently limited to the northern borders of San Pablo and Suisun Bays.	Bay-Delta	Moderate. Suitable habitat is present in areas proposed for restoration.	

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Riparian woodrat	*Neotoma fuscipes riparia*	FE/--/SSC	Historically found in riparian habitat along the San Joaquin, Stanislaus, and Tuolumne Rivers. Now known only from Caswell Memorial State Park on the Stanislaus River near its confluence with the San Joaquin River in very low gradient portion of river.	Bay-Delta, Stanislaus, San Joaquin	Moderate. Suitable habitat is present in areas proposed for restoration.	
Riparian brush rabbit	*Sylvilagus bachmani riparius*	FE/SE/–	Historical distribution may have extended along portions of the San Joaquin River and its tributaries on the valley floor from at least Stanislaus County to the Delta. Currently restricted to several populations at Caswell Memorial State Park, near Manteca in San Joaquin County, along the Stanislaus River, along Paradise Cut (a channel of the San Joaquin River in the southern part of the Delta), and a recent reintroduction on private lands adjacent to the San Joaquin River NWR.	Bay-Delta, Stanislaus River, San Joaquin River	Moderate. Suitable habitat is present in areas proposed for restoration.	X
San Joaquin kit fox	*Vulpies macrotis mutica*	FT/ST/–	Saltbush scrub, grassland, oak, savanna, and freshwater scrub.	Bay-Delta, San Joaquin River	None. No activities are proposed in suitable habitat for this species.	

Common Name	Scientific Name	Status Federal/ State/ CDFW	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation and in EIS (indicated with an X)
Sierra Nevada red fox	*Vulpes vulpes necator*	FC/ST/–	Range is throughout high elevations of the Sierra Nevada from Tulare County northward to Sierra County, and from Mount Shasta and Lassen Peak westward to the Trinity Mountains, Trinity County. Seldom seen below 5,000 feet (1,500 meters) and most often observed above 6,889 feet (2,100 meters). Occurs at low densities. Occupied habitat is a composite of high elevation barren, conifer and shrub habitat, montane meadows, subalpine woodlands, and fell-fields. Dens in natural cavities, earthen dens, boulder piles, and vacant space under human-made structures.	Upper reaches of Battle Creek, Paynes Creek, Mills Creek, Dear Creek, Butte Creek	None. No activities are proposed in suitable habitat for this species.	

Abbreviations
Status Codes
BCC = bird species of conservation concern
CE = candidate for state listing as endangered under the California Endangered Species Act
CT = candidate for state listing as threatened under the California Endangered Species Act
FC = candidate for federal listing under the federal Endangered Species Act
FD = federal delisted
FE = federally listed as endangered
FP = California fully protected species
FT = federally listed as threatened
PT = proposed threatened
SE = state-listed as endangered
SSC = California species of special concern
ST = state-listed as threatened
WL = California Department of Fish and Wildlife watch list
Other Abbreviations
BDCP = Bay Delta Conservation Plan
CDFW = California Department of Fish and Wildlife
NWR = National Wildlife Refuge

Table P.1-2. Special-Status Plant Species

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
Adobe sanicle	*Sanicula maritima*	–/SR/1B.1	Clay and serpentine soils in chaparral, coastal prairie, meadow and seeps, and annual grassland.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Beach layia	*Layia carnosa*	FE/SE/1B.1	Coastal dunes and coastal scrub on sandy soils.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Bensoniella	*Bensoniella oregona*	–/SR/1B.1	Bogs and fens, meadows and seeps, and mesic areas in lower montane coniferous forest.	Trinity River	None. No activities are proposed within suitable habitat in the known range of the species.	
Bogg's Lake hedge-hyssop	*Gratiola heterosepala*	–/SE/1B.2	Marshy and swampy lake margins, vernal pools. Known from north Delta and from the Sacramento and San Joaquin Valleys. CNDDB documents occurrences at Jepson Prairie, the Rio Linda area, and Mather County Park.	Sacramento River, Yolo Bypass, Sutter Bypass, Bay-Delta, San Joaquin River	None. No activities are proposed within suitable habitat in the known range of the species.	
Bolander's water hemlock	*Cicuta maculata* var. *bolanderi*	–/–/2.1	Coastal fresh or brackish marshes and swamps in Contra Costa, Sacramento, Marin, and Solano Counties. Present at north and central Delta and Suisun Marsh.	Sacramento River, Bay-Delta, Suisun Marsh	High. Restoration activities are proposed within suitable habitat in the known range of the species.	
Butte County meadowfoam	*Limnanthes floccosa* ssp. *californica*	FE/SE/1B.1	Vernal pools and swales in annual grassland.	Sacramento River and its tributaries in Butte County	None. No activities are proposed within suitable habitat in the known range of the species.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
Legenere	*Legenere limosa*	–/–/1B.1	Vernal pools and swales in annual grassland.	Sacramento River, Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Sandford's arrowhead	*Saggitaria sanfordii*	–/–/1B.2	Freshwater mashes and swamps	Sacramento River, Bay-Delta, San Joaquin River	Low. Some activities could occur near marshes and swamps for this species.	
California jewelflower	*Caulanthus californicus*	FE/SE/1B.1	Sandy soils on chenopod scrub, Pinyon and juniper woodland, and annual grassland.	San Joaquin River	None. No activities are proposed within suitable habitat in the known range of the species.	
California seablite	*Suaeda californica*	FE/–/1B.1	Margins of tidal salt marsh.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Chinese Camp brodiaea	*Brodiaea pallida*	FT/SE/1B.1	Ephemeral streams, often on serpentine, in cismontane woodland and annual grassland.	Stanislaus and Tuolumne Rivers	None. No activities are proposed within suitable habitat in the known range of the species.	
Colusa grass	*Neostapfia colusana*	FT/SE/1B.1	Adobe soils of vernal pools.	Sacramento River, Yolo Bypass, Sutter Bypass, Stanislaus River, San Joaquin River	None. No activities are proposed within suitable habitat in the known range of the species.	
Coulter's goldfields	*Lasthenia glabrata* ssp. *coulteri*	–/–/1B.1	Coastal salt marshes and swamps, playas, vernal pools	Sacramento River, San Joaquin River	None. No activities are proposed within suitable habitat in the known range of the species.	
Contra Costa goldfields	*Lasthenia conjugens*	FE/–/1B.1	Wet areas in cismontane woodland, valley and foothill grassland, vernal pools, alkaline playas, or saline vernal pools and swales.	Sacramento River, Bay-Delta	Low. Some activities could occur near vernal pools where this species occurs.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
Crystal Springs fountain thistle	*Cirsium fontinale* var. *fontinale*	FE/SE/1B.1	Serpentine seeps in chaparral openings and valley and foothill grassland.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Delta button-celery	*Eryngium racemosum*	–/SE/1B.1	Vernally mesic clay depressions in riparian scrub. Extant occurrences recorded along San Joaquin River in Merced County and in south Delta. Reclamation (2010) concluded this species could potentially occur near New Melones Reservoir.	Bay-Delta, Stanislaus River, New Melones Reservoir, San Joaquin River	Moderate. Potentially affected by floodplain restoration activities.	
Delta tule pea	*Lathyrus jepsonii* var. *jepsonii*	–/–/1B.2	Freshwater and brackish marshes and swamps in the Bay-Delta region. Known from north, central, and west Delta, and Suisun Marsh. CNDDB documents occurrences at Snodgrass, Barker, Lindsey, Hass, and Cache Sloughs; Delta Meadows Park; and Calhoun Cut.	Yolo Bypass, Sutter Bypass, Bay-Delta	High. Restoration activities are proposed within suitable habitat in the known range of the species.	
Franciscan manzanita	*Arctostaphylos hookeri* ssp. *franciscana*	FE/–/1B.1	Coastal scrub on serpentine soils. Known from only a single occurrence in the Presidio of San Francisco.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Greene's tuctoria	*Tuctoria greenei*	FE/SR/1B.1	Dry vernal pools.	Shasta River/Shasta Lake, Feather River, Sacramento River,	None. No activities are proposed within suitable habitat in the known range of the species.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
				American River, San Joaquin River		
Hairy Orcutt grass	*Orcuttia pilosa*	FE/FE/1B.1	Vernal pools.	San Joaquin River, New Melones Reservoir	None. No activities are proposed within suitable habitat in the known range of the species.	
Hartweg's golden sunburst	*Pseudobahia bahiifolia*	FE/FE/1B.1	Predominantly on northern slopes of rocky, bare areas along rolling hills, shady creeks, adjacent to vernal pools and streams, on heavy clay soils in valley and foothill grasslands and cismontane woodland.	Stanislaus River, Tuolumne River, San Joaquin River.	None. No activities are proposed within suitable habitat in the known range of the species.	
Hoover's spurge	*Chamaesyce hooveri*	FT/–/1B.2	Below the high-water mark of large northern hardpan and volcanic vernal pools.	Sacramento River, Feather River, American River, San Joaquin River	None. No activities are proposed within suitable habitat in the known range of the species.	
Keck's checkerbloom	*Sidalcea keckii*	FE/–/1B.1	Serpentine clay soils in cismontane woodland, valley, and foothill grassland.	Sacramento River, Feather River, American River, Bay-Delta, San Joaquin River.	None. No activities are proposed within suitable habitat in the known range of the species.	
Large-flowered fiddleneck	*Amsinckia grandiflora*	FE/SE/1B.1	Cismontane woodland, valley, and foothill grassland slopes.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Livermore tarplant	*Deinandra bacigalupii*	–/SE/1B.2	Alkaline meadows and seeps.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
Marin western flax	*Hesperolinon congestum*	FT/ST/1B.1	Serpentinite chaparral, serpentinite grassland.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Mason's lilaeopsis	*Lilaeopsis masonii*	–/SR/1B.1	Brackish or freshwater marshes and swamps, riparian scrub in Bay-Delta region. Known and locally common in certain regions of Delta and in Suisun Marsh. CNDDB documents occurrences of this species in Barker, Lindsey, Cache, and Snodgrass Sloughs as well as in Calhoun Cut.	Bay-Delta	High. Restoration activities are proposed within suitable habitat in the known range of the species.	
North Coast semaphore grass	*Pleuropogon hooverianus*	–/ST/1B.1	Open, mesic areas in broadleafed upland forest, meadows and seeps, and North Coast coniferous forest.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Pacific manzanita	*Arctostaphylos pacifica*	–/SE/1B.1	Chaparral and coastal scrub. Known only from San Bruno Mountain in San Mateo County.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Pallid manzanita	*Arctostaphylos pallida*	FT/SE/1B.1	Siliceous shale, sandy or gravelly soils in broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, and coastal scrub habitats. Known only from the East Bay Hills.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
Palmate-bracted bird's-beak	*Cordylanthus palmatus*	FE/SE/1B.1	Alkaline sites in grassland and chenopod scrub.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Pitkin marsh lily	*Lilium pitkinense*	FE/SE/1B.1	Mesic, sandy soils in cismontane woodland, meadows and seeps, freshwater marshes, and swamps.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Presidio clarkia	*Clarkia franciscana*	FE/SE/1B.1	Coastal scrub and grassland, typically on serpentine soils. Known only in the cities of San Francisco and Oakland.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Presidio manzanita	*Arctostaphylos hookeri* ssp. *ravenii*	FE/SE/1B.1	Serpentine outcrops in chaparral, coastal prairie, and coastal scrub. Known only from the Presidio of San Francisco.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Red hills vervain	*Verbena californica*	FT/ST/1B.1	Mesic areas along serpentine seeps or creeks surrounded by cismontane woodland or grassland. Known only from the Red Hills.	Tuolumne River	None. No activities are proposed within suitable habitat in the known range of the species.	
Robust spineflower	*Chorizanthe robusta* var. *robusta*	FE/–/1B.1	Sandy or gravelly areas in coastal scrub, coastal dunes, and openings in cismontane woodland.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Sacramento Orcutt grass	*Orcuttia californica* var. *viscida*	FE/SE/1B.1	Vernal pools.	Sacramento River	None. No activities are proposed within suitable habitat in the known range of the species.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
San Bruno Mountain manzanita	*Arctostaphylos imbricata*	–/SE/1B.1	Rocky areas in chaparral and coastal scrub habitat.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
San Francisco lessingia	*Lessingia germanorum*	FE/SE/1B.1	Coastal scrub on remnant dunes.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
San Francisco popcornflower	*Plagiobothrys diffusus*	–/SE/1B.1	Coastal prairie and annual grassland.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
San Joaquin Valley Orcutt grass	*Orcuttia inaequalis*	FT/SE/1B.1	Vernal pools.	San Joaquin River	None. No activities are proposed within suitable habitat in the known range of the species.	
San Mateo thorn-mint	*Acanthomintha duttonii*	FE/SE/1B.1	Serpentine soils in valley and foothill grassland, open areas in chaparral and coastal scrub.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
San Mateo woolly sunflower	*Eriophyllum latilobum*	FE/SE/1B.1	Open areas in coast live oak woodland, often on roadsides, sometimes on serpentinite.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Santa Cruz tarplant	*Holocarpha macradenia*	FT/SE/1B.1	Coastal terrace grasslands, coastal scrub, often on light sandy to sandy clay soils.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Slender Orcutt grass	*Orcuttia tenuis*	FT/SE/1B.1	Vernal pools.	Sacramento River	None. No activities are proposed within suitable habitat in the known range of the species.	
Soft bird's-beak	*Chloropyron molle* ssp. *molle*	FE/SR/1B.2	Coastal salt marshes and swamps in Contra Costa, Napa, and Solano Counties.	Bay-Delta	High. Restoration activities are proposed within suitable habitat in the known range of the species.	X

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
Suisun marsh aster	*Symphyotrichum lentum*	–/–/1B.2	Endemic to Delta, generally occurs in marshes and swamps, often along sloughs, from 0 to 3 meters in elevation. Brackish and freshwater marshes and swamps in the Bay-Delta region. Known from many areas of Delta and from Suisun Marsh.	Yolo Bypass, Sutter Bypass, Bay-Delta, Suisun Marsh	High. Restoration activities are proposed within suitable habitat in the known range of the species.	
Suisun thistle	*Cirsium hydrophilum* var. *hydrophilum*	FE/–/1B.1	Salt marshes and swamps. Two known occurrences in Grizzly Island Wildlife Area and Peytonia Slough Ecological Reserve. Present at Suisun Marsh.	Bay-Delta	High. Restoration activities are proposed within suitable habitat in the known range of the species.	X
Tiburon jewelflower	*Streptanthus niger*	FE/SE/1B.1	Serpentine grasslands. Known from only two occurrences on the Tiburon Peninsula.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Tiburon mariposa lily	*Calochortus tiburonensis*	FT/ST/1B.1	Serpentine grasslands. Known only from one occurrence on Ring Mountain Preserve.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Tiburon paintbrush	*Castilleja affinis* var. *neglecta*	FE/ST/1B.2	Serpentine grasslands.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	
Two-fork clover	*Trifolium amoenum*	FE/–/1B.1	Low elevation grasslands, including swales and disturbed areas, sometimes on serpentinite soils.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	

Common Name	Scientific Name	Status Federal/State/ CRPR*	Habitat/Distribution	Areas with Potential for Occurrence	Potential for Effect	Species Addressed in Reinitiation of Consultation (indicated with an X)
White-rayed pentachaeta	*Pentachaeta bellidiflora*	FE/SE/1B.1	Annual grassland, often on serpentinite.	Bay-Delta	None. No activities are proposed within suitable habitat in the known range of the species.	

Abbreviations
* *Status Codes*
FE = federally endangered
SE = state endangered
FT = federally threatened
ST = state threatened
SR = state rare

CRPR Codes
1B = Plants that are rare, threatened, or endangered in California and elsewhere
2 = Plants that are rare, threatened, or endangered in California but more common elsewhere

CRPR Threat Ranks
1 = Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
2 = Fairly threatened in California (20–80% occurrences threatened / moderate degree and immediacy of threat)
3 = Not very threatened in California (<20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

Other Abbreviations
CNDDB= California Natural Diversity Database
CRPR = California Rare Plant Rank

P.1.3 Critical Habitat

Critical habitat refers to areas designated by USFWS for the conservation of species listed as threatened or endangered under the Endangered Species Act (ESA) of 1973, as amended through the 108th Congress. When a species is proposed for listing under the ESA, USFWS considers whether there are certain areas essential to the conservation of the species. Critical habitat is defined in Section 3, Provision 5 of the ESA as follows.

(5)(A) The term "critical habitat" for a threatened or endangered species means -

(i) the specific areas within the geographical area occupied by a species at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species, and (II) which may require special management considerations or protection; and

(ii) specific areas outside the geographical area occupied by a species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.

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

The federally listed wildlife and plant species considered in this EIS that have designated critical habitat areas that could be affected by the project are presented in Table P.1-3, Critical Habitat for Terrestrial Species in the Study Area.

Table P.1-3. Critical Habitat for Terrestrial Species in the Study Area

Common Name	Scientific Name	Year Designated	Jurisdiction
Soft bird's-beak	*Cordylanthus mollis* ssp. *mollis*	2007	USFWS
Suisun thistle	*Cirsium hydrophilum* var. *hydrophilum*	2007	USFWS
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	1980	USFWS
Western yellow-billed cuckoo	*Coccyzus americanus*	2014 (proposed)	USFWS
California tiger salamander	*Ambystoma californiense*	2011 (Sonoma County DPS), 2005 (Central DPS)	USFWS

P.1.4 Wetlands and Waters of the United States

Wetlands and waters of the United States that occur in the study area are described below.

P.1.4.1 *Lake/Reservoir Communities*

Reservoirs that store CVP and SWP water supplies provide habitat used by some terrestrial species, either within the open water area of the reservoirs or along the margins and in drawdown areas.

P.1.4.1.1 Open Water Areas

Water surface elevations in reservoirs that store CVP and SWP water supplies change seasonally and annually due to hydrologic and operational variables. The open water areas of these reservoirs are used as foraging and resting sites by waterfowl and other birds and by semi-aquatic mammals such as river otter and beaver. Bald eagles and ospreys nest in forests at the margins of these reservoirs and frequently use the reservoirs to forage for fish.

Margins and Drawdown Areas

The CVP and SWP reservoirs in the Central Valley are generally located in canyons where the surrounding slopes are dominated by upland vegetation such as woodland, forest, and chaparral. Within the inundation area, the water surface elevations in these reservoirs fluctuate between maximum allowed storage elevations and minimum elevations defined by the lowest elevation on the intake structure. Along the water surface edge of the inundation area, the soils are usually shallow. Soil is frequently lost to wave action and periodic inundation, followed by severe desiccation when the water elevation declines, generally resulting in a barren drawdown zone around the perimeter of the reservoirs. Natural regeneration of vegetation within the drawdown zone is generally prevented by the timing of seed release when reservoir levels are high in the spring, lack of sediment replenishment necessary for seedling establishment in the spring, and high temperatures combined with low soil moisture levels of exposed soils in the summer.

Lack of vegetative cover within the drawdown zone can limit wildlife use of this area. Rapidly rising reservoir levels can potentially result in direct mortality of some sedentary wildlife species or life stages within the drawdown zone of reservoirs. As reservoir levels drop, energy expenditures can increase for piscivorous (fish-eating) birds foraging in the reservoirs as these species must travel greater distances to forage (DWR 2004).

P.1.4.2 *Riverine Communities*

The rivers and streams influenced by the long-term coordinated operation of the CVP and SWP support habitats for plants and wildlife. The primary components of the riverine environment that support plants and wildlife, including open water areas and adjacent riparian and floodplain communities (including bypasses that are inundated at high flows), are described below.

P.1.4.2.1 Open Water Areas

The riverine environment downstream of reservoirs is managed generally for water supply and flood control purposes. As such, the extent of open water in the rivers varies somewhat predictably, although not substantially, within and among years. In the wetter years when bypasses and floodplains are inundated, vast areas of open water become available during the flood season, generally in the late winter and early spring. Open water portions of riverine systems provide foraging habitat for fish-eating birds and waterfowl. Gulls, terns, ospreys, and bald eagles forage over open water. Near-shore and shoreline areas provide foraging habitat for birds such as waterfowl, herons, egrets, shorebirds, and belted kingfishers. Many species of insectivorous birds such as swallows, swifts, and flycatchers forage over open water areas of lakes and streams. Mammals known to associate with open water and shoreline habitats include river otters, American minks, muskrats, and beavers.

P.1.4.2.2 Riparian and Floodplain Areas

The riparian and floodplain communities that could be affected by CVP and SWP operations entail the vegetation and associated wildlife community supported and influenced by proximity to the waterway, including areas frequently flooded by rising water levels in the rivers (floodplains). The extent of riparian vegetation within the Central Valley has been reduced over time due to a variety of actions, including local, state, and federal construction and operation of flood control facilities on isolated historic floodplains; agricultural and land use development that occurred following development of flood control projects; regulation of flows from dams that has reduced the magnitude and frequency of larger flow events, increased recession rates, and increased summertime flows; and construction and maintenance of active ship channels by USACE (DWR 2012). Currently, 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, including the Delta (DWR 2009).

Characteristic riparian tree species in the Central Valley include willows, cottonwoods, California sycamore, and valley oaks. Typical understory plants include elderberry, blackberries, and poison oak. On the valley floor in the deep alluvial soils, the structure and species composition of the plant communities change with distance from the river, with the denser stands of willow and cottonwood at the water's edge transitioning into stands of valley oaks on the less frequently inundated terraces. In other areas, the riparian zone does not support a canopy of large trees and instead is dominated by shrub species (sometimes referred to as *riparian scrub*).

Riparian and floodplain vegetation supports wildlife habitats because of its high floristic and structural diversity, high biomass and high food abundance, and proximity to water. In addition to providing breeding, foraging, and roosting habitat for an array of animals, riparian and floodplain vegetation also provides movement corridors for some species, connecting a variety of habitats throughout the region. The Sacramento and San Joaquin Valleys lack substantial areas of natural habitat that support native biodiversity or corridors between the areas of natural habitat; therefore, riparian and floodplain corridors play a critical role in connecting wildlife among the few remaining natural areas (California Department of Transportation and CDFG 2010).

River flows and associated hydrologic and geomorphic processes are important for maintaining riparian and floodplain ecosystems. Most aspects of a flow regime (e.g., the magnitude, frequency, timing, duration, and sediment load) affect a variety of riparian and floodplain habitat processes. Two processes that create riparian and floodplain ecosystems are disturbance and plant recruitment. The interaction of these processes across the landscape is primarily responsible for the pattern and distribution of riparian and floodplain habitat structure and condition, and for the composition and abundance of riparian-associated species.

High flow events and associated scour, deposition, and prolonged inundation can create exposed substrate for plant establishment or openings in existing riparian and floodplain communities. Early successional species, like cottonwoods and willows 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 and floodplain vegetation could increase, as could overall wildlife habitat values. Without disturbance, larger trees and species less tolerant of frequent disturbance begin to dominate riparian woodlands.

The recruitment of cottonwoods and willows 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. Riparian and floodplain communities also undergo natural disturbance cycles when flood flows remove streamside vegetation and redistribute sediments and seeds, thereby maintaining habitat diversity for terrestrial species that associate with riparian and floodplain corridors.

Both prolonged drought and prolonged inundation, however, can lead to plant death and loss of riparian plants (Kozlowski and Pallardy 2002). Riparian plants have high moisture requirements during the active growing season (spring through fall), and dry soil conditions can reduce growth and injure or kill plants. On the other hand, prolonged inundation creates anaerobic conditions that, during the active growing season, also can reduce growth, injure, or kill plants.

The continuation of riparian and floodplain communities is anticipated to change along levees within the federally authorized levee systems that have maintenance agreements with the USACE (including Delta levees along the Sacramento and San Joaquin Rivers) and other levees that are eligible for the federal Rehabilitation and Inspection Program (Public Law 84-99). The vegetation management policies of the USACE were changed in 2009 and 2010. Historically, the USACE allowed brush and small trees to be located on the waterside of federal flood management project levees if the vegetation would preserve, protect, and/or enhance natural resources, and/or protect rights of Native Americans, while maintaining the safety, structural integrity, and functionality of the levee (DWR 2011). After Hurricane Katrina in 2005, the USACE issued a policy and draft policy guidance to remove substantial vegetation from these levees throughout the nation. In 2010, the USACE issued a draft policy guidance letter, *Draft Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls* (75 FR 6364-6368) that included procedures for state and local agencies to request variances on a site-specific basis. DWR has been in negotiations with USACE to remove vegetation on the upper third of the waterside slope, top, and landside of the levees, and continue to allow vegetation on the lower two-thirds of the waterside slope of the levee and along benches above the water surface. The effects of these changes have not become widespread at this time. Future conditions under these requirements are further described under the description of the No Action Alternative in this technical appendix.

P.1.4.3 *Wetlands, Marshes, and Wet Meadows*

Wetlands in the study area can be characterized as perennial or seasonal with perennial wetlands further classified as tidal or non-tidal. Natural, non-tidal perennial wetlands are scattered along the Sacramento and San Joaquin Rivers, typically in areas with slow moving backwaters. Management of wetlands, marshes, and wet meadows can include irrigating open areas to support native herbaceous plants or cultivated species; periodic or continuous flooding to provide feeding and roosting sites for many wetland-associated birds; and either limited tilling or no tilling or disturbance of the managed areas.

Managed seasonal wetlands on the west side of the Sacramento River generally occur between Willows and Dunnigan along the Colusa Basin Drain. Substantial portions of these managed wetland habitats occur at the flood bypasses, including the Yolo Bypass Wildlife Area and Fremont Weir, as a part of the Sacramento National Wildlife Refuge Complex, and around the Thermalito Afterbay. Both tidal and nontidal, perennial wetlands are found in the Delta and Suisun Marsh.

P.1.4.3.1 Perennial Non-Tidal (Freshwater) Wetlands and Marshes

In the Sacramento and San Joaquin Valleys and foothills, perennial non-tidal wetland habitats include freshwater emergent wetlands and wet meadows. Freshwater emergent wetlands, or marshes, are dominated by large, perennial herbaceous plants, particularly tules and cattails, which are generally restricted to shallow water. 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. Wet meadows are similar to perennial freshwater wetlands in many regards; however, they are dominated by a greater variety of perennial plants such as rushes, sedges, and grasses than are found in freshwater wetlands. Perennial freshwater wetlands also provide ecological functions related to water quality and hydrology. These areas generally qualify as jurisdictional wetlands subject to USACE jurisdiction under Sections 401 and 404 of the federal Clean Water Act.

Perennial freshwater wetlands are among the most productive wildlife habitat in California (CDFG 1988). In the Sacramento and San Joaquin Valleys and foothills, these wetlands support several sensitive amphibians, reptiles, birds, and mammals. Perennial freshwater wetlands also provide food, cover, and water for numerous species of wildlife. Wetlands in the Sacramento and San Joaquin Valleys and foothills are especially important to migratory birds and wintering waterfowl.

P.1.4.3.2 Seasonal Wetlands

Natural seasonal wetlands occur in topographic depressions and swales that are seasonally saturated and exhibit hydric soils that support hydrophytic plant species. Natural seasonal wetlands are generally dominated by hydrophytic plants during the winter and spring months. Characteristic plant species in seasonal wetlands consist of both native and nonnative species. Native species include coyote thistle, toad rush, hyssop loosestrife, and foothill meadowfoam. Natural 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. Like perennial wetlands, seasonal wetlands have been substantially reduced from their historical extent.

Numerous managed seasonal wetlands occur within the Sacramento Colusa, Sutter, Tisdale, and Yolo Bypasses and around the Thermalito Afterbay.

Managed marsh areas are intentionally flooded and managed during specific seasonal periods to enhance habitat values for specific wildlife species (CALFED 2000). Managed marsh areas are distributed largely in the northern, central, and western portions of the Delta, as well as in Suisun Marsh and the Yolo Bypass, Stone Lakes NWR, Cosumnes River Preserve, and Suisun Marsh.

P.1.4.3.3 Perennial Tidal Wetlands and Open Water

In the study area tidal wetlands and open water are primarily found in the Delta and Suisun Marsh. Tidal wetlands are influenced by tidal movement of salt water from San Francisco Bay and inflow of freshwater from the Delta and smaller local watersheds. Salinity levels vary throughout the year and are influenced largely by inflow from the Delta (Reclamation et al. 2011). Tidal open water in the Delta is mainly freshwater habitat, with brackish and saline conditions occurring in the western Delta at times of high tides and low flows into the western Delta. It is freshwater in the Yolo Bypass and mainly brackish and saline in Suisun Marsh. Tidal mudflats occur as mostly unvegetated sediment deposits in the intertidal zone between the tidal wetland communities at its upper edge and the tidal perennial aquatic community at its lower edge. Tidal brackish wetlands exist from near Collinsville westward to the Carquinez Strait.

Suisun Marsh is the largest contiguous brackish water marsh remaining on the North America west coast (Reclamation et al. 2011). Tidal freshwater marshes occur at the shallow, slow-moving or stagnant edges of freshwater waterways in the intertidal zone and are subject to frequent, long duration flooding.

P.2 Evaluation of Alternatives

This section describes the technical background for the evaluation of environmental consequences associated with the Project alternatives and the No Action Alternative. This section also describes the results of the impact analysis for each Project alternative and the No Action Alternative. Most of the actions from the project that will affect terrestrial species are programmatic. The only effects from project-specific actions are from flow changes, discussed below. The remainder of the effects are associated with programmatic-level actions.

P.2.1 Technical Background

P.2.1.1 *Land Cover*

Reclamation used existing land cover data to assess effects on terrestrial biological resources. Data sources are listed below:

- Aerial Information Systems, Inc. 2011. Delta Vegetation and Land Use. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/200_299/ds292.zip. Accessed: December 10, 2018.
- U.S. Geological Survey. 2017. NHD Flowline. Available: http://prd-tnm.s3-website-us-west-2.amazonaws.com/?prefix=StagedProducts/Hydrography/NHD/State/HighResolution/GDB. Accessed: May 4, 2017.
- U.S. Geological Survey. 2017. NHD Area. Available: http://prd-tnm.s3-website-us-west-2.amazonaws.com/?prefix=StagedProducts/Hydrography/NHD/State/HighResolution/GDB. Accessed: May 4, 2017.
- Geographic Information Center, Chico Research Foundation. 2016. Vegetation—Great Valley Ecoregion. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets/2600_2699/ds2632.zip. Accessed: November 11, 2017.
- Chico State University and California DWR. 2001. Legal Delta Boundary. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: December 11, 2018. \

P.2.1.2 *Federally Listed Species and Critical Habitat*

To identify federally listed as endangered and threatened species that may occur in the study area, Reclamation used the list generated by the IPaC online service. The species identified by the IPaC list are shown in Tables P.1-1 and P.1-2.

To determine which project components could affect the federally listed terrestrial species identified in Tables P.1-1 and P-1.2, Reclamation reviewed species range maps to assess which project components overlap the species' ranges. All the range maps originated from the following data sources:

- California Department of Fish and Wildlife California Interagency Wildlife Task Group. 2016. California Tiger Salamander Range. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: January 24, 2019.
- California Department of Fish and Wildlife California Interagency Wildlife Task Group. 2016. Clapper Rail Range. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: January 2, 2019.
- California Department of Fish and Wildlife California Interagency Wildlife Task Group. 2016. Giant Garter Snake Range. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: January 2, 2019.
- California Department of Fish and Wildlife California Interagency Wildlife Task Group. 2016. Least Tern Range. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: January 24, 2019.
- California Department of Fish and Wildlife California Interagency Wildlife Task Group. 2016. Salt-Marsh Harvest Mouse Range. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: January 2, 2019.
- California Department of Fish and Wildlife California Interagency Wildlife Task Group. 2016. Yellow-Billed Cuckoo Range. Available: ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed: January 2, 2019.
- U.S. Geological Survey Gap Analysis Project. 2018. San Joaquin Valley Wood Rat Range. Available: https://gapanalysis.usgs.gov/species/data/download. Accessed: January 15, 2019.
- Carol W. Witham, Robert F. Holland, and John Vollmar. 2014. Changes in the Distribution of Great Valley Vernal Pool Habitats from 2005 to 2012. Available: https://vernalpools.org/2012CVPIA/2012RemapVernalPoolsFINAL.zip. Accessed: August 27, 2017.
- U.S. Fish and Wildlife. 2005. Vernal Pool Core Areas.

Reclamation used existing species habitat models where available to assess which project components would affect the habitat of federally listed species. Reclamation developed mitigation measures with the first goal being to avoid effects on federally listed species and the second goal being to minimize and compensate for unavoidable effects. Reclamation analyzed each project component to determine whether it could fully avoid effects on federally listed species. If effects were determined to be unavoidable, or potentially unavoidable, Reclamation developed measures to compensate for unavoidable effects. All effects on federally listed species are addressed at a programmatic level and are qualitatively described rather than quantified.

The analyses of potential effects on species' designated critical habitat follow the species analyses. Potential effects on primary constituent elements (PCEs)/physical and biological features (PBFs) of critical habitat are analyzed for western yellow-billed cuckoo and valley elderberry longhorn beetle. These analyses often draw on the foundation provided in the species analyses. Analysis of effects on critical habitat is guided by consideration of recent analyses by USFWS and National Marine Fisheries Service, which included refined interpretation of critical habitat PCEs/PBFs relative to the original descriptions at the time critical habitat was designated.

P.2.1.3 *Special-Status Species That Are Not Federally Listed*

To identify non-federally listed special-status species that may occur in the study area, Reclamation queried the CNDDB (CDFW 2019). These species are listed in Tables P.1-1 and P.1-2. Reclamation then evaluated each of these species based on the species' habitat and the distribution of land cover types in the study area that meet each species' habitat requirements.

For species with potential to be affected as identified in Tables P.1-1 and P.1-2, Reclamation developed mitigation measures with the first goal being to avoid effects on each special-status species, and the second goal being to minimize and compensate for unavoidable effects. Reclamation analyzed each project component to determine whether it could fully avoid effects on the special-status species. If effects were determined to be unavoidable, or potentially unavoidable, Reclamation developed measures to minimize and compensate for unavoidable effects. All effects on special-status species are addressed at a programmatic level and are qualitatively described rather than quantified.

P.2.1.4 *Wetlands and Waters of the United States*

Wetlands and waters of the United States in the study area that could be potentially affected have not been delineated, and the footprints of many of the project components are unknown; therefore, Reclamation addresses effects on wetlands and waters of the United States at a programmatic, qualitative level only. Based on land cover data described in Section P.2.1.1, *Land Cover*, Reclamation evaluated which wetland/waters land cover types may be affected by project components, developed measures for avoiding effects on these wetlands, and developed measures for minimizing and mitigating unavoidable effects.

P.2.2 No Action Alternative

The No Action Alternative for the project means that Reclamation and DWR would continue with current operations of the CVP and SWP. Under the No Action Alternative, no additional habitat restoration activities would occur other than the 8,000 acres of restoration required in the 2009 Biological Opinion. There would be no additional restoration in the Upper Sacramento, American River, Bay-Delta, Stanislaus, or Lower San Joaquin River Watersheds. Other than for 8,000 acres of restoration in the Bay-Delta area, habitat in these watersheds along rivers and tidal channels and in floodplains and marshes currently occupied by or suitable for terrestrial species would remain in the same condition as described in Section P.1.1, *Vegetation and Wildlife*, affected only by normal seasonal and annual variations and future climate change. Under the No Action Alternative, the existing UC Davis Fish Culture and Conservation Laboratory (FCCL) would be used to produce and release up to 50,000 adult Delta Smelt annually into the Bay-Delta to supplement the existing population. The proposed Delta Fish Species Conservation Hatchery (Conservation Hatchery) in Rio Vista would not be built nor constructed in areas that are occupied by or could potentially support terrestrial species such as burrowing owl, California tiger salamander, and vernal pool invertebrates.

P.2.3 Alternative 1

P.2.3.1 Project-Level Effects

Potential changes to wildlife and plant habitat on river banks

Compared to the No Action Alternative, operation of the CVP and SWP under Alternative 1 would change river flows and reservoir levels, which would change existing flow conditions. If river flows or

reservoir levels have substantive declines or increases in areas with wildlife or plant habitat, the flows could adversely affect that habitat. Alternative 1, however, would have only minor changes to the water levels in reservoirs and along rivers. The flow changes are relatively small during each year type and would not result in substantive changes to riparian habitat.

For the purposes of the wildlife and plant species analyses, *flow changes* constitute the expected effects of implementing Alternative 1 in comparison with the No Action Alternative. Differences in flow management between Alternative 1 and the No Action Alternative would have the potential to affect a special-status wildlife or plant species if flow changes were to directly affect the species, directly alter habitat availability or quality, or result in vegetation changes that would alter habitat availability or quality. The great majority of stream channels within the study area are linear channels confined by levees or other engineered works that provide negligible habitat for special-status wildlife or plant species. There is, however, potential to affect such species at those sites where habitat has not been removed by channel alteration, or where habitat has been restored, or where habitat is expected to be restored during the proposed term of the proposed action. In the first two of these cases, existing habitat shows evidence of adaptation to anthropogenic modifications to the ecosystem that date back decades and, in many cases, over a century. These modifications include hydrologic changes associated with water manipulation; topographic changes associated with flood control, agriculture, restoration site construction, and other causes; and biological changes associated with the introduction of nonnative species. Implementation of Alternative 1 would generally result in very minor potential changes relative to the No Action Alternative, and these changes are small relative to normal month-to-month and year-to-year variability in the system.

Compared to the No Action Alternative, Alternative 1 is expected to have only minor effects on habitat along the banks of rivers and reservoirs; however, flow changes would have the potential to affect the amount of yellow-billed cuckoo riparian habitat. Alternative 1 may modify flows in a manner that would limit channel-forming flows, which could result in less riparian habitat establishment and expansion over time. If hydrologic modifications lead to too little or too much water during different times of the year, existing riparian habitat could be affected (79 FR 59991 60038); higher flows could result in erosion and potential loss of riparian vegetation while lower flows—especially in spring—could result in drought stress or less riparian vegetation recruitment, such as cottonwood seed dispersal. The hydrologic regime (stream flow pattern) and supply of (and interaction between) surface and subsurface water are driving factors in the long-term maintenance, growth, recycling, and regeneration of western yellow-billed cuckoo habitat (78 FR 61621 61666). Higher flows could also result in higher sedimentation along the channel banks that similarly result in the inability of riparian vegetation to establish or regenerate. Alternatively, lower flows could diminish the water table, leading to reduced groundwater availability and water stress in riparian trees. Physiological stress in native vegetation from prolonged lower flows or groundwater results in reduced growth rate, morphological change, or mortality of plants; altered species composition dominated by more drought-tolerant vegetation; and conversion to habitat dominated by nonnative species (Poff et al. 1997). These effects reduce and degrade habitat for the western yellow-billed cuckoo for foraging, nesting, and cover.

Flow change could adversely affect nesting habitat for bank swallows on the Sacramento and Feather Rivers. One of the primary threats to bank swallows is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of resulting limited available habitat and the reduction of natural river processes, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breeding season (generally April 1–August 31). The potential impacts of changes in upstream flows on bank swallows during the breeding season are the flooding of active burrows and destruction of colonies from increased bank sloughing.

Bank swallows arrive in California and begin to excavate their burrows in March, and peak egg-laying occurs between April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, high-flow events on the Sacramento and Feather Rivers that occur after March when the swallows have nested and laid eggs in the burrows could adversely affect bank swallows and result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cubic feet per second (cfs) have been associated with localized bank collapses that resulted in partial or complete colony failure (Stillwater Sciences 2007).

Additionally, flows above 50,000 cfs on the Sacramento River could lead to multiple colony failures during the breeding season, but they may be beneficial during the non-breeding season because erosion can create new breeding habitat in the form of cut banks (Stillwater Sciences 2007).

Model results illustrate that, relative to the No Action Alternative, flows on the Sacramento River would be higher under Alternative 1 (due to spring pulses) during the bank swallow breeding season. Projected differences between the No Action Alternative and Alternative 1 would occur from mid-April to July; during this time period, average flows on the Sacramento River under Alternative 1 would be slightly greater than under the No Action Alternative but slightly lower than under Alternatives 2 and 3.

Average flows on the Sacramento River downstream of Keswick Reservoir, at Bend Bridge, and below Red Bluff Diversion Dam would increase under Alternative 1 during the bank swallow breeding season, with model results predicting flow staying below 15,000 cfs. Average flows on the Sacramento River at Hamilton City, at Wilkins Slough, and at Freeport under Alternative 1 would generally decrease during the bank swallow breeding season. Monthly flows are highest at Freeport during the bank swallow breeding season, with predicted monthly flows between 15,000 and 19,000 cfs under Alternative 1.

Model results illustrate that, relative to the No Action Alternative, flows on Feather River would be higher under Alternative 1 (due to spring pulses) during the bank swallow breeding season. Projected differences between the No Action Alternative and Alternative 1 would occur from mid-May to July. Average flows on Feather River downstream of Thermalito would increase under Alternative 1 during the bank swallow breeding season, with model results predicting peak flows of 7,000 cfs. However, average flows on the Feather River at the Sacramento River confluence would decrease under Alternative 1 during the bank swallow nesting season.

P.2.3.2 *Program-Level Effects*

Potential changes to existing marshes and associated special-status species in the Bay-Delta region

Alternative 1 would restore tidal wetlands, diked wetlands, and muted marsh habitat in the Bay-Delta region. Several sites including Dutch Slough, Winter Island, Hill Slough, Arnold Slough/Bradmoor Island, Chipps Island, and Lower Yolo Ranch are being restored to tidal habitat as mitigation for adverse impacts on Delta Smelt and its habitat. Tidal habitat restoration at each site would be achieved by conversion of currently leveed, cultivated land through breaching or setback of levees, thereby restoring tidal fluctuation to land parcels currently isolated behind those levees. Where appropriate, portions of restoration sites would be raised to elevations that would support tidal marsh vegetation following levee breaching. Depending on the degree of subsidence and location, lands may be elevated by grading higher elevations to fill subsided areas, importing clean dredged or fill material from other locations, or planting tules or other appropriate vegetation to raise elevations in shallowly subsided areas over time through organic material accumulation. Surface grading would create a shallow elevation gradient from the marsh plain to the upland transition habitat. Based on assessments of local hydrodynamic conditions, sediment

transport, and topography, restoration activities may be designed and implemented in a manner that accelerates the development of tidal channels within restored marsh plains. Following reintroduction of tidal exchange, tidal marsh vegetation is expected to establish and maintain itself naturally at suitable elevations relative to the tidal range. Depending on site-specific conditions and monitoring results, patches of native emergent vegetation may be planted to accelerate the establishment of native marsh vegetation on restored marsh plain surfaces.

Habitat restoration activities and restoration of tidal inundation could have deleterious short-term effects on existing tidal, non-tidal, and managed marsh habitats and associated special-status species, including Suisun marsh aster, Mason's lilaeopsis, Bolander's water hemlock, soft bird's-beak, Suisun thistle, delta tule pea, western pond turtle, California black rail, California Ridgway's rail, Suisun song sparrow, saltmarsh common yellowthroat, short eared owl, Suisun shrew, and salt-marsh harvest mouse. The potential effects on tidal marsh habitat would include the conversion of mid- and high-marsh habitat types to low-marsh types; the conversion of low-marsh habitat to subtidal habitat; and the conversion of upland refugia habitat to tidal habitat. While it is expected that the habitat would persist after restoration of tidal action, the extent of mid- and high-marsh is expected to decrease in the near-term. In the longer-term, and with the implementation of remedial measures, the extent of habitat is expected to expand. The extent of habitat may not expand to pre-restoration conditions, although the habitat will be of great extent and more resilient to climate change because tidal habitat has potential to accrete sediment to keep up with sea level rise whereas diked wetlands do not. Furthermore, diked wetlands have the risk of breached dikes that cause excessive flooding of mid- and high-marsh habitats.

Tidal habitat restoration is not expected to occur in areas with occupied habitat for soft bird's-beak or Suisun thistle, and no negative effects would be expected from restoration activities. Over time, the restored and enhanced area is expected to be suitable and of higher long-term value for the species because it would be less vulnerable to sea level rise by including gradual slopes up from the current tidal region, potentially allowing introduction of the species into the restored areas. Thus, Alternative 1 is expected to have a wholly beneficial effect on special-status plant species.

Potential changes to existing riparian areas and associated special-status species

Habitat restoration under Alternative 1 could result in the loss of riparian habitat and associated special-status species. Riparian species potentially affected include valley elderberry longhorn beetle, western yellow-billed cuckoo, foothill yellow-legged frog, least Bell's vireo, yellow warbler, Swainson's hawk, white-tailed kite, yellow-breasted chat, osprey, bald eagle, ring-tailed cat, riparian brush rabbit, and riparian woodrat.

Alternative 1 includes creation of spawning habitat and side channels along rivers, floodplain restoration, or other aquatic habitat restoration in riparian areas. The construction of setback levees to restore seasonally inundated floodplain could permanently remove species habitat and would be expected to transition species habitat from areas that flood frequently (i.e., every 1–2 years) to areas that flood infrequently (i.e., every 10 years or more). Periodic inundation as a result of floodplain restoration is not expected to adversely affect nesting bird species because flooding is unlikely to occur during the breeding season, and the potential effects of inundation on existing riparian vegetation are expected to be minimal. While frequent flooding in the lower elevations of the floodplain may result in scouring of riparian vegetation, this is expected to have a beneficial rather than an adverse long-term effect on most riparian species because periodic scouring increases successional and structural diversity of the habitat. Alternative 1 also includes a yellow-billed cuckoo baseline surveys component will identify habitat and implement nesting bird protocols during construction to minimize impacts.

Floodplain restoration may result in periodic flooding of habitat for riparian brush rabbit and riparian woodrat, which are primarily ground-dwelling species that are adversely affected by flooding if no upland refugia are available during flood events. In addition, the removal of oak trees in floodplains would remove nest building materials for riparian woodrats in floodplains. However, the mitigation measure for riparian brush rabbit and riparian woodrat (MM BIO-21) will avoid and minimize both of these impacts. MM BIO-21 requires floodplain restoration projects to include refugia habitat to provide shelter from flood events and avoidance of mature oak trees in areas identified by a qualified biologist as being occupied by riparian brush rabbit and riparian woodrat. MM BIO-21 also puts limits on the amount of habitat that can be impacted by restoration.

Potential changes to habitat for special-status reptiles

Alternative 1 includes creation of spawning habitat and side channels along rivers, channel margin restoration, floodplain restoration, and other aquatic habitat restoration on the banks of waterbodies that could result in loss of habitat for giant garter snake and western pond turtle. Aquatic habitat and floodplain restoration could result in directly mortality of these species.

Permanent effects on giant garter snake aquatic habitat are likely to occur when agricultural ditches are modified and flooded as part of the tidal habitat restoration process. Permanent effects on both giant garter snake and western pond turtle habitat could occur where channel margin restoration entails levee setback. For giant garter snake, the conversion of rice to tidal habitat would be a permanent loss; however, rice is not common in the areas where tidal restoration and channel margin restoration would likely be sited. Other aquatic features with potential to occur on restoration sites include natural channels and topographic depressions. Tidal aquatic edge habitat where open water meets the levee edge will also be permanently lost in those reaches where the levee is breached. Temporary effects on aquatic edge habitat are also likely to occur during the time of construction, though these effects would not be expected to last more than 2 years. Permanent effects on upland habitat will primarily occur where upland habitat is removed to create tidal connectivity.

Potential to injure or kill special-status species

Construction-related actions associated with habitat restoration and the installation/upgrade of facilities under Alternative 1 could injure or kill special-status species in occupied habitat. The operation of equipment for land clearing and restoration could result in injury or mortality of special-status species. This risk is highest for species with periods of dormancy, like California tiger salamander and giant garter snake. Increased vehicular traffic associated with construction activities could contribute to a higher incidence of road kill. However, construction monitoring and other mitigation measures have been identified to avoid and minimize injury or mortality of special-status species during construction.

In tidal marsh habitat, construction actions such as excavation of levees, construction of tidal control gates, movement and staging of large construction equipment, piling and storage of soils, dredging, and filling and grading of vegetated areas could cause the injury or mortality of special-status species that may be in the vicinity of the construction area. Tidal marsh species are especially vulnerable during periods of higher tides and peak flooding by storms; during these periods, these species move into upland marsh areas for protection. Tidal marsh species could drown or be preyed upon if construction activities or equipment isolate tidal marsh species from their refugia habitat or confuse or disturb them.

Equipment operation for the creation of side channels and levees in riparian habitat during periods of high seasonal activity, such as the nesting bird or bat maternity seasons, could also injure or kill special-status

species. Risk is greatest to bird eggs and nestlings or bat pups that could be injured or killed through crushing by heavy equipment, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is unlikely, as these individuals are expected to avoid contact with construction equipment.

Night construction could disrupt animal behavior and/or sleep cycles or adversely affect bat foraging activity in all impacted habitat types if special-status species are exposed to night lighting. For example, bird species are attracted to artificial lights, which may disrupt their behavioral patterns or cause collision-related fatalities (Gauthreaux and Belser 2006). Night lighting can also result in circadian/behavior disruptions which can cause bird species to molt and develop their reproductive system earlier than in dark nights. Night lighting can also influence the endocrine system of vertebrates, which can lead to health deterioration (Fonken and Nelson 2014; Ouyang et al. 2018).

Construction-related noise levels could cause additional behavioral modifications if special-status species are present in the general vicinity. Construction activities may create noise up to 60 dBA at no more than 1,200 feet from the edge of the noise generating activity. While 60 dBA is the standard noise threshold for birds (Dooling and Popper 2007), this standard is generally applied during the nesting season, when birds are more vulnerable to behavioral modifications that can cause nest failure. There is evidence, however, that migrating birds will avoid noisy areas during migration (McClure et al. 2013). Noise and visual disturbance outside the project footprint but within 200 feet of construction activities could temporarily affect the use of adjacent habitat by giant garter snake. These effects will be minimized by siting construction 200 feet away from the banks of giant garter snake aquatic habitat, where feasible, as described in MM BIO-5.

Contaminants could be introduced into species' habitats as a result of construction. Exhaust from construction and maintenance vehicles may result in deposition of particulates, heavy metals, and mineral nutrients that could influence the quality and quantity of vegetation and thereby affect presence and abundance of special-status species. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that will affect occupied, suitable, or adjacent habitat. These accidental spills could also affect special-status species prey, resulting in less food availability. Increased runoff from impervious surfaces into wetland areas carries pollutants that are harmful to reptiles and amphibians, which are particularly sensitive to contaminants and other pollutants in the water.

Potential changes to vernal pools and associated special-status species

Tidal habitat restoration and the construction of the Conservation Hatchery under Alternative 1 could have direct and indirect effects on vernal pools and associated special-status species. Vernal pool species that could be affected include California tiger salamander, Contra Costa goldfields, and vernal pool invertebrates. Direct effects include loss of habitat and individual mortality as a result of construction. Tidal natural community restoration could result in the permanent loss of vernal pool crustacean habitat. It is anticipated that much of the existing vernal pool habitat that would be impacted by the project is already degraded. Vernal pools in the Sacramento and San Joaquin Valleys have already experienced significant disturbance due to agricultural development (e.g., plowing, disking, or leveling), which results in compacted soils, loss of hydrologic connections, and reductions in the size and extent of vernal pools.

Construction of the Conservation Hatchery could result in direct removal of vernal pools if it is constructed in an area that contains vernal pool complexes. Similarly, if these pools are occupied, vernal

pool crustaceans could be destroyed. These effects will be avoided through the implementation of the identified/proposed mitigation measures.

Indirect conversion of vernal pool habitat could also occur due to hydrological changes as a result of tidal habitat restoration or construction of the hatchery. Construction restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. Therefore, MM BIO-1 will ensure a buffer of 250 feet for construction or restoration near vernal pool habitat.

Potential to affect special-status bat species and their habitat

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. Special-status bat roosting habitats include riparian habitat, developed lands, and landscaped trees such as eucalyptus, palms, and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

Four California bat species of special concern could occur in the study area (Table P.1-1) as could several common bat species. Construction and restoration activities associated with Alternative 1 would result in both temporary and permanent losses of foraging and roosting habitat for special-status bat species. Tidal habitat restoration and floodplain restoration would result in permanent and temporary loss of riparian roosting habitat and conversion of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Development of the Conservation Hatchery could also result in the removal of roosting and foraging habitat. Noise and visual disturbances during implementation of riparian habitat restoration and other construction activities could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. Impacts on special-status bat species that occupy artificial structures are expected to be negligible in comparison to the amount of impacts on natural habitat types, but temporary and permanent impacts on special-status bat species occupying artificial structures could result in local adverse effects.

Despite having potential to result in some adverse effects, implementation of Alternative 1 would result in an overall benefit to special-status bats within the study area through restoration of their foraging and roosting habitats. The majority of affected habitat would be agricultural, and such land would be converted to natural communities with higher value foraging and roosting potential such as riparian land, tidal and nontidal wetlands, and periodically inundated lands. Restored habitats are expected to be of higher value because, compared to agricultural land, pesticide use would be lower and greater numbers of flying insect prey species would be available. In addition, any impact from construction, restoration, or periodic inundation on special-status bats and their habitat would be mitigated through implementation of MM BIO-24, which would ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications, and no substantial reduction in numbers nor a restriction in the range of special-status bats.

Potential changes to wetlands and waters of the United States

The restoration projects associated with Alternative 1 would likely require some fill of wetlands and waters of the United States. Wetlands and waters of the United States are those aquatic resources that are protected under Section 404 of the Clean Water Act. Fill could occur from dredging work, spoils areas, side channel construction, and installation of the Conservation Hatchery. The majority of the impacts on wetlands and waters of the United States are likely on tidal channels, emergent wetlands, and on wetlands and waters found within cultivated lands (agricultural ditches[2] and seasonal wetlands). Reclamation will obtain and implement the conditions and requirements of state and federal permits that may be required prior to the construction of the proposed project.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. The restoration projects would ultimately result in a net increase of wetlands and waters of the United States, but restoration could result in short-term losses.

Restoration could also result in conversion from one wetland type to another. Wetland functions are defined as a process or series of processes that take place within a wetland. These include the storage of water, transformation of nutrients, growth of living matter, and diversity of wetland plants, and they have value for the wetland itself, for surrounding ecosystems, and for people. Functions can be grouped broadly as habitat, hydrologic/hydraulic, or water quality. Not all wetlands perform all functions nor do they perform all functions equally well. The location and size of a wetland may determine what functions it will perform. For example, the geographic location may determine its habitat functions, and the location of a wetland within a watershed may determine its hydrologic/hydraulic or water quality functions. Many factors determine how well a wetland will perform these functions: climatic conditions, quantity and quality of water entering the wetland, and disturbances or alteration within the wetland or the surrounding ecosystem. Wetland disturbances may be the result of natural conditions, such as an extended drought, or human activities, such as land clearing, dredging, or the introduction of nonnative species. Wetlands are among the most productive habitats in the world, providing food, water, and shelter for fish, shellfish, birds, and mammals, and serving as a breeding ground and nursery for numerous species. Many endangered plant and animal species are dependent on wetland habitats for their survival. Hydrologic and hydraulic functions are those related to the quantity of water that enters, is stored in, or leaves a wetland. These functions include such factors as the reduction of flow velocity, the role of wetlands as ground-water recharge or discharge areas, and the influence of wetlands on atmospheric processes. Water-quality functions include the trapping of sediment, pollution control, and the biochemical processes that take place as water enters, is stored in, or leaves a wetland.

The functions of the waters of the United States that would be temporarily or permanently impacted by Alternative 1 would vary, depending primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. Some facilities that are regularly maintained can still support some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by Alternative 1 support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. Alkaline wetlands and vernal pools exist in nonnative grasslands and have been subjected to some disturbance due

[2] Ditches (including roadside ditches) excavated wholly in and draining only uplands that do not carry a relatively permanent flow of water are not jurisdictional because they are not tributaries and do not have a significant nexus to traditional navigable waters (USEPA 2008).

to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel) islands or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions would be considerably lower. All wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however, the depressions may support wetland vegetation at their edges.

Potential changes to terrestrial species' critical habitat

The restoration projects under Alternative 1 could result in loss of terrestrial species' critical habitat. Western yellow-billed cuckoo proposed critical habitat is present in Tisdale Bypass and Sutter Bypass. However, Alternative 1 does not propose to modify flows in the Tisdale or Sutter Bypasses. Changes in frequency of inundation in the Sacramento River would be minor, and within the current minimum and maximum flows. Alternative 1 could provide for some different riparian species that require year-round flows, as compared to the No Action Alternative, where low flows in the fall would stress invasive plants and encourage drought-tolerant native species to persist.

Critical habitat for valley elderberry longhorn beetle is present along the American River. However, under the action alternatives Reclamation will avoid valley elderberry longhorn critical habitat.

Critical habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp is present in areas that Reclamation could potentially use for tidal habitat restoration. Reclamation will, however, avoid areas that would affect the primary constituent habitat elements for these species in the critical habitat units.

Critical habitat for California tiger salamander is present in areas that Reclamation could potentially use for tidal habitat restoration. Reclamation will, however, avoid areas that would affect the primary constituent habitat elements for this species in the critical habitat units.

Critical habitat for soft bird's-beak and Suisun thistle is present in areas that Reclamation could potentially use for tidal habitat restoration. Reclamation will, however, avoid areas that would affect the primary constituent habitat elements for these species in the critical habitat units.

P.2.4 Alternative 2

With respect to terrestrial species, Alternative 2 is nearly the same as the No Action Alternative described in Section P.2.2, *No Action Alternative*. Like the No Action Alternative, Alternative 2 proposes no additional restoration activities that would affect terrestrial species, and the existing FCCL would be used to produce and release Delta Smelt instead of constructing and using the new Conservation Hatchery. The only effects on terrestrial species under Alternative 2 would be from river flows, which would be slightly higher than under the No Action Alternative and Alternative 1, and from reservoir levels and inundation in the Yolo and Sutter Bypasses, which are discussed in Section P.2.3, *Alternative 1*, and Section P.2.5, *Alternative 3*.

Based on data indicating bank swallow colonies may be affected at 14,000 to 30,000 cfs, Alternative 2 would not have a significant effect on erosion of bank swallow colonies compared with the No Action Alternative.

P.2.5 Alternative 3

P.2.5.1 *Project-Level Effects*

Potential changes to wildlife and plant habitat on river banks.

Compared to the No Action Alternative, operation of the CVP and SWP under Alternative 3 would change river flows and reservoir levels, which would change existing flow conditions. If river flows or reservoir levels have substantive declines or increases in areas with riparian vegetation, the flows could adversely affect habitat. For example, higher flows could result in erosion and potential loss of riparian vegetation while lower flows, especially during the spring, could result in drought stress or less riparian vegetation recruitment, such as cottonwood seed dispersal. Alternative 3, however, would result in only minor changes to the water levels in reservoirs and along rivers. The flow changes are relatively small during each year type and would not result in substantive changes to riparian habitat.

For the purposes of the wildlife and plant species analyses, *flow changes* constitute the expected effects of implementing Alternative 3 in comparison with the No Action Alternative. Differences in flow management between Alternative 3 and the No Action Alternative would have the potential to affect a special-status wildlife or plant species if flow changes were to directly affect the species, directly alter habitat availability or quality, or result in vegetation changes that would alter habitat availability or quality. The great majority of stream channels within the study area are linear channels confined by levees or other engineered works that provide negligible habitat for special-status wildlife or plant species. There is, however, potential to affect such species at those sites where habitat has not been removed by channel alteration, or where habitat has been restored, or where habitat is expected to be restored during the proposed term of the proposed action. In the first two of these cases, existing habitat shows evidence of adaptation to anthropogenic modifications to the ecosystem that date back decades, and in many cases over a century. These modifications include hydrologic changes associated with water manipulation; topographic changes associated with flood control, agriculture, restoration site construction, and other causes; and biological changes associated with the introduction of nonnative species. Implementation of Alternative 3 would generally result in very minor potential changes relative to the No Action Alternative, and these changes are small relative to normal month-to-month and year-to-year variability in the system.

Compared to the No Action Alternative, Alternative 3 is expected to have only minor effects on habitat along the banks of rivers and reservoirs; however, flow changes would have the potential to affect the amount of yellow-billed cuckoo riparian habitat. Alternative 3 may modify flows in a manner that would limit channel-forming flows, which could result in less riparian habitat establishment and expansion over time. If hydrologic modifications lead to too little or too much water during different times of the year, existing riparian habitat could be affected (79 FR 59991–60038); higher flows could result in erosion and potential loss of riparian vegetation while lower flows—especially during the spring—could result in drought stress or less riparian vegetation recruitment, such as cottonwood seed dispersal. The hydrologic regime (stream flow pattern) and supply of (and interaction between) surface and subsurface water are driving factors in the long-term maintenance, growth, recycling, and regeneration of western yellow-billed cuckoo habitat (78 FR 61621-61666). Higher flows could also result in higher sedimentation along the channel banks that similarly result in the inability of riparian vegetation to establish or regenerate. Alternatively, lower flows could diminish the water table, leading to reduced groundwater availability and water stress in riparian trees. Physiological stress in native vegetation from prolonged lower flows or groundwater results in reduced growth rate, morphological change, or mortality of plants; altered species composition dominated by more drought-tolerant vegetation; and conversion to habitat dominated by

nonnative species (Poff et al. 1997). These effects reduce and degrade habitat for the western yellow-billed cuckoo for foraging, nesting, and cover.

Flow changes could adversely affect nesting habitat for bank swallows. One the primary threats to bank swallows is loss of nesting habitat from the placement of rock revetment for levee stabilization. Because of this limited available habitat, and the reduction of natural river processes, the species is highly sensitive to 1) reductions in winter flows which are necessary to erode banks for habitat creation, and 2) high flows during the breeding season. The potential impacts of changes in upstream flows on bank swallows during the breeding season are the flooding of active burrows and destruction of burrows from increased bank sloughing. Bank swallows arrive in California and begin to excavate their burrows in March, and peak egg-laying occurs between April and May (Bank Swallow Technical Advisory Committee 2013). Therefore, increases in flows after March when the swallows have nested and laid eggs in the burrows could result in the loss of nests. On the Sacramento River, breeding season flows between 14,000 and 30,000 cfs have been associated with localized bank collapses which resulted in partial or complete colony failure (Stillwater Sciences 2007).

Additionally, flows above 50,000 cfs on the Sacramento River could lead to multiple colony failures during the breeding season, but they may be beneficial during the non-breeding season because erosion can create new breeding habitat in the form of cut banks (Stillwater Sciences 2007).

Model results illustrate that, relative to the No Action Alternative, flows on the Sacramento River would be higher under Alternative 3 during the bank swallow breeding season. Projected differences between the No Action Alternative and Alternative 3 occur from mid-April to July; during this time period, average flows under Alternative 3 would be slightly greater than under the No Action Alternative and Alternative 1.

Average flows on the Sacramento River downstream of Keswick Reservoir, at Bend Bridge, and below Red Bluff Diversion Dam would increase under Alternative 3 during the bank swallow breeding season, with model results predicting flow staying below 15,000 cfs. Average flows on the Sacramento River at Hamilton City, at Wilkins Slough, and at Freeport under Alternative 3 would generally decrease during the bank swallow breeding season. Monthly flows are highest at Freeport during the bank swallow breeding season, with predicted monthly flows between 15,000 and 19,000 cfs under Alternative 3.

Model results illustrate that, relative to the No Action Alternative, flows on Feather River would be higher under Alternative 3 during the bank swallow breeding season. Projected differences between the No Action Alternative and Alternative 3 would occur from mid-May to July. Average flows on Feather River downstream of Thermalito would increase under Alternative 3 during the bank swallow breeding season, with model results predicting peak flows of 7,000 cfs. However, average flows on the Feather River at the Sacramento River confluence would decrease under Alternative 3 during the bank swallow nesting season.

P.2.5.2 *Program-Level Effects*

Potential changes to existing marshes and associated special-status species in the Bay-Delta region

Alternative 3 would restore tidal wetlands, diked wetlands, and muted marsh habitat in the Bay-Delta region. Several sites including Dutch Slough, Winter Island, Hill Slough, Arnold Slough/Bradmoor Island, Chipps Island, and Lower Yolo Ranch are being restored to tidal habitat as mitigation for adverse impacts on Delta Smelt and its habitat. Tidal habitat restoration at each site would be achieved by

conversion of currently leveed, cultivated land through breaching or setback of levees, thereby restoring tidal fluctuation to land parcels currently isolated behind those levees. Where appropriate, portions of restoration sites would be raised to elevations that would support tidal marsh vegetation following levee breaching. Depending on the degree of subsidence and location, lands may be elevated by grading higher elevations to fill subsided areas, importing clean dredged or fill material from other locations, or planting tules or other appropriate vegetation to raise elevations in shallowly subsided areas over time through organic material accumulation. Surface grading would create a shallow elevation gradient from the marsh plain to the upland transition habitat. Based on assessments of local hydrodynamic conditions, sediment transport, and topography, restoration activities may be designed and implemented in a manner that accelerates the development of tidal channels within restored marsh plains. Following reintroduction of tidal exchange, tidal marsh vegetation is expected to establish and maintain itself naturally at suitable elevations relative to the tidal range. Depending on site-specific conditions and monitoring results, patches of native emergent vegetation may be planted to accelerate the establishment of native marsh vegetation on restored marsh plain surfaces.

Habitat restoration activities and restoration of tidal inundation could have deleterious short-term effects on existing tidal, non-tidal, and managed marsh habitats and associated special-status species, including Suisun marsh aster, Mason's lilaeopsis, Bolander's water hemlock, soft bird's-beak, Suisun thistle, delta tule pea, western pond turtle, California black rail, California Ridgway's rail, Suisun song sparrow, saltmarsh common yellowthroat, short eared owl, Suisun shrew, and salt-marsh harvest mouse. The potential effects on tidal marsh habitat would include the conversion of mid- and high-marsh habitat types to low-marsh types; the conversion of low-marsh habitat to subtidal habitat; and the conversion of upland refugia habitat to tidal habitat. While it is expected that the habitat would persist after restoration of tidal action, the extent of mid- and high-marsh is expected to decrease in the near-term. In the longer-term, and with the implementation of remedial measures and adaptive management, the extent of habitat is expected to expand. The extent of habitat may not expand to pre-restoration conditions, although the habitat will be of great extent and more resilient to climate change because tidal habitat has potential to accrete sediment to keep up with sea level rise whereas diked wetlands do not. Furthermore, diked wetlands have the risk of breached dikes that cause excessive flooding of mid- and high-marsh habitats.

Tidal habitat restoration is not expected to occur in areas with occupied habitat for soft bird's-beak or Suisun thistle, and no negative effects would be expected from restoration activities. Over time, the restored and enhanced area is expected to be suitable and of higher long-term value for the species because it would be less vulnerable to sea level rise by including gradual slopes up from the current tidal region, potentially allowing introduction of the species into the restored areas. Thus, Alternatives 1 and 3 are expected to have a wholly beneficial effect on special-status plant species.

The effect of tidal marsh restoration on special-status species in the Bay-Delta will be magnified under Alternative 3, as compared to the No Action Alternative and Alternative 1, given that Alternative 3 proposes 25,000 acres of habitat restoration within the Delta— more than triple the amount of habitat restoration under the No Action Alternative and Alternative 1. Although it is unknown at this time how much of the affected habitat is suitable for special-status species, it is likely that additional habitat for special-status species would be affected under Alternative 3. Additional habitat restoration would require a greater extent of permanent and temporary habitat loss, the latter of which would be expected to recover and restore over time. Habitat restoration will ultimately benefit special-status species by increasing the amount of available habitat and enhancing degraded habitat areas.

Potential changes to existing riparian areas and associated special-status species

Habitat restoration under Alternative 3 could result in the loss of riparian habitat and associated special-status species. Riparian species potentially affected include valley elderberry longhorn beetle, western yellow-billed cuckoo, foothill yellow-legged frog, least Bell's vireo, yellow warbler, Swainson's hawk, white-tailed kite, yellow-breasted chat, osprey, bald eagle, ring-tailed cat, riparian brush rabbit, and riparian woodrat.

Alternative 3 includes creation of spawning habitat and side channels along rivers, floodplain restoration, or other aquatic habitat restoration in riparian areas. The construction of setback levees to restore seasonally inundated floodplain could permanently remove species habitat and would be expected to transition species habitat from areas that flood frequently (i.e., every 1–2 years) to areas that flood infrequently (i.e., every 10 years or more). Periodic inundation as a result of floodplain restoration is not expected to adversely affect nesting bird species because flooding is unlikely to occur during the breeding season, and the potential effects of inundation on existing riparian vegetation are expected to be minimal. While frequent flooding in the lower elevations of the floodplain may result in scouring of riparian vegetation, this is expected to have a beneficial rather than an adverse long-term effect on most riparian species because periodic scouring increases successional and structural diversity of the habitat.

Floodplain restoration may result in periodic flooding of habitat for riparian brush rabbit and riparian woodrat, which are primarily ground-dwelling species that are adversely affected by flooding if no upland refugia are available during flood events. In addition, the removal of oak trees in floodplains would remove nest building materials for riparian woodrats in floodplains. However, the mitigation measure for riparian brush rabbit and riparian woodrat (MM BIO-21) will avoid and minimize both of these impacts. MM BIO-21 requires floodplain restoration projects to include refugia habitat to provide shelter from flood events and avoidance of mature oak trees in areas a qualified biologist has identified as being occupied by riparian brush rabbit and riparian woodrat. MM BIO-21 also puts limits on the amount of habitat that can be impacted by restoration.

The effect of aquatic habitat and floodplain restoration on special-status species in riparian areas would be magnified under Alternative 3, as compared to the No Action Alternative and Alternative 1, given that Alternative 3 proposes 25,000 acres of habitat restoration within the Delta. More than triple the amount of habitat will be restored under Alternative 3 than under the No Action Alternative and Alternative 1. Although it is unknown at this time how much of this habitat is suitable for special-status species in riparian areas, it is likely that additional habitat for special-status species would be affected under Alternative 3. Additional habitat restoration would result in a greater extent of permanent and temporary habitat loss, the latter of which would be expected to recover and restore over time. Habitat restoration would ultimately benefit special-status species in riparian areas by increasing the amount of available habitat and enhancing degraded habitat areas.

Potential changes to habitat for special-status reptiles

Alternative 3 includes creation of spawning habitat and side channels along rivers, channel margin restoration, floodplain restoration, and other aquatic habitat restoration on the banks of waterbodies that could result in loss of habitat for giant garter snake and western pond turtle. Aquatic habitat and floodplain restoration could result in directly mortality of these species.

Permanent effects on giant garter snake aquatic habitat are likely to occur when agricultural ditches are modified and flooded as part of the tidal habitat restoration process. Permanent effects on both giant garter snake and western pond turtle habitat could occur where channel margin restoration entail levee setback. For giant garter snake, the conversion of rice to tidal habitat would be a permanent loss,

however, rice is not common in the areas where tidal restoration and channel margin restoration would likely be sited. Other aquatic features with potential to occur on restoration sites include natural channels and topographic depressions. Tidal aquatic edge habitat where open water meets the levee edge will also be permanently lost in those reaches where the levee is breached. Temporary effects on aquatic edge habitat are also likely to occur during the time of construction, though these effects would not be expected to last more than 2 years. Permanent effects on upland habitat will primarily occur where upland habitat is removed to create tidal connectivity.

The effect of aquatic habitat and floodplain restoration on special-status reptiles would be magnified under Alternative 3, as compared to the No Action Alternative and Alternative 1, given that Alternative 3 proposes 25,000 acres of habitat restoration within the Delta—more than triple the amount of habitat restored under the No Action Alternative and Alternative 1. Although it is unknown at this time how much of this habitat is suitable for special-status reptiles, it is likely that additional habitat for special-status reptiles will be affected. Additional habitat restoration will occur in a greater extent of permanent and temporary habitat loss, the latter of which would be expected to recover and restore. However, both western pond turtle and giant garter snake occur over a substantial range, which will reduce the magnitude of these effects. The giant garter snake range extends from Chico in Butte County to the Mendota Wildlife Area in Fresno County, and western pond turtle is found throughout Washington, Oregon, and California. Habitat restoration would ultimately benefit special-status reptiles by increasing the amount of available habitat and enhancing degraded habitat areas.

Potential to injure or kill special-status species

Construction-related actions associated with habitat restoration and the installation/upgrade of facilities under Alternative 3 could injure or kill special-status species in occupied habitat. The operation of equipment for land clearing and restoration could result in injury or mortality of special-status species. This risk is highest for species with periods of dormancy, like California tiger salamander and giant garter snake. Increased vehicular traffic associated with construction activities could contribute to a higher incidence of road kill. However, construction monitoring and other mitigation measures have been identified to avoid and minimize injury or mortality of special-status species during construction.

In tidal marsh habitat, construction actions such as excavation of levees, construction of tidal control gates, movement and staging of large construction equipment, piling and storage of soils, dredging, and filling and grading of vegetated areas, could cause the injury or mortality of special-status species that may be in the vicinity of the construction area. Tidal marsh species are especially vulnerable during periods of higher tides and peak flooding by storms; during these periods, these species move into upland marsh areas for protection. Tidal marsh species could drown or be preyed upon if construction activities or equipment isolate tidal marsh species from their refugia habitat or confuse or disturb them.

Equipment operation for the creation of side channels and levees in riparian habitat during periods of high seasonal activity, such as the nesting bird or bat maternity seasons, could also injure or kill special-status species. Risk is greatest to bird eggs and nestlings or bat pups that could be injured or killed through crushing by heavy equipment, nest abandonment, or increased exposure to the elements or to predators. Injury to adults and fledged juveniles is unlikely, as these individuals are expected to avoid contact with construction equipment.

Night construction could disrupt animal behavior and/or sleep cycles or adversely affect bat foraging activity in all impacted habitat types if special-status species are exposed to night lighting. For example, bird species are attracted to artificial lights, which may disrupt their behavioral patterns or cause collision-

related fatalities (Gauthreaux and Belser 2006). Night lighting can also result in circadian/behavior disruptions which can cause bird species to molt and develop their reproductive system earlier than in dark nights. Night lighting can also influence the endocrine system of vertebrates, which can lead to health deterioration (Fonken and Nelson 2014; Ouyang et al. 2018).

Construction-related noise levels could cause additional behavioral modifications if special-status species are present in the general vicinity. Construction activities may create noise up to 60 dBA at no more than 1,200 feet from the edge of the noise generating activity. While 60 dBA is the standard noise threshold for birds (Dooling and Popper 2007), this standard is generally applied during the nesting season, when birds are more vulnerable to behavioral modifications that can cause nest failure. There is evidence, however, that migrating birds will avoid noisy areas during migration (McClure et al. 2013). Noise and visual disturbance outside the project footprint but within 200 feet of construction activities could temporarily affect the use of adjacent habitat by giant garter snake. These effects will be minimized by siting construction 200 feet away from the banks of giant garter snake aquatic habitat, where feasible, as described in MM BIO-5.

Contaminants could be introduced into species' habitats as a result of construction. Exhaust from construction and maintenance vehicles may result in deposition of particulates, heavy metals, and mineral nutrients that could influence the quality and quantity of vegetation and thereby affect presence and abundance of special-status species. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that will affect occupied, suitable, or adjacent habitat. These accidental spills could also affect special-status species prey, resulting in less food availability. Increased runoff from impervious surfaces into wetland areas carries pollutants that are harmful to reptiles and amphibians, which are particularly sensitive to contaminants and other pollutants in the water.

Construction-related effects would be magnified under Alternative 3, as compared to the No Action Alternative and Alternative 1, given that Alternative 3 proposes 25,000 acres of habitat restoration within the Delta. Although the construction activities would be the same across Alternatives 1 and 3 (e.g., noise, lighting, equipment), Alternative 3 has a greater potential to occur in special-status species habitat and directly affect (i.e., injure or kill) a special-status species. Given that construction under Alternative 3 would occur in more than double the area that it will occur under Alternative 1, Alternative 3 has a greater potential to impact entire populations in the vicinity of the construction area or even an entire species, especially if that species has restrictive habitat requirements and a narrow range distribution. For example, Suisun shrew is only found in the northern borders of San Pablo and Suisun Bay, and Suisun thistle is known from only two occurrences and is present in Suisun March. However, if construction is properly cited and mitigation measures are in place, impacts on species with restrictive habitat requirements and range distribution can be avoided.

Potential changes to vernal pools and associated special-status species

Tidal habitat restoration and the construction of the Conservation Hatchery under the Alternative 3 could have direct and indirect effects on vernal pools and associated special-status species. Vernal pool species that could be affected include California tiger salamander, Contra Costa goldfields, and vernal pool invertebrates. Direct effects include loss of habitat and individual mortality as a result of construction. Tidal natural community restoration could result in the permanent loss of vernal pool crustacean habitat. It is anticipated that much of the existing vernal pool habitat that would be impacted by the project is already degraded. Vernal pools in the Sacramento and San Joaquin Valleys have already experienced

significant disturbance due to agricultural development (e.g., plowing, disking, or leveling) which results in compacted soils, loss of hydrologic connections, and reductions in the size and extent of vernal pools.

Construction of the Conservation Hatchery could result in direct removal of vernal pools if it is constructed in an area that contains vernal pool complexes. Similarly, if these pools are occupied, vernal pool crustaceans could be destroyed. These effects will be avoided through the implementation of the identified/proposed mitigation measures.

Indirect conversion of vernal pool habitat could also occur due to hydrological changes as a result of tidal habitat restoration or construction of the hatchery. Construction restoration activities may result in the modification of hardpan and changes to the perched water table, which could lead to alterations in the rate, extent, and duration of inundation of nearby vernal pool crustacean habitat. USFWS typically considers construction within 250 feet of vernal pool crustacean habitat to constitute and a possible conversion of crustacean habitat unless more detailed information is provided to further refine the limits of any such effects. Therefore, MM BIO-1 will ensure a buffer of 250 feet for construction or restoration near vernal pool habitat.

The effect of the project on vernal pools and special-status species will be magnified under Alternative 3, as compared to Alternative 1, given that Alternative 3 proposes an additional 25,000 acres of habitat restoration. Although it is unknown at this time how much occupied and suitable vernal pool habitat will be impacted by each Action Alternative, additional habitat restoration is likely to impact a greater amount of vernal pool habitat. However, as stated above, MM1 requires full avoidance of vernal pools.

Potential to affect special-status bat species and their habitat

Special-status bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as tunnels, buildings, and bridges. Various roost strategies could include night roosts, maternity roosts, migration stopover, or hibernation. Special-status bat roosting habitats include riparian habitat, developed lands, and landscaped trees such as eucalyptus, palms and orchards. Potential foraging habitat includes all riparian habitat types, cultivated lands, developed lands, grasslands, and wetlands.

Four California bat species of special concern could occur in the study area (Table P.1-1), as well as a number of common bat species. Construction and restoration activities associated with Alternative 3 would result in both temporary and permanent losses of foraging and roosting habitat for special-status bat species. Tidal habitat restoration and floodplain restoration would result in permanent and temporary loss of riparian roosting habitat and conversion of foraging habitat from mostly cultivated lands and managed wetlands to tidal and nontidal wetlands. Development of the Conservation Hatchery could also result in the removal of roosting and foraging habitat. Noise and visual disturbances during implementation of riparian habitat restoration and other construction activities could result in temporary disturbances that, if bat roost sites are present, could cause temporary abandonment of roosts. Impacts on special-status bat species that occupy artificial structures are expected to be negligible in comparison to the amount of impacts on natural habitat types, but temporary and permanent impacts on special-status bat species occupying artificial structures could result in local adverse effects.

Despite having potential to result in some adverse effects, implementation of Alternative 3 would result in an overall benefit to special-status bats within the study area through restoration of their foraging and roosting habitats. The majority of affected habitat would be agricultural, and such land would be converted to natural communities with higher value foraging and roosting potential such as riparian land,

tidal and nontidal wetlands, and periodically inundated lands. Restored habitats are expected to be of higher value because, compared to agricultural land, pesticide use would be lower and greater numbers of flying insect prey species would be available. In addition, any impact from construction, restoration, or periodic inundation on special-status bats and their habitat would be mitigated through implementation of MM BIO-24, which would ensure there is no significant impact on roosting special-status bats, either directly or through habitat modifications, and no substantial reduction in numbers nor a restriction in the range of special-status bats.

Potential changes to wetlands and waters of the United States

The restoration projects associated with Alternative 3 would likely require some fill of wetlands and waters of the United States. Wetlands and waters of the United States are those aquatic resources that are protected under Section 404 of the Clean Water Act. Fill could occur from dredging work, spoils areas, side channel construction, and installation of the Conservation Hatchery. The majority of the impacts on wetlands and Waters of the United States are likely on tidal channels, emergent wetlands, and on wetlands and waters found within cultivated lands (agricultural ditches[3] and seasonal wetlands). Reclamation will obtain and implement the conditions and requirements of state and federal permits that may be required prior to the construction of the proposed project.

Unavoidable impacts on waters of the United States would be the same as previously described for this impact under Section P.2.3.

The functions of the Waters of the United States that would be temporarily or permanently impacted by Alternative 1 and Alternative 3 would vary, given that Alternative 3 proposes to restore 25,000 acres while Alternative 1 would restore 8,000 acres. The significance of the impact would depend primarily on existing land uses and historical levels of disturbance. Generally, agricultural ditches and conveyance channels, which are regularly maintained and often devoid of vegetation, support only minimal hydraulic function (water conveyance), with virtually no water quality or habitat function. Some facilities that are regularly maintained can still support some hydrologic, hydraulic, and water quality functions (e.g., reduction of velocity, groundwater recharge, and trapping of sediment). Tidal channels affected by this alternative support functions in all three categories, but the level at which these functions perform vary depending on setting, size, and level of disturbance. Alkaline wetlands and vernal pools exist in nonnative grasslands and have been subjected to some disturbance due to past land uses. Although these features likely support habitat, water quality, and hydrologic/hydraulic functions, the capacity of these features to perform such functions vary depending on the overall ecological setting and level of disturbance. Functions associated with emergent wetland, forest, and scrub-shrub depend primarily on the location of these habitat types. Where they exist as in-stream (in-channel islands) or as the thick band of habitat adjacent to a waterway, these features are expected to function at a high level. However, where these habitats exist as thin bands, or where they are situated in agricultural fields, their habitat functions would be considerably lower. All wetlands classified as seasonal wetlands occur in agricultural fields. As such, their habitat functions have been greatly compromised, but they retain some water quality and hydrologic/hydraulic function. Like seasonal wetlands, most depressions occur within agricultural areas; however the depressions may support wetland vegetation at their edges

[3] Ditches (including roadside ditches) excavated wholly in and drainiange only uplands that do not carry a relatively permanent flow of water are not jurisdictional because they are not tributaries and do not have a significant nexus to traditional navigable waters (USEPA 2008).

Potential changes to terrestrial species' critical habitat

The restoration projects under Alternative 3 could result in loss of terrestrial species' critical habitat.

Western yellow-billed cuckoo proposed critical habitat is present in Tisdale Bypass and Sutter Bypass. However, Alternative 3 does not propose to modify flows in the Tisdale or Sutter Bypasses. Changes in frequency of inundation in the Sacramento River would be minor, and within the current minimum and maximum flows. The action alternatives could provide for some different riparian species that require year-round flows, as compared to the No Action Alternative, where low flows in the fall would stress invasive plants and encourage drought tolerant native species to persist.

Critical habitat for valley elderberry longhorn beetle is present along the American River. However, Reclamation will avoid valley elderberry longhorn critical habitat.

Critical habitat for vernal pool fairy shrimp and vernal pool tadpole shrimp is present in areas that Reclamation could potentially use for tidal habitat restoration. Reclamation will, however, avoid areas that would affect the primary constituent habitat elements for these species in the critical habitat units.

Critical habitat for California tiger salamander is present in areas that Reclamation could potentially use for tidal habitat restoration. Reclamation will, however, avoid areas that would affect the primary constituent habitat elements for this species in the critical habitat units.

Critical habitat for soft bird's-beak and Suisun thistle is present in areas that Reclamation could potentially use for tidal habitat restoration. Reclamation will, however, avoid areas that would affect the primary constituent habitat elements for these species in the critical habitat units.

Therefore, Alternative 3 would have no effect on critical habitat for these species.

P.2.6 Alternative 4

P.2.6.1 *Project-Level Effects*

Potential changes to wildlife and plant habitat on river banks

Compared to the No Action Alternative, operation of the CVP and SWP under Alternative 4 would change river flows and reservoir levels, which would change existing flow conditions. Increases in peak flows are expected in the affected stream reaches for the Sacramento River, Clear Creek, Feather River, American River and Yolo Bypass under Alternative 4 compared to the No Action Alternative. If peak river flows or reservoir levels have substantive increases beyond the No Action Alternative, it could kill or injure special-status species and remove their habitat along rivers and reservoirs. However, evaluation of changes in peak flow indicates that increases would maintain higher flows generally from the months of February through June, where it is common for seasonal discharge to increase naturally. These flows are not expected to result in river bank overtopping/flooding or increased inundation in the Yolo Bypass, therefore flow increases under Alternative 4 would not result in any change to wildlife and plant habitat on river banks in comparison to the No Action Alternative.

P.2.6.2 *Program-Level Effects*

Potential changes to habitat for special-status reptiles

Alternative 4 components to increase water use efficiencies in agricultural areas may result in loss of habitat for giant garter snake. Permanent effects on giant garter snake aquatic habitat are likely to occur when agricultural ditches and canals are replaced with pipes to reduce water loss.. In addition, the conversion of rice to dryland farming or land uses would be a permanent loss of habitat for giant garter snake. Temporary effects on aquatic habitat for giant garter snake may also occur during the time of construction, though these effects would not be expected to last more than 2 years. Permanent effects on upland habitat would primarily occur where upland habitat is removed during construction of new on-farm irrigation or distribution systems or during alteration of existing on-farm distribution systems.

Potential to injure or kill special-status species

Construction-related actions associated with construction of new agricultural water use efficiency facilities under Alternative 4 could injure or kill giant garter snake and elderberry longhorn beetle in occupied habitat. The operation of equipment for land clearing could result in injury or mortality of special-status species. This risk is highest during the giant garter snake period of dormancy in the winter, where these snakes estivate in burrows adjacent to aquatic habitat, and when elderberry shrubs are removed along canals and ditches. Increased vehicular traffic associated with construction activities could contribute to a higher incidence of vehicle strikes. However, construction monitoring and other mitigation measures have been identified to avoid and minimize injury or mortality of giant garter snake and valley elderberry longhorn beetle during construction.

Construction-related noise levels could cause additional behavioral modifications if special-status species are present in the general vicinity. Construction activities may create noise up to 60 dBA at no more than 1,200 feet from the edge of the noise generating activity. While 60 dBA is the standard noise threshold for birds (Dooling and Popper 2007), this standard is generally applied during the nesting season, when birds are more vulnerable to behavioral modifications that can cause nest failure. There is evidence, however, that migrating birds will avoid noisy areas during migration (McClure et al. 2013). Noise and visual disturbance outside the project footprint but within 200 feet of construction activities could temporarily affect the use of adjacent habitat by giant garter snake. These effects will be minimized by siting construction 200 feet away from the banks of giant garter snake aquatic habitat, where feasible, as described in MM BIO-5.

Contaminants could be introduced into species' habitats as a result of construction. Exhaust from construction and maintenance vehicles may result in deposition of particulates, heavy metals, and mineral nutrients that could influence the quality and quantity of vegetation and thereby affect presence and abundance of special-status species. The use of mechanical equipment during construction might cause the accidental release of petroleum or other contaminants that will affect occupied, suitable, or adjacent habitat. These accidental spills could also affect special-status species prey, resulting in less food availability. Increased runoff from impervious surfaces into wetland areas carries pollutants that could contaminant the water.

Potential changes to wetlands and waters of the United States

The agricultural water use efficiency facilities associated with Alternative 4 would likely require some fill of wetlands and waters of the United States. Wetlands and waters of the United States are those aquatic resources that are protected under Section 404 of the Clean Water Act. The impacts on wetlands and

waters of the United States are waters found within cultivated lands (e.g., agricultural ditches[4], canals, seasonal wetlands). Reclamation will obtain and implement the conditions and requirements of state and federal permits that may be required prior to the construction of the proposed project.

Unavoidable impacts on waters of the United States would be offset such that the loss of acreage and functions due to construction activities are fully compensated. Unlike the alternatives described above which include restoration, construction would likely not result in a net increase of wetlands and waters of the United States. These losses may be short-term if construction results in conversion from one wetland type to another.

P.2.7 Mitigation Measures

Mitigation measures are included in this document to avoid, minimize, or compensate for adverse environmental effects of alternatives as compared to the No Action Alternative. The first set of mitigation measures described below are measures to avoid or minimize effects on special-status species, and to compensate for unavoidable effects (Section P.2.8, *Summary of Impacts*). A summary of how each of the measures will mitigate effects for each alternative is provided below.

P.2.7.1 *Species-Specific Mitigation Measures*

Reclamation will implement the following mitigation measures to avoid or minimize effects on special-status species and their habitat. Species-specific measures described below have been developed to avoid and minimize effects that could result from the proposed action on listed and nonlisted species addressed in this appendix. Table P.2-1, Mitigation Measures for Terrestrial Species in the Study Area, briefly summarizes the species-specific measures.

Table P.2-1. Mitigation Measures for Terrestrial Species in the Study Area

Number	Title	Summary
BIO-1	Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Conservancy Fairy Shrimp, Longhorn Fairy Shrimp	Avoidance of vernal pool habitat and critical habitat, regardless of occupancy, and maintain 250-foot nondisturbance buffer; conduct protocol-level surveys or assume presence.
BIO-2	Valley Elderberry Longhorn Beetle	Habitat avoidance where possible, preconstruction surveys, fencing, monitoring. Mitigate unavoidable impacts consistent with *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (USFWS 2017).
BIO-3	California Tiger Salamander and Western Spadefoot Toad	Habitat avoidance (including critical habitat).
BIO-4	Foothill Yellow-Legged Frog	Preconstruction survey, timing, compensate for unavoidable effects
BIO-5	Giant Garter Snake	Habitat avoidance where possible, preconstruction survey, and biological monitoring. Unavoidable habitat loss will be offset through habitat protection and/or restoration at a 3:1 ratio.
BIO-6	Western Pond Turtle	Habitat assessment, preconstruction survey, and relocation.

[4] Ditches (including roadside ditches) excavated wholly in and drainiange only uplands that do not carry a relatively permanent flow of water are not jurisdictional because they are not tributaries and do not have a significant nexus to traditional navigable waters (USEPA 2008).

Number	Title	Summary
BIO-7	California Black Rail	Protocol-level surveys, habitat avoidance, nondisturbance buffer, and timing of project activity.
BIO-8	California Ridgway's Rail	Preconstruction protocol-level survey, timing, habitat avoidance.
BIO-9	Greater and Lesser Sandhill Crane	Timing of construction, habitat avoidance where possible. Preconstruction survey, avoid roosts where possible, directional lighting.
BIO-10	Least Bell's Vireo	Habitat assessment, preconstruction survey, nondisturbance buffer, noise analysis, limit construction activity near nests. Mitigate unavoidable impacts through habitat creation at a 2:1 ratio.
BIO-11	Suisun Song Sparrow, Saltmarsh Common Yellowthroat, Yellow-Breasted Chat, Yellow Warbler	Preconstruction survey, nondisturbance buffer, biological monitoring of active nests, noise reduction, minimize construction traffic, directional lighting.
BIO-12	Swainson's Hawk	Preconstruction survey, habitat avoidance where possible, nondisturbance buffer. Mitigate unavoidable loss of foraging habitat through foraging habitat protection at a 1:1 ratio and unavoidable loss of nesting habitat through riparian restoration at a 2:1 ratio.
BIO-13	Tricolored Blackbird	Preconstruction survey, habitat avoidance, biological monitoring. Mitigate unavoidable loss of foraging habitat at a 1:1 ratio and unavoidable loss of nesting habitat through restoration at a 2:1 ratio.
BIO-14	Western Burrowing Owl	Protocol-level survey, preconstruction survey, habitat avoidance, relocation during nonbreeding season, nondisturbance buffer, biological monitoring. Mitigate unavoidable loss of nesting, wintering, and satellite burrows, and burrowing owl habitat in comparable habitat at an approved mitigation ratio in consultation with the California Department of Fish and Wildlife.
BIO-15	Western Yellow-Billed Cuckoo	Baseline survyes, habitat avoidance (including critical habitat), preconstruction surveys.
BIO-16	White-Tailed Kite	Preconstruction survey, nondisturbance buffer, work window restriction, biological monitoring. Mitigate unavoidable loss of foraging habitat through foraging habitat protection at a 1:1 ratio and unavoidable loss of nesting habitat through riparian restoration at a 2:1 ratio.
BIO-17	Bald Eagle	Nesting habitat avoidance, nondisturbance buffer, monitoring.
BIO-18	Bank Swallow	Preconstruction survey, nondisturbance buffer, monitoring, project design to avoid impacts.
BIO-19	California Least Tern	Habitat avoidance.
BIO-20	Migratory Nesting Birds	Preconstruction survey, nondisturbance buffer, monitoring.
BIO-21	Riparian Woodrat and Riparian Brush Rabbit	Habitat suitability assessment, protocol-level survey, habitat avoidance where possible. 3:1 compensation for unavoidable impacts.
BIO-22	Salt Marsh Harvest Mouse and Suisun Shrew	Preconstruction survey, biological monitoring, exclusion fence.

Number	Title	Summary
BIO-23	Ring-Tailed Cat	Avoid denning period, preconstruction survey, nondisturbance buffer, biological monitoring.
BIO-24	Special-Status Bats	Preconstruction surveys, monitoring, exclusion, timing, buffers.
BIO-25	Suisun Thistle and Soft Bird's-Beak	Botanical survey, habitat avoidance (including critical habitat), minimize introduction of invasive plants. 1:1 compensation for unavoidable impacts.
BIO-26	Other Special-Status Plant Species	Botanical survey, habitat avoidance, prevent spread of invasive plant species. 1:1 compensation for unavoidable impacts.
BIO-27	Wetlands and Waters of the United States	Avoid fill of wetlands and waters of the United States. To the extent feasible, offset unavoidable effects through wetland creation, restoration, or enhancement.

Mitigation Measure BIO-1: Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Conservancy Fairy Shrimp, Longhorn Fairy Shrimp

Reclamation will avoid vernal pool crustacean habitat, including habitat for vernal pool fairy shrimp, vernal pool tadpole shrimp, conservancy fairy shrimp, and longhorn fairy shrimp with a minimum 250-foot nondisturbance buffer. Reclamation will either conduct protocol-level surveys to assess whether habitat is occupied or will assume presence of the species.

Reclamation will avoid affecting any of the primary constituent elements of critical habitat for vernal pool fairy shrimp or vernal pool tadpole shrimp within designated critical habitat units.

Mitigation Measure BIO-2: Valley Elderberry Longhorn Beetle

Suitable Habitat

Valley elderberry longhorn beetle habitat is defined as elderberry shrubs within the study area. Elderberry shrubs in the study area could be found in riparian areas, along levee banks, grasslands, and in agricultural settings where vegetation is not being maintained (e.g., fence rows, fallow fields).

Avoidance and Minimization

Activities will be located to avoid or minimize disturbance of valley elderberry longhorn beetle suitable habitat within the species' range to the greatest extent practicable.

Reclamation will avoid valley elderberry longhorn beetle critical habitat during implementation of the project components.

Complete avoidance (i.e., no adverse effects) may be assumed when elderberry shrubs are not present or within a 165-foot buffer of the activity. USFWS will be consulted before any disturbances, including construction, within the 165-foot buffer area if it contains elderberry shrubs and/or riparian habitat.

Preconstruction surveys for elderberry shrubs will be conducted within all project construction footprints and areas within 165 feet by a biologist familiar with the appearance of valley elderberry longhorn beetle exit holes in elderberry shrubs. When possible, preconstruction surveys will be conducted in the calendar year prior to disturbance and will follow the guidance of USFWS's *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (USFWS 2017), herein referred to as the 2017 VELB Framework.

For elderberry shrubs not directly affected by construction but that occur between 20 feet and 165 feet from ground-disturbing activities, the following measures will be implemented.

- All areas to be avoided during construction activities will be fenced and/or flagged as close to construction limits as feasible.
- Activities that may damage or kill an elderberry shrub (e.g., trenching, paving, etc.) may need an avoidance area of at least 20 feet (6 meters) from the drip-line, depending on the type of activity.
- A qualified biologist will provide training for all contractors, work crews, and any onsite personnel on the status of the valley elderberry longhorn beetle, its host plant and habitat, the need to avoid damaging the elderberry shrubs, and the possible penalties for noncompliance.
- A qualified biologist will monitor the work area at project-appropriate intervals to assure that all avoidance and minimization measures are implemented. The amount and duration of monitoring will depend on the project specifics and should be discussed with the USFWS biologist.
- As much as feasible, all activities that could occur within 165 feet (50 meters) of an elderberry shrub will be conducted outside of the flight season of the valley elderberry longhorn beetle (March to July).
- Trimming may remove or destroy valley elderberry longhorn beetle eggs and/or larvae and may reduce the health and vigor of the elderberry shrub. To avoid and minimize adverse effects to valley elderberry longhorn beetle, trimming will occur between November and February and will avoid the removal of any branches or stems that are greater than or equal to 1 inch in diameter. Measures to address regular and/or large-scale maintenance (trimming) should be established in consultation with the USFWS.
- Herbicides will not be used within the drip-line of the shrub. Insecticides will not be used within 98 feet (30 meters) of an elderberry shrub. All chemicals will be applied using a backpack sprayer or similar direct application method.
- Mechanical weed removal within the drip-line of the shrub will be limited to the season when adults are not active (August to February) and will avoid damaging the elderberry.
- Erosion control will be implemented, and the affected area will be revegetated with appropriate native plants.
- The potential effects of dust on valley elderberry longhorn beetle will be minimized by applying water during construction activities or by presoaking work areas that will occur within 100 feet of any potential elderberry shrub habitat. Elderberry shrubs with stems greater than 1 inch that are directly affected by construction should be transplanted under the following conditions:
    - If the elderberry shrub cannot be avoided.
    - If indirect effects will result in the death of stems or the entire shrub.

The removal of the elderberry shrub may either include the roots or just the removal of the aboveground portion of the plant. When possible, the entire root ball will be retained and the elderberry shrub will be transplanted as close as possible to its original location. Elderberry shrubs will be relocated adjacent to the project footprint if (1) the planting location is suitable for elderberry growth and reproduction; and (2) the project proponent is able to protect the shrub and ensure that the shrub becomes reestablished. If these criteria cannot be met, the shrub may be transplanted to an

appropriate USFWS-approved mitigation site. Any elderberry shrub that is unlikely to survive transplanting because of poor condition or location, or a shrub that would be extremely difficult to move because of access problems, may not be appropriate for transplanting. The following transplanting guidelines may be used by agencies/applicants in developing their valley elderberry longhorn beetle conservation measures:

- A qualified biologist will be onsite for the duration of transplanting activities to ensure compliance with avoidance and minimization measures and other conservation measures.
- Exit-hole surveys will be completed immediately before transplanting. The number of exit holes found, GPS location of the plant to be relocated, and the GPS location of where the plant is transplanted will be reported to the USFWS and to the CNDDB.
- Elderberry shrubs will be transplanted when the shrubs are dormant (November through the first 2 weeks in February) and after they have lost their leaves. Transplanting during the nongrowing season will reduce shock to the shrub and increase transplantation success.
- Transplanting will follow the most current version of the ANSI A300 (Part 6) guidelines for transplanting (http://www.tcia.org/).
- Trimming will occur between November and February and should minimize the removal of branches or stems that exceed 1 inch in diameter.

Compensation for Unavoidable Effects

Reclamation will coordinate with the USFWS to offset unavoidable impacts on elderberry shrubs by either creating valley elderberry longhorn beetle habitat or by purchasing the equivalent credits at a USFWS-approved conservation bank with a service area that overlaps with the study area. Compensatory mitigation will be coordinated with the USFWS to determine the appropriate type and amount of compensatory mitigation and follow criteria in the 2017 VELB Framework. These guidelines recommend that the permanent loss of valley elderberry longhorn beetle habitat be replaced with habitat that is commensurate with the type (riparian or nonriparian) and amount of habitat lost. For plants in riparian areas, compensation may be appropriate for any impacts to valley elderberry longhorn beetle habitat. In nonriparian areas, compensation may be appropriate for occupied shrubs. Suitable riparian habitat may be replaced at a minimum ratio of 3:1 for all acres that will be permanently affected by the project. Suitable nonriparian habitat may be replaced at a minimum ratio of 1:1 for all acres that will be permanently affected by the project. Impacts on individual shrubs in riparian areas may be replaced by the purchase of two credits (one credit = 1,800 square feet) at a USFWS-approved bank for each shrub that will be trimmed regardless of the presence of exit holes. If the shrub will be completely removed by the activity, the entire shrub may be transplanted to a USFWS-approved location in addition to the credit purchase. Impacts on individual shrubs in nonriparian areas be replaced through a purchase of 1 credit at a USFWS-approved bank for each shrub that will be trimmed if exit holes have been found in any shrub on or within 165 feet of the project. If the shrub will be completely removed by the activity, the entire shrub will be transplanted to a USFWS-approved location in addition to a credit purchase. These ratios may apply if compensation occurs prior to or concurrent with the impacts. If compensation occurs after the impacts, a higher ratio may be required by USFWS. Appropriate compensatory mitigation may include purchasing credits at a USFWS-approved conservation bank, providing onsite mitigation, or establishing and/or protecting habitat for valley elderberry longhorn beetle.

Mitigation Measure BIO-3: California Tiger Salamander and Western Spadefoot Toad

For restoration projects and construction of the Conservation Hatchery, Reclamation will avoid California tiger salamander and western spadefoot toad upland and aquatic habitat. Reclamation will avoid affecting any of the primary constituent elements of critical habitat for California tiger salamander within designated critical habitat units.

Mitigation Measure BIO-4: Foothill Yellow-Legged Frog

Species-specific mitigation for foothill yellow-legged frog will only be required for projects occurring within or adjacent to suitable habitat as identified by assessments conducted during the project component planning phase. A qualified biologist will conduct a field evaluation for foothill yellow-legged frog for all project activities that occur within suitable habitat.

Prior to any ground-disturbing activity scheduled to occur during the dry season (June 1–October 15), a qualified biologist will survey potential breeding habitat for the presence of foothill yellow-legged frogs using methods from the *Draft Visual Encounter Survey Protocol for* Rana boylii *in Lotic Environments* (Peek et al. 2017) or other more recent guidelines, if available. Surveys will be conducted no more than 30 days before the start of ground-disturbing activities and will be spatially phased to precede construction activities. Avoidance and minimization measures, including moving individuals to nearby ponds or other appropriate measures, will be implemented with authorizations issued under the California Endangered Species Act (CESA).

Compensation for Unavoidable Effects

Reclamation will provide compensatory mitigation for unavoidable permanent impacts on habitat for foothill yellow-legged frog. Impacts on occupied or presumed occupied aquatic habitat will be compensated for at a ratio of 3:1 for breeding and foraging habitat.

Mitigation Measure BIO-5: Giant Garter Snake

Avoidance and Minimization Measures

Species-specific mitigation for giant garter snake will be required only for projects occurring within or adjacent to suitable habitat, as identified by assessments conducted during the project component planning phase. A qualified biologist will conduct a field evaluation of suitable upland or aquatic habitat for giant garter snake for all covered activities that occur within suitable giant garter snake habitat.

If the project does not fully avoid effects on suitable habitat, the following measures will be required:

- Initiate construction between May 1 and October 1 within suitable giant garter snake upland habitat, which corresponds with the snake's active period. Work in giant garter snake upland habitat may also occur between October 2 and November 1 or between April 1 and May 1 if ambient temperatures exceed 75 degrees Fahrenheit (°F) during construction activities and maximum daily temperatures have exceeded 75°F for a least 3 consecutive days immediately preceding work. During these periods, giant garter snakes are more likely to be active in aquatic habitats and less likely to be found in upland habitats. To the extent practicable, conduct all activities within paved roads, farm roads, road shoulders, and similarly disturbed and compacted areas; confine ground disturbance and habitat removal to the minimum area necessary to facilitate construction activities. For construction activities and any conveyance facility maintenance

involving heavy equipment, giant garter snake aquatic and upland habitat that can be avoided will be clearly delineated on the work site, with high-visibility fencing and signage identifying these areas as sensitive. The fencing will be installed before equipment is moved onsite and before any ground-disturbing activities begin. The purpose of the fencing is to prevent construction activities from encroaching into sensitive habitat areas and not intended to exclude animals. To minimize the potential for snakes and other ground-dwelling animals to be caught in the construction fencing, the fencing will be placed with at least a 6-inch gap between the ground and the bottom of the fencing to allow animals to pass under.

- All construction personnel and personnel involved in operations and maintenance in or near giant garter snake habitat will attend worker environmental awareness training (as described in Appendix O, *Aquatic Resources Technical Appendix*). This training will include instructions to workers on how to recognize giant garter snakes, their habitat(s), and the nature and purpose of protection measures.
- Within 24 hours prior to construction activities or maintenance activities requiring heavy equipment within giant garter snake habitat, a USFWS-approved biologist will survey all areas planned for disturbance and at least 50 feet outside the disturbance area where giant garter snake could be present. The surveyor will inspect all burrows, soil cracks, and crevices that could be used by giant garter snake. To the extent that these habitat features can be avoided within the work area, they will be flagged, and the locations will be provided to the biological monitor. This survey of the work area will be repeated if a lapse in construction activity of 2 weeks or greater occurs during the giant garter snake inactive period (October 1 to May 1) or if the lapse in construction activity is more than 12 hours during the active period (May 1 to October 1). If a giant garter snake is encountered during surveys or construction, activities will cease until appropriate corrective measures have been completed, it has been determined that the giant garter snake will not be harmed, or the giant garter snake has left the work area.
- For all construction activities that occur in giant garter snake habitat that could result in injury or mortality of snakes (e.g., movement of heavy equipment; excavation of soil, rock, or existing structures; grading; vegetation removal), a USFWS-approved biologist will be present to monitor these activities. As work is performed, the biologist will visually scan work areas, under equipment, and excavated materials for giant garter snakes. The biologist will also help guide access and construction work around wetlands, active rice fields, and other sensitive habitats capable of supporting giant garter snake to minimize habitat disturbance and risk of injuring or killing giant garter snakes.
- Report all observations of giant garter snakes to the USFWS-approved biological monitor. If a giant garter snake is observed in the work area, the monitor will have the authority to stop work in the immediate vicinity of the snake. If possible, the snake will be allowed to leave the work area on its own volition and the monitor will remain in the area until the snake is safely out of harm's way. A giant garter snake may be captured and relocated out of the work area with prior authorization from USFWS and by an individual with the appropriate handling permit. The snake will be relocated to suitable habitat at least 200 feet from the work area.
- Maintain all construction and operations and maintenance equipment to prevent leaks of fuel, lubricants, and other fluids and use extreme caution when handling and or storing chemicals

(such as fuel and hydraulic fluid) near waterways, and abide by all applicable laws and regulations. Follow all applicable hazardous waste BMPs and keep appropriate materials onsite to contain, manage, and clean up any spills.

- Conduct service and refueling procedures in uplands in staging areas and at least 200 feet away from waterways when practicable.
- During construction and operation and maintenance activities in and near giant garter snake habitat, employ erosion (non-monofilament silt fence), sediment, material stockpile, and dust control BMPs. Avoid using fill or allowing runoff into wetland areas or waterways to the extent practicable.
- Return temporary work areas to pre-existing contours and conditions upon completion of work. Where revegetation and soil stabilization are necessary in nonagricultural habitats, revegetate with appropriate noninvasive native plants at a density and structure similar to that of preconstruction conditions. Restoration of aquatic vegetation in giant garter snake aquatic habitat and annual grassland within giant garter snake upland habitat will be detailed in a mitigation and monitoring plan that will be reviewed and approved by USFWS prior to the start of construction. Habitat will be restored within one season (defined as May 1 to October 1).
- Properly contain and remove from the worksite all trash and waste items generated by construction and crew activities to prevent the encouragement of predators such as raccoons and coyotes from occupying the site.
- Permit no pets, campfires, or firearms at the worksite.
- Store equipment in designated staging area areas at least 200 feet away from giant garter snake aquatic habitat to the extent practicable.
- Confine any vegetation clearing to the minimum area necessary to facilitate construction activities.
- Limit vehicle speed to 10 miles per hour (mph) on access routes (except for public roads and highways) and within work areas that are within 200 feet of giant garter snake aquatic habitat but not protected by exclusion fencing to avoid running over giant garter snakes.
- Visually check for giant garter snake under vehicles and equipment prior to moving them. Cap all onsite materials (conduits, pipe, etc.), precluding wildlife from becoming entrapped. Check any crevices or cavities in the work area where individuals may be present including stockpiles that have been left for more than 24 hours where cracks or crevices may have formed.
- For proposed activities that will occur within suitable aquatic giant garter snake habitat during the active giant garter snake season (May 1 through October 1), prior to proposed construction activities that will commence during the inactive period, and when unavoidable, all aquatic giant garter snake habitat will be dewatered for at least 14 days prior to excavating or filling the dewatered habitat. Dewatering is necessary because aquatic habitat provides prey and cover for giant garter snake; dewatering serves to remove the attractant and increase the likelihood that giant garter snake will move to other available habitat. Any deviation from this measure will be done in coordination with, and with approval of, the USFWS.

- Following dewatering of aquatic habitat, all potential affected areas that provide suitable aquatic or upland giant garter snake habitat will be surveyed for giant garter snake by the USFWS-approved biologist. If giant garter snakes are observed, they will be passively allowed to leave the area, or the USFWS will be consulted to determine the appropriate course of action for removing giant garter snake from the area.

Maintenance activities such as vegetation and rodent control, embankment repair, and channel maintenance will occur at conveyance facilities with permanent structures and at conveyance facility and restoration sites with flexible locations (e.g., transmission line right of ways, restoration locations, etc.). The following avoidance and minimization measures will be applied to maintenance activities in suitable aquatic habitat and uplands within 200 feet of suitable aquatic habitat, to minimize effects on the giant garter snake:

- Vegetation control will take place during the active period (May 1 through October 1) when snakes are able to move out of areas of activity.
- Trapping or hunting methods will be used for rodent control rather than poison bait. All rodent control methods will be approved by USFWS. If trapping or other nonpoison methods are ineffective, the USFWS will be consulted to determine the best course of action.
- Movement of heavy equipment will be confined to outside 200 feet of the banks of giant garter snake aquatic habitat to minimize habitat disturbance.
- All construction personnel and personnel involved in operations and maintenance in or near giant garter snake habitat will attend worker awareness training (as described in Appendix O). This training will include instructions to workers on how to recognize giant garter snakes, their habitat, and the nature and purpose of protection measures.

Compensation for Unavoidable Effects

Where giant garter snake habitat cannot be avoided, compensation for the permanent loss of the habitat will occur at a rate of 3:1 for aquatic and upland habitat.

Mitigation Measure BIO-6: Western Pond Turtle

Species-specific mitigation for western pond turtle will only be required for projects occurring within or adjacent to suitable habitat as identified by assessments conducted during the project component planning phase. A qualified biologist will conduct a field evaluation of suitable upland or aquatic habitat for western pond turtles for all covered activities that occur within suitable pond turtle habitat.

If the project does not fully avoid effects on suitable habitat, the following measures will be required.

- The project proponent will retain a qualified wildlife biologist to conduct a preconstruction survey within 48 hours of disturbance in aquatic and riparian habitats to determine presence or absence of pond turtles in the construction work area.
- If possible, the surveys will be timed to coincide with the time of day and year when turtles are most likely to be basking and visible (during the cooler part of the day, 8:00 a.m. to 12:00 p.m., during spring, summer, and late summer). Prior to conducting presence/absence surveys the biologist will locate the microhabitats for turtle basking (logs, rocks, brush thickets) and determine a location to quietly observe turtles.

- Each survey will include a 30-minute wait time after arriving at the site to allow startled turtles to return to open basking areas. The survey will consist of a minimum 15-minute observation time per area where turtles could be observed.
- If turtles are observed during a survey, they will be relocated outside of the construction area to appropriate aquatic habitat by a biologist.

Mitigation Measure BIO-7: California Black Rail

Preconstruction surveys for California black rail will be conducted where potentially suitable habitat for this species occurs within 500 feet of work areas where access is available. Potentially suitable habitat includes tidal and nontidal seasonal or perennial wetlands at least 2 acres in size with any kind of vegetation types consistent with black rail use in the Delta, as determined by field evaluations conducted by a qualified biologist with experience surveying for black rail, over 10 inches high, whether or not the patch in question was mapped as modeled habitat. Surveys will be initiated sometime between January 15 and February 1. A minimum of four surveys will be conducted. The survey dates will be spaced at least 2 to 3 weeks apart and will be scheduled so that the last survey is conducted no more than 2 weeks before April 15. This will allow the surveys to encompass the time period when the highest frequency of calls is likely to occur. These surveys will involve the following protocols (based on Evens et al. 1991), or other approved survey methodologies that may be developed using new information and best-available science, and will be conducted by biologists with the qualifications stipulated in the approved methodologies.

- Listening stations will be established at 300-foot intervals throughout potential black rail habitat that will be affected by covered activities. Listening stations will be placed along roads, trails, and levees to avoid trampling.
- California black rail vocalization recordings will be played at each station, and playing will cease immediately once a response is detected.
- Each listening station will be occupied for 6 minutes, including 1 minute of passive listening, 1 minute of “grr” calls followed by 30 seconds of “ki-ki-krrr” calls, then followed by another 3.5 minutes of passive listening.
- Each survey will include a survey at sunrise and a survey at sunset.
- Sunrise surveys will begin 60 minutes before sunrise and conclude 75 minutes after sunrise (or until presence is detected).
- Sunset surveys will begin 75 minutes before sunset and conclude 60 minutes after sunset (or until presence is detected).
- Surveys will not be conducted when tides are greater than National Geodetic Vertical Datum or when sloughs and marshes are more than bank-full.
- California black rail vocalizations will be recorded on a data sheet. A GPS receiver and compass will be used to identify surveys stations, angles to call locations, and call locations and distances. The call type, location, distance from listening station, and time will be recorded on a data sheet.

The project will be implemented in a manner that will not result in take of California black rail, as defined by Section 86 of the California Fish and Game Code. If California black rail is present in the immediate construction area, the following measures will apply during construction activities:

- To avoid the loss of individual California black rails, activities within 500 feet of potential habitat will not occur within 2 hours before or after extreme high tides (6.5 feet or above, as measured at the Golden Gate Bridge). During high tide, protective cover for California black rail is sometimes limited, and activities could prevent them from reaching available cover.
- To avoid the loss of individual California black rails, activities within 500 feet of tidal marsh areas and managed wetlands will be avoided during the rail breeding season (February 1 to August 31), unless surveys are conducted to determine that no rails are present within the 500-foot buffer.
- If breeding California black rail is determined to be present, activities will not occur within 500 feet of an identified calling center (unless a qualified biologist determines that a smaller distance will not result in the take of the state-listed species). If the intervening distance between the rail calling center and any activity area is greater than 200 feet and across a major slough channel or substantial barrier (e.g., constructed noise barrier) it may proceed at that location within the breeding season.
- If California black rail are determined to be present in habitat that must be disturbed, vegetation will be removed during the nonbreeding season (September 1 to January 31) to encourage them to leave the area. Vegetation removal will be completed carefully using hand tools or vegetation removal equipment that is approved by a biologist. The biologist will search vegetation immediately in front of the removal equipment, and will stop removal if rails are detected. Vegetation removal will resume when the black rail leaves the area.
- If construction activities require removal of potential California black rail habitat, whether or not black rails have been detected there, vegetation will be removed during the nonbreeding season (September 1 to January 31). Vegetation removal will be completed carefully using hand tools or vegetation removal equipment that is approved by a biologist. The biologist will search vegetation immediately in front of the removal equipment, and will stop removal if rails are detected. Vegetation removal will resume when the rail leaves the area.
- Exception: Inspection, maintenance, or nonconstruction monitoring activities may be performed during the California black rail breeding season (February 1 to August 31) in areas within or adjacent to breeding habitat (within 500 feet) with CDFW approval and under the supervision of a permitted, approved biologist.
- If the construction footprint is within 500 feet of a known calling center, noise reduction structures such as temporary noise reducing walls, will be installed at the edge of construction footprint, as determined by an onsite biologist. Noise-causing construction will begin during the nonbreeding season (September 1 to January 31) so that rails can acclimate to noise and activity prior to initiating nests.

Mitigation Measure BIO-8: California Ridgway's Rail

If construction or restoration activities are necessary during the breeding season, preconstruction surveys for California Ridgway's rail will be conducted where suitable habitat for these species occurs within or adjacent to work areas. Surveys will be initiated sometime between January 15 and February 1. A minimum of four surveys will be conducted. The survey dates will be spaced at least 2 to 3 weeks apart and will cover the time period from the date of the first survey through the end of

March and mid-April. This will allow the surveys to encompass the time period when the highest frequency of calls is likely to occur. These surveys will involve the following protocols (based on USFWS 2015 and Evens et al. 1991), or other approved survey methodologies that may be developed based on new information and evolving science, and will be conducted by biologists with the qualifications stipulated in the approved methodologies.

- Listening stations will be established at 200-meter intervals along roads, trails, and levees that will be affected by covered activities.
- California Ridgway's rail vocalization recordings will be played at each station, and playing will cease immediately once a response is detected.
- For California Ridgway's rail, each listening station will be occupied for a period of 10 minutes, followed by 1 minute of playing California Ridgway's rail vocalization recordings, then followed by an additional minute of listening.
- Sunrise surveys will begin 60 minutes before sunrise and conclude 75 minutes after sunrise (or until presence is detected).
- Sunset surveys will begin 75 minutes before sunset and conclude 60 minutes after sunset (or until presence is detected).
- Surveys will not be conducted when tides are greater than 4.5 National Geodetic Vertical Datum or when sloughs and marshes are more than bank-full.
- California Ridgway's rail vocalizations will be recorded on a data sheet. A GPS receiver and compass will be used to identify surveys stations, angles to call locations, and call locations and distances. The call type, location, distance, and time will be recorded on a data sheet.

If California Ridgway's rail is present in the immediate construction area, the following measures will apply during construction activities.

- To avoid the loss of individual California Ridgway's rails, activities within or adjacent to the species' habitat will not occur within 2 hours before or after extreme high tides (6.5 feet or above, as measured at the Golden Gate Bridge), when the marsh plain is inundated. During high tide, protective cover for California Ridgway's rail is sometimes limited, and activities could prevent them from reaching available cover.
- To avoid the loss of individual California Ridgway's rails, activities within or adjacent to tidal marsh areas will be avoided during the rail breeding season (February 1 through August 31), unless surveys are conducted to determine rail locations and territories can be avoided.
- If breeding California Ridgway's rail are determined to be present, activities will not occur within 500 feet of an identified calling center (unless a qualified biologist determines that a smaller distance will not result in the take of the state-listed species). If the intervening distance is across a major slough channel or across a substantial barrier between the rail calling center and any activity area is greater than 200 feet, it may proceed at that location within the breeding season.
- Exception: Inspection, maintenance, or nonconstruction monitoring activities may be performed during the California Ridgway's breeding season in areas within or adjacent to breeding habitat (within 500 or 200 feet, as specified above) as long as a qualified biologist determines the action

will not result in take. These activities will be conducted under the supervision of a qualified, permitted biologist.

Mitigation Measure BIO-9: Greater and Lesser Sandhill Crane

If construction and restoration activities are to occur during sandhill crane wintering season (September 15 through March 15) in a greater sandhill crane winter use area or within suitable lesser sandhill crane wintering habitat, the following avoidance and minimization measures will be implemented.

- Construction will be minimized during the sandhill crane wintering season to the extent practicable in light of project schedule and cost and logistical considerations.
- To the extent feasible, construction that cannot be completed prior to commencement of the wintering season will be started before September 15 or after March 15, such that no new sources of noise or other major disturbance that could affect cranes will be introduced after the cranes arrive at their wintering grounds.
- Preconstruction surveys will be conducted for sandhill crane temporary and permanent roost sites within 0.75 mile of the construction area boundary where access is available. Surveys will be conducted during the winter prior to project implementation, over multiple days within the survey area by a qualified biologist with experience observing the species. Alternatively, roost sites within 0.75 mile of the construction area boundary can be identified by a qualified sandhill crane biologist familiar with roost sites. If a sandhill crane roost site is located within 0.75 mile of the construction area boundary, then to the extent practicable, nighttime (1 hour before sunset to 1 hour after sunrise) project activities will be relocated to maintain a 0.75-mile nondisturbance buffer.
- Route truck traffic to reduce headlight impacts in roosting habitat.
- Install light barriers to block the line-of-sight between the nearest roosting areas and the primary nighttime construction light source areas.
- Operate portable lights near roosting habitat at the lowest allowable wattage and height, while in accordance with the National Cooperative Highway Research Program's (NCHRP's) *Report 498: Illumination Guidelines for Nighttime Highway Work.*
- Screen all lights and direct them down toward work activities and away from the night sky and nearby roost sites. A biological construction monitor will ensure that lights are properly directed at all times.
- Limit the number of nighttime lights used to the greatest extent practicable in light of worker safety requirements.
- If restoration takes place near Stone Lake NWR, install a vegetation screen or other noise and visual barrier along the south side of Hood Franklin Road along the length of Stone Lake NWR's property to reduce disturbance to sandhill cranes. The noise and visual barrier will be a minimum of 5 feet high (above the adjacent elevated road, if applicable) and will provide a continuous surface impenetrable by light. This height may be obtained by installing a temporary structure, such as fencing (e.g., chain link with privacy slats) or a semipermanent structure, such as a concrete barrier (e.g., a roadway median barrier or architectural concrete wall system) retrofitted

with an approved visual screen, if necessary, to meet the required height. This barrier will not be installed immediately adjacent to crane foraging habitat, and placement will be coordinated with a qualified crane biologist.

Mitigation Measure BIO-10: Least Bell's Vireo

Species-specific mitigation measures for least Bell's vireo will be required for activities occurring within suitable habitat within the species' range. Prior to disturbing an area potentially supporting habitat for the species, a USFWS approved biologist will evaluate the area to identify suitable habitat.

Activities will be located to avoid or minimize disturbance of least Bell's vireo suitable habitat within the species' range. The following measures will be required for project components unable to avoid least Bell's vireo habitat:

- Prior to construction, all suitable least Bell's vireo habitat within the species' range in the construction area will be surveyed.
- At least five surveys will be conducted in suitable habitats within 30 days of the onset of construction, with the last survey conducted within 3 days of the onset of construction, by a qualified biologist with experience surveying and observing these species and familiar with their vocalizations.
- If an active nest site is present, a 500-foot nondisturbance buffer will be established around nest sites during the breeding season (generally, late February through late August).
- Disturbance to previous least Bell's vireo nesting sites (for up to 3 years since known nest activity) will also be avoided during the breeding season unless the disturbance is to maintain public safety. Least Bell's vireo uses previous nesting sites, and disturbance during the breeding season may preclude birds from using existing unoccupied nest sites.
- The required buffer may be reduced in areas where barriers or topographic relief are sufficient to protect the nest from excessive noise or other disturbance, as determined by a the qualified biologist on a case-by-case basis.
- If occupied nests are identified, a qualified biologist will monitor construction activities in the vicinity of all active least Bell's vireo nests to ensure that covered activities do not affect nest success.
- If surveys find least Bell's vireos in the area where vegetation will be removed, vegetation removal will be done when the birds are not present.
- If an activity is to occur within 1,200 feet of least Bell's vireo habitat (or within 2,000 feet if pile driving will occur) during the breeding period for least Bell's vireos, the following measures will be implemented to avoid noise effects on least Bell's vireo.
    - Prior to the construction, a noise expert will create a noise contour map showing the 60 A-weighted decibel noise contour specific to the type and location of construction to occur in the area.
    - During the breeding period for least Bell's vireo, a USFWS-approved biologist will survey any suitable habitat for least Bell's vireo within the 60 dBA noise contour daily during a 2-week period prior to construction. While construction is occurring within this work window, the USFWS-approved biologist will conduct daily surveys in any suitable habitat where

construction related noise levels could exceed 60 dBA L_{eq} (1 hour). If a least Bell's vireo is found, sound will be limited to 60 dBA in the habitat being used until the USFWS-approved biologist has confirmed that the bird has left the area.

- Limit pile driving to daytime hours (7:00 a.m. to 7:00 p.m.).
- Locate, store, and maintain portable and stationary equipment as far as possible from suitable least Bell's vireo habitat.
- Employ preventive maintenance including practicable methods and devices to control, prevent, and minimize noise.
- Route truck traffic to reduce construction noise impacts and traffic noise levels within 1,200 feet of suitable least Bell's vireo habitat during migration periods.
- Limit trucking activities (e.g., deliveries, export of materials) to the hours of 7:00 a.m. to 10:00 p.m.
- Screen all lights and direct them down toward work activities away from migratory habitat. A biological construction monitor will ensure that lights are properly directed at all times.
- Operate portable lights at the lowest allowable wattage and height, while in accordance with NCHRP's *Report 498: Illumination Guidelines for Nighttime Highway Work* (Transportation Research Board 2003).

Compensation to Offset Effects

Reclamation will offset the loss of least Bell's vireo habitat through habitat creation or restoration at a 2:1 ratio. Reclamation will develop a riparian restoration plan that will identify the location and methods for riparian creation or restoration, and this plan will be subject to USFWS approval.

Mitigation Measure BIO-11: Suisun Song Sparrow, Saltmarsh Common Yellowthroat, Yellow-Breasted Chat, Yellow Warbler

Preconstruction surveys of potential breeding habitat for the Suisun song sparrow, saltmarsh common yellowthroat, yellow-breasted chat, and yellow warbler will be conducted within 500 feet project activities where access is available. At least five surveys will be conducted in suitable habitats within 30 days of the onset of construction, with the last survey conducted within 3 days of the onset of construction, by a qualified biologist with experience surveying and observing these species and familiar with their vocalizations.

If an active nest site is present, a 250-foot nondisturbance buffer will be established around nest sites during the breeding season (generally, late February through late August for yellow-breasted chat, early April through mid-July for saltmarsh common yellowthroat and yellow warbler, and early April through late August for Suisun song sparrow).

The required buffer may be reduced in areas where barriers or topographic relief are sufficient to protect the nest from excessive noise or other disturbance, as determined by a qualified biologist on a case-by-case basis.

If occupied nests are identified, a qualified biologist will monitor construction activities in the vicinity of all active nests to ensure that covered activities do not affect nest success.

To the extent feasible, the contractor will employ the following best practices to reduce construction noise during daytime and evening hours (7:00 a.m. to 10:00 p.m.) such that construction noise levels do not exceed 60 dBA Leq (1 hour) during migration periods:

- Limit construction during nighttime hours (10:00 p.m. to 7:00 a.m.) such that construction noise levels do not exceed 50 dBA L_{max} (1 hour) at the nearest residential land uses.
- Limit construction activities to daytime hours (7:00 a.m. to 7:00 p.m.), where feasible.
- Locate, store, and maintain portable and stationary equipment 300 feet away from suitable nesting habitat during migration periods, and 300 feet from active breeding sites.
- Employ preventive maintenance including practicable methods and devices to control, prevent, and minimize noise.
- Except where equipment must cross through riparian zones, route truck traffic to at least 300 feet from suitable avian migratory habitat during migration periods.
- Limit trucking activities (e.g., deliveries, export of materials) to the hours of 7:00 a.m. to 10:00 p.m. within 300 feet of migration habitat during migration periods.
- Screen all lights and direct them down toward work activities away from migratory habitat. A biological construction monitor will ensure that lights are properly directed at all times.
- Operate portable lights at the lowest allowable wattage and height, while in accordance with the NCHRP *Report 498: Illumination Guidelines for Nighttime Highway Work* (Transportation Research Board 2003).

Mitigation Measure BIO-12: Swainson's Hawk

Preconstruction surveys will be conducted to identify the presence of active nest sites of tree-nesting raptors within 0.25 mile of project sites, staging and storage areas, construction access roads, work areas, and soil stockpile areas where accessible by a qualified biologist with experience identifying Swainson's hawk. Transportation routes along public roads (roads leading to and from work areas) are considered disturbed, and no surveys or monitoring are required for nests along those roadways unless they are within 0.25 mile of work areas. Surveys for nesting Swainson's hawks will be conducted to ensure nesting activity is documented prior to the onset of construction activity. Swainson's hawks nest in the study area between approximately March 15 and September 15. While many nest sites are traditionally used for multiple years, new nest sites can be established in any year. Therefore, construction activity that is planned after March 15 of any year will require surveys during the year of the construction. If construction is planned before March 15 of any year, surveys will be conducted the year immediately prior to the year of construction. If construction is planned before March 15 of any year and subject to prior-year surveys, but is later postponed to after March 15, surveys will also be conducted during the year of construction.

The survey protocol shown in Table P.2-2, Timing and Methodology for Swainson's Hawk Nesting Surveys, is modified from the recommended timing and methodology for Swainson's hawk nesting surveys in the Central Valley (Swainson's Hawk Technical Advisory Committee 2000). This protocol will be used to detect active nests for Swainson's hawk. If active nests are found, appropriate avoidance and minimization measures will be implemented as described. If no activity is found, then construction can proceed with no restrictions until the following breeding season. Survey results will be documented in a memo no less than 5 days prior to commencement of construction activities, and provided to the Program Environmental Manager and Construction Supervisor. The designated biologist will include the location of any known nest trees (occupied within 1 or more of the last 5 years) present within 0.25 mile of the construction footprint.

Removal of known nest trees (defined as a tree that has been used for nesting at least once in the last 3 years) will be avoided to the maximum extent feasible. No trees with occupied nests will be removed until the nest is vacated.

The designated biologist will survey potential Swainson's hawk nest trees and monitor occupied Swainson's hawk nests as described below. When proposed construction will occur within 0.25 mile of known nest trees, construction activities will be limited to outside the breeding season if feasible, or until the tree site is determined to be inactive.

Where construction activities cannot be restricted to more than 0.25 mile of an occupied nest site, activities will be restricted during the period of egg-laying to post-hatching to the extent feasible. If construction activities must occur in that time frame, construction will be initiated prior to egg-laying to the extent feasible. This will allow time for Swainson's hawks to acclimate to disturbance before eggs are laid, reducing the potential for abandonment. If construction activities must begin after egg-laying is initiated, a 650-foot-radius nondisturbance buffer will be established at least until eggs have hatched.

When construction activities will occur within 0.25 mile of an occupied Swainson's hawk nest, a 650-foot-radius nondisturbance buffer will be established around each occupied hawk nest tree. To the greatest extent feasible, no construction activity will be allowed to occur within the buffer while a Swainson's hawk nest is occupied. A nest is considered occupied from the time the nest is being constructed until the young leave the nest, or until the nesting attempt fails and the nest is abandoned. Occupied nests will be monitored to track progress of nesting activities. The buffer will be clearly delineated with fencing or other conspicuous marking.

Where construction will occur within 0.25 mile of an occupied Swainson's hawk nest tree, the following monitoring plan will be implemented. If a project nesting bird monitoring and management plan is prepared by a designated biologist, it will prevail where it differs from the measures below.

- A designated biologist will observe any nest site that is within 0.25 mile of construction activities for at least 1 hour and until normal nesting behavior can be determined 5 days and 3 days prior to the initiation of construction. The biologist will determine nest status and document normal nesting behaviors, which may be used to compare to the hawks' activities once construction begins. The results of preconstruction monitoring will be reported in a memo and provided to the Program Environmental Manager and Construction Supervisor.
- Where a Swainson's hawk occupied nest occurs less than 325 feet from construction activities, the designated biologist will observe the nest periodically throughout the day where covered activities occur to ensure the hawks are engaged in normal nesting behavior.
- Where a Swainson's hawk occupied nest occurs between 325 and 650 feet from construction, the designated biologist will observe the nest for at least 2 hours per construction day where covered activities occur to ensure the hawks are engaged in normal nesting behavior.
- Where a Swainson's hawk occupied nest occurs between 650 and 1,300 feet from construction, the designated biologist will observe the nest for at least 3 days per construction week to ensure the hawks are engaged in normal nesting behavior and to check the status of the nest.

Physical contact with an active nest tree will be prohibited from the time of egg laying to fledging. Construction personnel outside of vehicles must remain at least 650 feet, unless the biologist determines that a smaller buffer will not result in take of this state-listed species, from the nest tree unless construction activities require them to be closer.

All personnel will be out of the line of sight of an occupied nest during breaks if within 650 feet of the nest (as stated above, activities will only occur within 650 feet of a nest with approval by the designated biologist).

If during construction the designated biologist determines that a nesting Swainson's hawk within 0.25 mile of the project is disturbed by project activities, to the point where their reproductive failure could occur, the designated biologist will immediately notify the Construction Supervisor and Program Environmental Manager. The Program Environmental Manager will contact CDFW, and it will be determined by the parties whether additional protection measures can be implemented.

Potential nest abandonment and failure may be indicated if Swainson's hawk exhibits distress and/or abnormal nesting behavior such as swooping/stooping at construction equipment or personnel, excessive vocalization (distress calls) or agitation directed at construction equipment or personnel, failure to remain on nest, or failure to deliver prey items for an extended time period. Additional protection measures will remain in place until the Swainson's hawk behavior has normalized. The designated biologist will notify CDFW if nests or nestlings are abandoned and if the nestlings are still alive to determine appropriate actions for salvaging the eggs or returning nestlings to the wild.

In addition to the measures described above, the following measures will also be implemented for activities for which the extent and location of the activity have not yet been fully planned.

- Restoration exploration activities will fully avoid Swainson's hawk nesting habitat.
- Restoration exploration will not be conducted within 0.25 mile of an occupied Swainson's hawk nest.

Table P.2-2. Timing and Methodology for Swainson's Hawk Nesting Surveys

Survey Dates	Survey Time	Number of Surveys	Methodology
First week of April	Sunrise to 12:00 p.m.; 4:00 p.m. to sunset	1	Position the surveyor at 50 to 200 feet from suitable nesting habitat with a clear view of trees and surrounding area. Scan all trees for a minimum of 2 hours within 0.25 mile of the project boundary. Observe perching, nest building, mating, courtship, and other prenesting behaviors to identify a nest or nesting activity area.
Second week of April	Sunrise to 12:00 p.m.; 4:00 p.m. to sunset	1	Repeat the above survey in areas not determined to be occupied during the first survey. Attempt to confirm nest locations within nesting activity areas.
Third week of April	Sunrise to 12:00 p.m.; 4:00 p.m. to sunset	1	Repeat the above survey in areas not determined to be occupied during the first and second survey. In cases where a nest site was not identified within a nesting activity area during the first two surveys, approach the nesting activity area carefully to locate nests. If a nest is not found where there is reasonable certainty of nesting activity, rely on observations of courtship, mating, nest building, and other behaviors to define a nesting area and establish a buffer.
June 10 through July 15	Sunrise to 12:00 p.m.; 4:00 p.m. to sunset	3 surveys spaced at least 3 days apart	Inspect all previously identified nests for activity status. Walk and scan all other suitable nest trees within 0.25 mile of the project boundary for nests not found during the initial survey.

Mitigation Measure BIO-13: Tricolored Blackbird

Prior to implementation of project activities, a qualified biologist with experience surveying for and observing tricolored blackbird will conduct a preconstruction survey to establish use of suitable habitat by tricolored blackbird colonies. Surveys will be conducted in suitable habitat within 1,300 feet of proposed construction areas, where access allows, during the nesting season (generally March 15 to July 31) 1 year prior to, and then again the year of, construction. During each year, surveys will be conducted monthly in March, April, May, June, and July. If construction is initiated at a site during the nesting season, three surveys will be conducted within 15 days of construction with one of the surveys within 5 days of the start of construction. The CDFW Suisun Marsh Unit tracks tricolored blackbird colonies yearly in Suisun Marsh as part of the University of California, Davis/USFWS tricolored blackbird portal project; these records will also be searched and staff at the portal project consulted for recent colony information. If active tricolored blackbird nesting colonies are identified, minimization requirements and construction monitoring will be required.

- Project activities will avoid active tricolored blackbird nesting colonies and associated habitat during the breeding season (generally March 15 to July 31). Avoidance measures will include relocating covered activities away from the nesting colonies and associated habitat to the maximum extent practicable.
- Projects (construction and restoration) will be designed to avoid construction activity to the maximum extent practicable up to 1,300 feet, but not less than a minimum of 300 feet, from an active tricolored blackbird nesting colony. This minimum buffer may be reduced in areas with

dense forest, buildings, or other habitat features between the construction activities and the active nest colony, or where there is sufficient topographic relief to protect the colony from excessive noise or visual disturbance as determined by a biologist experienced with tricolored blackbird.

- Project activities potentially affecting a nesting colony will be monitored by a qualified biologist to verify that the activity is not disrupting the colony. If it is, the activity will be modified, as practicable, by either delaying construction until the colony abandons the site or until the end of the breeding season, whichever occurs first; temporarily relocating staging areas; or temporarily rerouting access to the construction site. Reclamation technical staff will consult with the fish and wildlife agencies and evaluate exceptions to the minimum nondisturbance buffer distance on a case-by-case basis.
- Prior to initiation of construction within 300 feet of suitable roosting habitat, a biologist with experience surveying for and observing tricolored blackbirds will conduct preconstruction surveys to establish use of roosting habitat by tricolored blackbird colonies. Surveys will be conducted in suitable habitat where access is available within 300 feet of proposed construction areas during the nonbreeding season (generally August 1 to March 14) 1 year prior to, and then again the year of, construction. If construction is initiated at a site during the nonbreeding season, three surveys will be conducted within 15 days prior to construction with one of the surveys within 5 days prior to the start of construction.
- Construction and restoration projects will also be designed to avoid construction activity within at least 300 feet from occupied active tricolored blackbird roosting habitat. This minimum buffer may be reduced in areas with dense forest, buildings, or other habitat features between the construction activities and the active roosting site, or where there is sufficient topographic relief to protect the roosting site from excessive noise or visual disturbance, or where sound curtains are used, as determined by a biologist experienced with tricolored blackbird.
- Construction activities that are within 300 feet of occupied roosting habitat will be monitored by a biologist familiar with tricolored blackbird behavior patterns to verify that the activity is not disrupting the roosting birds. If it is, the activity will be modified, as practicable, by delaying construction until the blackbirds are no longer using the roosting site, temporarily relocating staging areas, temporarily rerouting access to the construction site, or use of sound curtains. The biologist will evaluate the nondisturbance buffer distance on a case-by-case basis.

Unavoidable loss of foraging habitat will be mitigated through foraging habitat protection at a 1:1 ratio, and unavoidable loss of nesting habitat through riparian restoration at a 2:1 ratio.

Mitigation Measure BIO-14: Western Burrowing Owl

Species-specific measures for western burrowing owl will only be required for water conveyance construction, restoration, and operations and maintenance activities occurring within suitable habitat as identified from habitat assessments conducted in advance of initiating ground-disturbing and staging activities. This measure incorporates survey, avoidance, and minimization guidelines taken primarily from the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012).

Preconstruction Surveys

Western burrowing owl surveys will be required within and adjacent to (within 500 feet) water conveyance work areas and restoration sites where suitable habitat has been identified during habitat

assessment surveys where access is available. Surveys will be conducted during the breeding season that precedes construction.

Four survey visits will be conducted with at least one site visit between February 15 and April 15 and a minimum of three survey visits, at least 3 weeks apart, between April 15 and July 15, with at least one visit after June 15. Surveys will be conducted between 10:00 a.m. and 2 hours before sunset. A qualified biologist will survey the study area and record and map all burrowing owl observations and burrows that may be occupied (as indicated by tracks, feathers, egg shell fragments, pellets, prey remains, cast pellets, whitewash, or decoration) on the project site. The surveys will be conducted while walking transects throughout the entire project footprint, plus all accessible areas within a 500-foot radius of the project footprint. The centerlines of these transects will be spaced 15 to 60 feet apart and will vary in width to account for changes in terrain and vegetation that can preclude complete visual coverage of the area. For example, in hilly terrain with patches of tall grass, transects will be closer together, while in open areas with little vegetation they can be 60 feet apart. Surveyors will stop at least every 300 feet along each transect to scan the entire visible area for presence of burrowing owls. Adjacent parcels under different land ownership will be surveyed only if access is granted or if the parcels are visible from authorized areas.

In addition, preconstruction surveys will be conducted with one occurring 14 days prior to ground breaking and/or staging activities and another within 24 hours of these activities. These surveys will confirm whether owls identified during the breeding season surveys are still present or whether the site has since become occupied by burrowing owls.

Avoidance and Minimization

To the extent feasible, burrowing owls will be avoided by relocating work areas with flexible locations, such as geotechnical exploration sites and restoration sites. Within the construction footprint where ground disturbance cannot avoid burrowing owls, owls will be relocated during the nonbreeding season and burrows will be excavated.

If an active burrow is identified near a work area and work cannot be conducted outside of the nesting season (February 1 to August 31), a qualified biologist will establish a nondisturbance buffer that extends a minimum of 250 feet around the burrow. If burrowing owls are present at the site during the nonbreeding season (September 1 through January 31), a qualified biologist will establish a nondisturbance buffer that extends a minimum of 150 feet around the burrow.

If the appropriate nondisturbance buffer for breeding or nonbreeding burrowing owls cannot be established, a wildlife biologist experienced in burrowing owl behavior will evaluate site-specific conditions and recommend a smaller buffer that still minimizes the potential to disturb the owls (and still allows reproductive success during the breeding season), if possible. The site-specific buffer will be established by taking into consideration the type and extent of the proposed activity occurring near the occupied burrow, the duration and timing of the activity, the sensitivity and habituation of the owls to existing conditions, and the dissimilarity of the proposed activity to background activities. If an appropriate buffer cannot be established around the active owl burrows, actions will be taken to exclude the owls from the site per the requirements below.

A biological monitor will be present during all construction activities occurring within any reduced buffers. If during the breeding season there is any change in owl nesting and foraging behavior as a result of construction activities, the biological monitor will work with construction personnel and the Environmental Manager to provide additional protections to reduce disturbance, such as adding visual and sound curtains; any modifications to the standard protections will be approved by a qualified biologist.

If monitoring indicates that the nest is abandoned prior to the end of nesting season and the burrow is no longer in use by owls, the nondisturbance buffer may be removed. If necessary because the burrow cannot be avoided by construction activity, the biologist will excavate and collapse the burrow to prevent reoccupation.

Relocation

No exclusion of burrowing owls will occur during the breeding season. If burrowing owls are present within the construction footprint and cannot be avoided during the nonbreeding season (generally September 1 through January 31), they will be relocated through passive relocation, with or without burrow exclusion. Passive relocation will be used when (1) there is a sufficient amount of suitable habitat adjacent to the work area to support nesting and foraging, (2) there are compatible land use practices in the area and 3) the area is preferably currently under or proposed for conservation.

Passive relocation will be conducted during the nonbreeding season; however passive relocation techniques may be used during the breeding season (February 1 through August 30) if a qualified biologist determines through site surveillance that the burrow is not occupied by a breeding pair, young, or eggs. To the extent feasible, passive relocation will first be considered without the use of exclusion devices to avoid and minimize harassment of owls.

Passive Relocation without Exclusion

Prior to relocating owls, all potential burrowing owl burrows in suitable nesting habitat and within the project footprint and 75 feet around the footprint, will be surveyed for owl use, and excavated if no owls are found. If occupied burrows are found, two natural or artificial burrows will be provided for each occupied burrow in the above defined survey area, at least 250 feet from the construction footprint. Artificial burrows will be installed following the methods in Barclay (2008) and Johnson et al. (2010). Sites used for artificial burrows will either be properties currently used for or proposed for conservation. After constructing the artificial burrows, the owls will be given 60 days to relocate on their own. The study area will be monitored weekly for up to 60 days to determine whether the owls have left the burrow and to attempting to confirm occupancy at the artificial or other nearby burrows. The formerly occupied burrows will then be excavated. Whenever possible, burrows will be excavated using hand tools and refilled to prevent reoccupation. Sections of flexible plastic pipe (at least 3 inches in diameter) will be inserted into burrows during excavation to maintain an escape route for any animals inside the burrow.

Passive Relocation with Exclusion

If the burrowing owls found in the above survey area do not relocate on their own through the above methodology, passive relocation will be accomplished by installing one-way doors (e.g., modified dryer vents). The one-way doors will be left in place for a minimum of 48 hours and be monitored twice daily to ensure that the owls have left the burrow. The burrow will be excavated using hand tools, and a section of flexible plastic pipe (at least 3 inches in diameter) will be inserted into the burrow tunnel during excavation to maintain an escape route for any animals that may be inside the burrow.

Compensation for Unavoidable Effects

Mitigate unavoidable loss of nesting, wintering, and satellite burrows, and burrowing owl habitat in comparable habitat at an approved mitigation ratio in consultation with CDFW. The mitigation strategy will be consistent with the mitigation guidance in the *Staff Report on Burrowing Owl Mitigation* (CDFG 2012).

Mitigation Measure BIO-15: Western Yellow-Billed Cuckoo

Preconstruction Surveys

This measure for western yellow-billed cuckoo will be required for activities occurring within suitable habitat, or in the vicinity of suitable habitat. Prior to disturbing an area potentially supporting habitat for the species, a USFWS-approved biologist will evaluate the area to identify suitable habitat.

Project activities will be located to avoid or minimize disturbance of western yellow-billed cuckoo suitable habitat within the species' range. The following measures will be required for project components unable to avoid western yellow-billed cuckoo habitat.

- Prior to construction, all suitable western yellow-billed cuckoo habitat in the construction area will be surveyed.
- At least five surveys will be conducted in suitable habitats within 30 days of the onset of construction, with the last within 3 days of the onset of construction, by a qualified biologist with experience surveying and observing this species and familiar with its vocalizations.
- If an active nest site is present, a 500-foot nondisturbance buffer will be established around nest sites during the breeding season (generally, late February through late August).
- The required buffer may be reduced in areas where barriers or topographic relief are sufficient protect the nest from excessive noise or other disturbance, as determined by a qualified biologist on a case-by-case basis.
- If occupied nests are identified, a qualified biologist will monitor construction activities in the vicinity of all active western yellow-billed cuckoo nests to ensure that covered activities do not affect nest success.
- If surveys find western yellow-billed cuckoos in the area where vegetation will be removed, vegetation removal will be done when cuckoos are not present.
- Permanent or temporary loss of all suitable migratory habitat will be minimized by all activities associated with the proposed action through project design.

  Avoidance and Minimization

  If an activity is to occur within 1,200 feet of western yellow-billed cuckoo habitat (or within 2,000 feet if pile driving will occur) during the period of from June 15 through September 1 (the period in which yellow-billed cuckoos have been observed in the legal Delta) the following measures will be implemented to avoid noise effects on migrating western yellow- billed cuckoos.

  - Prior to the construction, a noise expert will create a noise contour map showing the 60 dBA noise contour specific to the type and location of construction to occur in the area.
  - During the period between June 15 and September 1, a qualified biologist will survey any suitable migratory habitat for yellow-billed cuckoos within the 60 dBA noise contour on a daily basis during a two-week period prior to construction. While construction is occurring within this work window, the USFWS-approved biologist will conduct daily surveys in any suitable habitat where construction related noise levels could exceed 60 dBA L_{eq} (1 hour). If a yellow-billed cuckoo is found, sound will be limited to 60 dBA in the habitat being used until the USFWS-approved biologist has confirmed that the bird has left the area.

- Locate, store, and maintain portable and stationary equipment as far as possible from suitable western yellow-billed cuckoo habitat.
- Employ preventive maintenance including practicable methods and devices to control, prevent, and minimize noise.
- Route truck traffic to reduce construction noise impacts and traffic noise levels within 1,200 feet of suitable western yellow-billed cuckoo migratory habitat during migration periods.
- Limit trucking activities (e.g., deliveries, export of materials) to the hours of 7:00 a.m. to 10:00 p.m.
- Screen all lights and direct them down toward work activities away from migratory habitat. A biological construction monitor will ensure that lights are properly directed at all times.
- Operate portable lights at the lowest allowable wattage and height, while in accordance with the NCHRP *Report 498: Illumination Guidelines for Nighttime Highway Work* (Transportation Research Board 2003).

Compensation to Offset Effects

Reclamation will offset the loss of western yellow-billed cuckoo migratory habitat through the creation or restoration at a 3:1 ratio, for a total of [to be determined] acres of migratory riparian habitat creation or restoration in USFWS-approved location. For restoration, Reclamation will develop a riparian restoration plan that will identify the location and methods for riparian creation or restoration, and this plan will be subject to USFWS approval.

Mitigation Measure BIO-16: White-Tailed Kite

Preconstruction surveys will be conducted to identify the presence of active nest sites of tree nesting raptors within 0.25 mile of project sites, staging and storage areas, construction access roads, work areas, and soil stockpile areas where accessible, by a qualified biologist with experience identifying white-tailed kite nests. Transportation routes along public roads (roads leading to and from work areas) are considered disturbed, and no surveys or monitoring are required for nests along those roadways unless they are within ¼ mile of work areas. Surveys for nesting white-tailed kites will be conducted within 30 days prior to construction to ensure nesting activity is documented prior to the onset of construction activity during the nesting season. White-tailed kites nest in the study area between approximately March 15 and September 15. While many nest sites are traditionally used for multiple years, new nest sites can be established in any year. Therefore, construction activity that is planned after March 15 of any year will require surveys during the year of the construction. If construction is planned before March 15 of any year, surveys will be conducted the year immediately prior to the year of construction. If construction is planned before March 15 of any year and subject to prior-year surveys, but is later postposed to after March 15, surveys will also be conducted during the year of construction.

Construction will be restricted to the greatest extent possible during the nesting season where nest sites occur within 0.25 mile of construction activities, unless an already existing suitable buffer between the construction activity and the nest site is identified by a biologist. Surveys for white-tailed kite nests and nesting activity will occur in conjunction with the surveys for bald eagles under MM BIO-17 and follow the same protocol. If active nests are found or nesting activity is identified within 0.25 mile of construction activities appropriate avoidance and minimization measures will be implemented as described. Results of the surveys will be summarized in a memo(s) and provided to

the Program Environmental Manager and Construction Supervisor prior to the commencement of construction.

Removal of known nest trees will be avoided to the maximum extent feasible. No trees with occupied nests will be removed until the nest is vacated.

The biologist will conduct a second survey of potential nesting trees and active nests, and monitor white-tailed kite nests no more than 72 hours prior to construction. If no nesting activity is found, then construction can proceed with no restrictions.

Where construction activities within 0.25 mile of an active nest cannot feasibly be avoided, construction will be initiated prior to egg-laying to the extent possible. If eggs and or young are present in the nest, work will be restricted until a biologist determines that white-tailed kites have acclimated to disturbance and exhibit normal nesting behavior.

A 650-foot-radius nondisturbance buffer will be established around each active white-tailed kite nest site. No construction activity will be allowed to occur in the buffer while a nest site is occupied by white-tailed kite during the breeding season. The buffer size may be modified based on the field examination and determination by the biologist of conditions that may minimize disturbance effects, including line-of-sight, topography, land use, type of disturbance, existing ambient noise and disturbance levels, and other relevant factors. The buffer will be clearly delineated with fencing or other conspicuous marking. Active nests will be monitored to track progress of nesting activities. Entry into the buffer will be granted when the biologist determines that the young have fledged and are capable of independent survival or the nest has failed and the nest site is no longer active.

Where it is infeasible to avoid construction within 0.25 mile of an active white-tailed kite nest identified in preconstruction surveys, at a minimum the following measures will be implemented as part of a nesting bird monitoring and management plan. The final plan may include additional measures that are specific to site conditions.

- A designated biologist will observe any nest site that is within 0.25 mile of construction activities for at least 1 hour and until normal nesting behavior can be determined 5 days and 3 days prior to the initiation of construction. The biologist will determine nest status and observe normal nesting behaviors, which may be used to compare to the nesting activities once construction begins. The results of preconstruction monitoring will be reported in a memo and provided to the Program Environmental Manager and Construction Supervisor.
- Where pre-project surveys have identified an occupied white-tailed kite nest less than 325 feet from construction, the designated biologist will observe the nest periodically throughout the day where covered activities occur to ensure the white-tailed kites demonstrate normal nesting behavior.
- Where pre-project surveys have identified an occupied white-tailed kite nest between 325 to 650 feet from construction, the designated biologist will observe the nest for at least 2 hours per construction day where covered activities occur to ensure the white-tailed kites are engaged in normal nesting behavior.
- Where pre-project surveys have identified an occupied white-tailed kite nest between 650 to 1,300 feet from construction, the Biological Monitor will observe the nest for at least 3 days per construction week to ensure the white-tailed kites are engaged in normal nesting behavior and to check the status of the nest.

During construction or ongoing operation and maintenance activities, physical contact with an active nest tree is prohibited from the time of egg laying to fledging, unless approved by CDFW. Construction personnel outside of vehicles must remain at least 650 feet, or the length of a buffer approved by a qualified biologist which will not result in take, from the nest tree unless construction activities require them to be closer.

All personnel will remain out of the line of sight of an occupied white-tailed kite nest during breaks if within 650 feet of the nest (as stated above, activities will only occur within 650 feet of a nest with approval by the designated biologist).

The project will be implemented in a manner that will not result in take of white-tailed kite as defined by Section 86 of the California Fish and Game Code. If during construction monitoring, the designated biologist determines that a nesting white-tailed kite within 650 feet of construction is disturbed by construction activities, to the point where reproductive failure could occur, the designated biologist will immediately notify the Construction Supervisor and Program Environmental Manager. The Program Environmental Manager will contact CDFW, and it will be determined by the parties whether additional protection measures can be implemented.

Potential nest abandonment and failure may be indicated if white-tailed kite exhibits distress and/or abnormal nesting behavior such as swooping/stooping at construction equipment or personnel, excessive vocalization (distress calls) or agitation directed at construction equipment or personnel, failure to remain on nest or failure to deliver prey items for an extended time period. Additional protection measures will remain in place until the white-tailed kite behavior has normalized.

Mitigate unavoidable loss of foraging habitat through foraging habitat protection at a 1:1 ratio, and unavoidable loss of nesting habitat through riparian restoration at a 2:1 ratio.

Mitigation Measure BIO-17: Bald Eagle

The following measures will be implemented to avoid and minimize impacts on bald eagle during Reclamation project activities.

- If restoration activities, including helicopter flights, need to take place during the nesting season and within 0.5 mile of potential bald eagle nesting habitat, qualified agency-approved biologists will conduct a preconstruction survey for occupied bald eagle nest in and within 0.5 mile of the work areas. An *occupied nest* is a “nest used for breeding in the current year by a [bald or golden eagle] pair” (Pagel et al. 2010). Survey procedures, including required surveyor qualifications, will follow the USFWS’ *Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations* (Pagel et al. 2010) or other more recent guidelines, if available.
- Reclamation will implement, at a minimum, the following measures to avoid disturbance of active eagle nests (i.e., “a golden eagle [or bald eagle] nest characterized by the presence of any adult, egg, or dependent young at the nest in the past 10 consecutive days immediately prior to, and including, at present” [Pagel et al. 2010]):
    - No activities involving loud noise (>90 decibels) or helicopter flight paths will be permitted within 0.5 mile of any active eagle nest found during preconstruction surveys. This restriction will be in effect from January to August 31 unless nest monitoring by a qualified agency-approved biologist reveals that the nest is no longer active (e.g., adults did not nest that year, nest failure from natural causes, young fledged).
    - Activities that do not involve loud noise will maintain an exclusion zone of 0.25 mile around all active eagle nests found during preconstruction surveys. This restriction will be in effect

from January to August 31 unless nest monitoring by a qualified agency-approved biologist reveals that the nest is no longer active.

- Eagle nest exclusion zones may be removed if monitoring reveals the nest to be inactive, and considered to be an "alternate nest" under current regulations under the Bald and Golden Eagle Protection Act. An alternate nest is "one of potentially several nests within a nesting territory that is not an in-use nest at the current time" (USFWS 2016). Monitoring to demonstrate that nests are not in-use will follow observational procedures described by Pagel et al. (2010).

Mitigation Measure BIO-18: Bank Swallow

The following measures will be implemented to avoid and minimize impacts on bank swallow individuals, colonies, current and potential habitat (i.e., natural banks), and, if feasible, to river processes. This applies to activities year-round, whether bank swallows are present or not.

Preconstruction Surveys

Prior to beginning project activities within 500 feet of the Sacramento River, Feather River, and lower American River during the bank swallow nesting season (April 1 through August 31), a preconstruction survey for bank swallow colonies will be conducted where bank swallow habitat is present within 500 feet of work areas. If no active nesting colonies are present, no further measures are required.

If an active colony is found and work must occur during the nesting season (April 1 through August 31), Reclamation will establish a nondisturbance buffer (in consultation with a biologist) around the colony during the breeding season. In addition, the biologist will monitor any active colony within 500 feet of work areas to ensure that activities do not affect nest success. No project activities will take place within the disturbance buffer.

Avoidance and Minimization

Prevent Impacts on Individuals, Colonies, and Habitat

To the extent feasible, where proposed water management or land-use projects (i.e., restoration activities) projects would impact bank swallows or river processes, alternatives such as setback levees can be used to avoid those impacts.

Consult with a biologist when planning projects within the floodplain of the Sacramento River and its tributaries to ensure projects do not affect colonies or current or potential habitat.

Develop flow criteria that avoid impacts of high water flows by limiting frequency and duration of peak flows over 14,000 cfs (Sacramento River) or rapid draw-downs to nesting bank swallow habitat during the breeding season (April 1 through August 31); this includes downstream tributary flows when timing water releases (Bank Swallow Technical Advisory Committee 2013).

Prevent Impacts on River Processes

To the extent feasible, where restoration activities would impact river processes, alternatives to bank stabilization, such as setback and adjacent levees, should be used to preserve dynamic river processes.

Maintain flow regimes during the nonbreeding season (September 1 through March 31) that promote natural river processes and create bank swallow habitat by providing annual flows that cause local

bank erosion and a minimum of one bankfull flood event every 3 years to promote bank erosion, meander migration, and channel cutoff. (Bank Swallow Technical Advisory Committee 2013).

Mitigation Measure BIO-19: California Least Tern

For restoration projects, Reclamation will avoid California least tern nesting colony sites.

Mitigation Measure BIO-20: Migratory Birds (Osprey, Short-Eared Owl, Tule Greater White-fronted Goose, Black Tern, Least Bittern, White-Faced Ibis)

The following measures will be implemented to avoid and minimize impacts on nesting migratory birds, including special-status birds, during Reclamation restoration activities.

- A qualified wildlife biologist with experience with nesting birds will conduct nesting surveys before the start of restoration activities. A minimum of three separate surveys will be conducted within 30 days prior to the initiation of work, with the last survey within 3 days prior to work beginning in a given work area. Surveys will include a search of all suitable nesting habitat in the work area. In addition, a 500-foot radius around the work area, where accessible, will be surveyed for nesting raptors, and an area within 50 feet of the work area will be surveyed for other nesting birds protected by the MBTA. If no active nests are detected during these surveys, no additional measures are required.

If active nests are found in the survey area, nondisturbance buffers will be established around the nest sites to avoid disturbance or destruction of the nest site until the end of the breeding season (approximately September 1) or until a qualified wildlife biologist determines that the young have fledged and moved out of the study area. The end of the breeding season varies by species and the stage of the nesting effort (i.e., nest building, egg laying, incubation, feeding nestling, feathered young, fledged young, etc.) as determined by the qualified wildlife biologist. A qualified wildlife biologist will monitor activities in the vicinity of the nests to ensure that activities do not affect nest success. The extent of the buffers will be determined by the biologist and will depend on the level of noise or disturbance, line-of-sight between the nest and the disturbance, ambient levels of noise and other disturbances, and other topographical or artificial barriers. Suitable buffer distances may vary between species.

Mitigation Measure BIO-21: Riparian Woodrat and Riparian Brush Rabbit

The measures for riparian woodrat and riparian brush rabbit will be implemented for projects occurring within suitable habitat. Within the study area, based on the known distribution of the species, suitable habitat is defined to include the areas within the legal Delta along San Joaquin and Stanislaus Rivers south of State Route 4 and Old River Pipeline. Within this area, suitable riparian habitat includes the vegetation types that make up a dense, brushy understory shrub layer with a minimum patch size of 0.05 acres. Riparian brush rabbit grassland habitat includes grasslands with a minimum patch size of 0.05 acres that are adjacent to riparian brush rabbit riparian habitat.

A qualified biologist will conduct a field evaluation of suitable habitat for both species for all covered activities that occur within the defined area for these species' habitat as described above. If the project cannot fully avoid effects on suitable habitat, the following measures will be required.

- A qualified biologist will assess habitat suitability for both species. If the qualified biologist determines the habitat to be suitable for the species, then Reclamation will avoid disturbing suitable habitat while accessing restoration sites (i.e., access to enhancement sites for in-stream activities such as gravel placement).

- If a habitat or floodplain restoration component would disturb suitable habitat, Reclamation will assume presence or conduct protocol-level surveys according to the USFWS *Draft Habitat Assessment Guidelines and Survey Protocol for the Riparian Brush Rabbit and the Riparian Woodrat* (USFWS n.d.).
- If occupied riparian woodrat or riparian brush rabbit habitat is present, or the habitat is assumed to be occupied, Reclamation will redesign the project to avoid occupied habitat. Avoidance requires the following buffers and avoidance measures:
    - Establish minimum 250-foot nondisturbance buffers between project activities and suitable riparian habitat that is occupied or assumed to be occupied. The nondisturbance buffer is not necessary for access to restoration sites provided existing access roads are used.
    - Establish a 1,400-foot buffer between any lighting and suitable riparian habitat that is occupied or assumed to be occupied.
    - Screen all lights and direct them down toward work activities away from riparian habitat that is occupied or assumed to be occupied. A biological construction monitor will ensure that lights are properly directed at all times.
    - Operate portable lights at the lowest allowable wattage and height, while in accordance with the NCHRP *Report 498: Illumination Guidelines for Nighttime Highway Work* (Transportation Research Board 2003).
- If the suitable habitat is determined through surveys to be unoccupied, Reclamation will implement the following measures to minimize long-term effects on the habitat so that it may provide for the recovery of the species. No more than 45 acres of suitable, unoccupied riparian habitat and 30 acres of adjacent grasslands may be permanently removed by levee construction in the San Joaquin River watershed. No more than 35 acres of suitable riparian habitat and 20 acres of adjacent grassland habitat may be temporarily removed for levee construction in the San Joaquin watershed. No more than 10 acres of suitable, unoccupied riparian habitat may be affected in the Stanislaus River watershed.
    - Floodplain restoration projects will be designed to minimize the removal of mature oaks in areas providing suitable habitat for the riparian woodrat.
    - Include refugia within the restored floodplains to provide shelter from flood events for any individuals of these species that may come to occupy the area.
- Reclamation will additionally implement the following measures to avoid and minimize noise and lighting-related effects on riparian brush rabbit:
    - Establish a 1,200-foot nondisturbance buffer between any project activities and suitable riparian habitat.
- Offset any unavoidable loss of suitable riparian habitat through restoration at a 3:1 ratio, using the following restoration design measures:
- Restoration must meet specific ecological requirements for the species.
- Restoration is adjacent to, or facilitates connectivity with, existing occupied or potentially occupied habitat.

Mitigation Measure BIO-22: Salt Marsh Harvest Mouse and Suisun Shrew

Where suitable salt marsh harvest mouse and Suisun shrew habitat has been identified within a tidal restoration work area or within 100 feet of a tidal restoration work area where ground-disturbing activities will occur (e.g., at a levee breach or grading location) a biologist will conduct preconstruction surveys for the mouse or shrew prior to ground disturbance. If a mouse or shrew is discovered, tidal restoration activities near the mouse or shrew will cease until wildlife staff can be contacted and a relocation plan can be developed. Prior to tidal restoration ground-disturbing activities, vegetation will first be removed with nonmechanized hand tools (e.g., goat or sheep grazing, or, in limited cases where the biological monitor can confirm that there is no risk of harming salt marsh harvest mouse or Suisun shrew, hoes, rakes, and shovels may be used) to allow salt marsh harvest mouse and Suisun shrew to passively move out of the location. Vegetation must be cleared to bare ground and removed from the work area, including roads. The upper 6 inches of soil excavated within salt marsh harvest mouse and Suisun shrew habitat will be stockpiled and replaced on top of backfilled material. Vegetation will be removed under supervision of a biological monitor familiar with salt marsh harvest mouse and Suisun shrew. Vegetation removal will start at the edge farthest from the salt marsh and work its way toward the salt marsh. This method of removal provides cover for salt marsh harvest mouse and Suisun shrew and allows them to move toward the salt marsh as vegetation is being removed.

Temporary exclusion fencing will be placed around a defined tidal restoration work area before construction activities start and immediately after vegetation removal. The fence should be made of material that does not allow a salt marsh harvest mouse or Suisun shrew to pass through and should be buried to a depth of 2 inches so that mice cannot crawl under the fence. Supports for the fence must be placed on the inside of the exclusion area. Prior to the start of daily activities during initial ground disturbance, the biologist will inspect the salt marsh harvest mouse-proof boundary for holes or rips. The work area will also be inspected to ensure no mice are trapped inside. Any mice or shrews found along or outside the fence will be closely monitored until they move away from the construction site. Tidal restoration work will be scheduled to avoid extreme high tides (6.5 feet or above, as measured at the Golden Gate Bridge) to allow for salt marsh harvest mouse to more easily move to higher grounds.

The biologist with previous salt marsh harvest mouse and Suisun shrew experience will be onsite during construction activities related to tidal restoration in suitable habitat. The biologist will document compliance with the project permit conditions and avoidance and conservation measures. The approved biologist will have the authority to stop tidal restoration activities if any of the requirements associated with these measures are not being fulfilled. If the biologist requests work stoppage because of take of any listed species, CDFW and USFWS staff will be notified within 1 day by email or telephone.

Mitigation Measure BIO-23: Ring-Tailed Cat

Because ring-tailed cats maintain multiple dens, the loss of one den would be a negligible impact. However, the loss of a natal or maternity den would be significant. Reclamation will implement the following measure for ring-tailed cat:

- A qualified biologist familiar with ring-tailed cat biology will conduct a habitat assessment of the proposed construction area. If highly suitable denning habitat is present, the area will be designated as an Environmental Sensitive Area and marked on project maps.
- When possible, the removal of vegetation and construction activities will be conducted outside of the breeding season for ring-tailed cat (February 1 through May 1).

- If the denning season cannot be completely avoided, a qualified biologist will conduct a preconstruction survey within 2 weeks prior to commencement of construction for potential natal or maternity den trees. If an active den is found, a qualified biologist, will determine a construction-free buffer zone to be establish around the den until the young have left the den.
- A biological monitor will be present when construction activities take place when active ring-tailed cat dens are identified within the construction work area and work takes place within 150 feet of the den.

Mitigation Measure BIO-24: Special-Status Bats

The following measure was designed to avoid and minimize adverse direct and indirect effects on special-status bats. Baseline data are not available or are limited on how bats use the study area and on individual numbers of bats and how they vary seasonally. Accordingly, it is difficult to determine if there would be a substantial reduction in species numbers. Bat species with potential to occur in the study area employ varied roost strategies, from solitary roosting in foliage of trees to colonial roosting in trees and artificial structures, such as buildings and bridges. Daily and seasonal variations in habitat use are common. To obtain the highest likelihood of detection, preconstruction bat surveys will be conducted by Reclamation and will include these components:

- Identification of potential roosting habitat within project footprint.
- Daytime search for bats and bat sign in and around identified habitat.
- Evening emergence surveys at potential day-roost sites, using night-vision goggles and/or active full-spectrum acoustic monitoring where species identification is sought.
- Passive full-spectrum acoustic monitoring and analysis to detect bat use of the area from dusk to dawn over multiple nights.
- Additional onsite night surveys as needed following passive acoustic detection of special-status bats to determine nature of bat use of the structure in question (e.g., use of structure as night roost between foraging bouts).
- Qualified biologists will have knowledge of the natural history of the species that could occur in the study area and experience using full-spectrum acoustic equipment. During surveys, biologists will avoid unnecessary disturbance of occupied roosts.

Preconstruction Bridge and Other Structure Surveys

Before work begins on the bridge/structure, qualified biologists will conduct a daytime search for bat sign and evening emergence surveys to determine if the bridge/structure is being used as a roost. Biologists conducting daytime surveys would listen for audible bat calls and would use naked eye, binoculars, and a high-powered spotlight to inspect expansion joints, weep holes, and other bridge features that could house bats. Bridge surfaces and the ground around the bridge/structure would be surveyed for bat sign, such as guano, staining, and prey remains.

Evening emergence surveys will consist of at least one biologist stationed on each side of the bridge/structure watching for emerging bats from a half hour before sunset to 1–2 hours after sunset for a minimum of 2 nights within the season that construction would be taking place. Night-vision goggles and/or full-spectrum acoustic detectors shall be used during emergence surveys to assist in

species identification. All emergence surveys would be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted).

Additionally, passive monitoring with full-spectrum bat detectors will be used to assist in determining species present. A minimum of 4 nights of acoustic monitoring surveys will be conducted within the season that the construction would be taking place. If site security allows, detectors should be set to record bat calls for the duration of each night. To the extent possible, all monitoring will be conducted during favorable weather conditions (calm nights with temperatures conducive to bat activity and no precipitation predicted). The biologists will analyze the bat call data using appropriate software and prepare a report with the results of the surveys. If acoustic data suggest that bats may be using the bridge/structure as a night roost, biologists will conduct a night survey from 1 to 2 hours past sunset up to 6 hours past sunset to determine if the bridge is serving as a colonial night roost.

If suitable roost structures will be removed, additional surveys may be required to determine how the structure is used by bats, whether it is as a night roost, maternity roosts, migration stopover, or for hibernation.

Preconstruction Tree Surveys

If tree removal or trimming is necessary, qualified biologists will examine trees to be removed or trimmed for suitable bat roosting habitat. High-value habitat features (large tree cavities, basal hollows, loose or peeling bark, larger snags, palm trees with intact thatch, etc.) will be identified and the area around these features searched for bats and bat sign (guano, culled insect parts, staining, etc.). Riparian woodland, orchards, and stands of mature broadleaf trees should be considered potential habitat for solitary foliage roosting bat species.

If bat sign is detected, biologists will conduct evening visual emergence surveys of the source habitat feature from a half hour before sunset to 1–2 hours after sunset for a minimum of 2 nights within the season that construction would be taking place. Methodology should follow that described above for the bridge emergence survey.

Additionally, if suitable tree roosting habitat is present, acoustic monitoring with a bat detector will be used to assist in determining species present. These surveys would be conducted in coordination with the acoustic monitoring conducted for the bridge structure.

Protective Measures for Bats using Bridges/Structures and Trees

Avoidance and minimization measures shall be necessary if it is determined that bats are using the bridge/structure or trees as roost sites and/or sensitive bats species are detected during acoustic monitoring. Appropriate measures shall include, as applicable, the measures listed below.

- Ensure that bats are protected from noise, vibrations, and light that result from construction activities associated with water conveyance facilities, conservation components, and ongoing habitat enhancement, as well as operations and maintenance of above-ground water conveyance facilities, including the transmission facilities. This would be accomplished by either directing noise barriers and lights inward from the disturbance or ensuring that the disturbances do not extend more than 300 feet from the point source.
- Disturbance of the bridge will be avoided between March 1 and October 31 (the maternity period) to avoid impacts on reproductively active females and dependent young.

- Installation of exclusion devices from March 1 through October 31 to preclude bats from occupying the bridge during construction. Exclusionary devices will only be installed by or under the supervision of an experienced bat biologist.
- Tree removal will be avoided between April 15 and September 15 (the maternity period for bat species that use trees) to avoid impacts on pregnant females and active maternity roosts (whether colonial or solitary).
- Tree removal will be conducted between September 15 and October 31 to the maximum extent feasible, which corresponds to a time period when bats would not likely have entered winter hibernation and would not be caring for flightless young.
- Trees will be removed in pieces, rather than felling the entire tree.
- If a maternity roost is located, whether solitary or colonial, that roost will remain undisturbed with a buffer as determined in by a qualified biologist until September 15 or until the qualified biologist has determined the roost is no longer active.
- If a non-maternity roost is found, that roost will be avoided to the maximum extent feasible and an appropriate buffer established in consultation with a qualified biologist. Every effort would be made to avoid the roost to the maximum extent feasible, as methods to evict bats from trees are largely untested. However, if the roost cannot be avoided, eviction will be attempted and procedures designed in consultation with the qualified biologist will be employed to reduce the likelihood of mortality of evicted bats. In all cases:
    - Eviction would not occur before September 15.
    - Qualified biologists would carry out or oversee the eviction tasks and would monitor the tree trimming/removal.
    - Eviction would take place late in the day or in the evening to reduce the likelihood of evicted bats falling prey to diurnal predators.
    - Eviction would take place during weather and temperature conditions conducive to bat activity.
    - Special-status bat roosts would not be disturbed.
- Eviction procedures shall include but are not limited to the following:
    - Pre-eviction surveys to obtain data to inform the eviction approach and subsequent mitigation requirements. Relevant data may include the species, sex, reproductive status and/or number of bats using the roost, and roost conditions themselves such as temperature and dimensions. Surveys may include visual emergence, night vision, acoustic, and/or capture.
    - If needed, structural changes to the roost, performed without harming bats, such that the conditions in the roost are undesirable to roosting bats and the bats leave on their own (e.g., open additional portals so that temperature, wind, light and precipitation regime in the roost change).
    - Non-injurious harassment at the roost site to encourage bats to leave on their own, such as ultrasound deterrents or other sensory irritants.
- Prior to removal/trimming, after other eviction efforts have been attempted, any confirmed roost tree would be shaken, repeatedly struck with a heavy implement such as an axe and several

minutes should pass before felling trees or trimming limbs to allow bats time to arouse and leave the tree. The biologists should search downed vegetation for dead and injured bats. The presence of dead or injured bats would be reported to CDFW.

Compensatory mitigation for the loss of roosting habitat will include the construction and installation of suitable replacement habitat onsite. Depending on the species and type of roost lost, various roost replacement habitats have met with some success (e.g., bat houses, "bat bark," planting cottonwood trees, leaving palm thatch in place rather than trimming). Creating natural habitat onsite is generally preferable to artificial habitat.

Artificial roosts are often unsuccessful, and care must be taken to determine as closely as possible the conditions in the natural roost to be replaced. Even with such care, artificial habitat may fail. Several artificial roosts have been highly successful in replacing bridge roost habitat when incorporated into new bridge designs. "Bat bark" has been successfully used by the Arizona Department of Game and Fish to create artificial crevice-roosting bat habitat mounted on pine trees (Mering and Chambers 2012:765). Bat houses have at best an inconsistent track record but information is mounting on how to create successful houses. There is no single protocol or recipe for bat-house success. Careful study of the roost requirements of the species in question; the particular conditions at the lost roost site including temperature, orientation of the openings, airflow, internal dimensions and structures (cavity vs. crevice, etc.) should increase the chances of designing a successful replacement.

Restoring riparian woodland with plantings shows signs of success in Colorado. Western red bat activity has been positively correlated with increased vegetation and tree growth, canopy complexity and restoration acreage at cottonwood-willow restoration sites along the Lower Colorado River (Broderick 2010). These complex woodland areas would ultimately provide a wider range of bat species with preferred roost types, including both foliage-roosting and crevice-/cavity-roosting bats.

Mitigation Measure BIO-25: Suisun Thistle and Soft Bird's-Beak

A complete botanical survey of project sites will be completed using *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996) and *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018). The surveys will be floristic in nature and conducted in a manner that maximizes the likelihood of locating Suisun thistle and soft bird's-beak (i.e., during the appropriate season and at an appropriate level of ground coverage).

Special-status plant surveys required for project-specific permit compliance will be conducted early in the planning process to allow design of the individual restoration projects to avoid adverse modification of habitat for specified covered plants. The purpose of these surveys will be to verify that the locations of Suisun thistle and soft bird's-beak identified in previous record searches or surveys are extant, identify any new occurrences, and cover any portions of the study area not previously identified. The extent of compensation for direct loss of or indirect effects on Suisun thistle and soft bird's-beak will be based on these survey results. Locations of the plants in proposed construction areas will be recorded using a GPS unit and flagged.

The following measures will be implemented:

- Design restoration projects to avoid the direct, temporary loss of occupied habitat from construction activities for Suisun thistle. In tidal restoration areas, Suisun thistle occurrences may experience the indirect effect of tidal damping. This effect will be monitored and adaptively managed to ensure the occurrence is protected from loss.

- If a soft bird's-beak occurrence has more than 10 individuals, no more than 5% of the total number of individuals in the occurrence will be removed. If an occurrence has 10 or fewer individuals, all individuals may be removed. Loss of individuals for all occurrences will be offset through replacement of occupied habitat at a ratio of at least 1:1, to achieve no net loss of occupied habitat.
- To minimize the spread of nonnative, invasive plant species from restoration sites, Reclamation will retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared contain invasive plants, then chipped vegetation material from those areas will not be used for erosion control; in these cases, the material will be disposed of to minimize the spread of invasive plant propagules (e.g., by burning, composting). All revegetation materials (such as mulches and seed mixtures used during restoration) shall be certified weed-free and come from locally adapted native plant materials.
- To minimize the introduction of invasive plant species, construction vehicles and construction machinery will be cleaned prior to entering construction sites that are in or adjacent to natural communities other than cultivated lands and prior to entering any restoration sites or conservation lands other than cultivated lands. Vehicles travelling off paved roads in areas with infestations of invasive plant species will be cleaned before travelling to other parts of the study area. Cleaning stations will be established at the perimeter of covered activities along construction routes as well as at the entrance to reserve system lands. Biological monitoring will include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species will be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.
- Reclamation will ensure that covered activities in designated critical habitat areas for Suisun thistle or soft bird's-beak, if any, will not result in the adverse modification of any of the primary constituent elements for Suisun thistle or soft bird's-beak critical habitat. The CDFW Suisun Marsh Unit tracks both of these species (GIS-mapped) in Suisun Marsh. No covered activities will take place within designated Suisun thistle or soft bird's-beak critical habitat areas without prior written concurrence from USFWS that such activities will not adversely modify any primary constituent elements of Suisun thistle or soft bird's-beak critical habitat. Primary constituent elements for Suisun thistle are defined as follows.
    - Persistent emergent, intertidal, estuarine wetland at or above the mean high water mark as extended directly across any intersecting channels).
    - Open channels that periodically contain moving water with ocean-derived salts in excess of 0.5%.
    - Gaps in surrounding vegetation to allow for seed germination and growth.
- Primary constituent elements for soft bird's-beak are defined as follows.
    - Persistent emergent, intertidal, estuarine wetland at or above the mean high water mark (as extended directly across any intersecting channels).
    - Rarity or absence of plants that naturally die in late spring (winter annuals).

- Partially open spring canopy cover at ground level, with many small openings to facilitate seedling germination.

Mitigation Measure BIO-26: Other Special-Status Plant Species (Contra Costa Goldfields, Delta Button-Celery, Delta Tule Pea, Mason's Lilaeopsis, Suisun Marsh Aster, Bolander's Water Hemlock, Sanford's Arrowhead)

A complete botanical survey of project sites in areas of suitable habitat for special-status plants will be completed using *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (CDFW 2018). The surveys will be floristic in nature and conducted in a manner that maximizes the likelihood of locating special-status plant species or special-status natural communities that may be present (i.e., during the appropriate season and at an appropriate level of ground coverage).

Special-status plant surveys required for project-specific permit compliance will be conducted during the planning phase to allow design of the individual project activities to avoid or minimize adverse impacts to habitat for specified covered plants. The purpose of these surveys will be to verify that the locations of special-status plants identified in previous record searches or surveys are extant, identify any new special-status plant occurrences, and cover any portions of the study area not previously identified. The extent of mitigation of direct loss of or indirect effects on special-status plants will be based on these survey results. Locations of special-status plants in proposed construction areas will be recorded using a GPS unit and flagged.

The following measures will be implemented.

- Design restoration projects to avoid the direct, temporary loss of occupied habitat from construction activities for other special-status plant species. If other special-status plant species occur in a floodplain restoration area, restoration projects may be designed to include occupied habitat in the restored floodplain provided ground disturbance is avoided in the occupied habitat and the restoration is designed such that the anticipated level of flooding and scouring is compatible with the life-history needs of the covered plant species. In tidal restoration areas, occurrences may experience the indirect effect of tidal damping. This effect will be monitored and adaptively managed to ensure the occurrence is protected from loss.
- Avoid modeled habitat for vernal pool plants to the maximum extent practicable. Where practicable, no ground-disturbing activities or alterations to hydrology will occur within 250 feet of vernal pools. Reclamation will ensure that there will be no adverse modification of critical habitat for vernal pool plants.
- Avoid the loss of extant occurrences of all other special-status plant species.
- If an occurrence has more than 10 individuals, no more than 5% of the total number of individuals in the occurrence will be removed. If an occurrence has 10 or fewer individuals, all individuals may be removed. Loss of individuals for all occurrences will be offset through replacement of occupied habitat at a ratio of at least 1:1, to achieve no net loss of occupied habitat.
- To minimize the spread of nonnative, invasive plant species from restoration sites, Reclamation will retain a qualified botanist or weed scientist prior to clearing operations to determine if affected areas contain invasive plants. If areas to be cleared contain invasive plants, then chipped vegetation material from those areas will not be used for erosion control; in these cases, the

material will be disposed of to minimize the spread of invasive plant propagules (e.g., by burning, composting). All revegetation materials (such as mulches and seed mixtures used during restoration) shall be certified weed-free and come from locally adapted native plant materials.

- To minimize the introduction of invasive plant species, construction vehicles and construction machinery will be cleaned prior to entering construction sites that are in or adjacent to natural communities other than cultivated lands, and prior to entering any project restoration sites or conservation lands other than cultivated lands. Vehicles travelling off paved roads in areas with infestations of invasive plant species will be cleaned before travelling to other parts of the project. Cleaning stations will be established at the perimeter of covered activities along construction routes as well as at the entrance to conservation lands. Biological monitoring will include locating and mapping locations of invasive plant species within the construction areas during the construction phase and the restoration phase. Infestations of invasive plant species will be targeted for control or eradication as part of the restoration and revegetation of temporarily disturbed construction areas.
- This mitigation measure does not apply to the routine management and maintenance activities of Reclamation. Reclamation will determine during implementation the most effective and cost-efficient means to minimize the unintentional spread of invasive plants through vehicle travel.

P.2.7.2 *Mitigation Measures for Wetlands and Waters of the United States*

Mitigation Measure BIO-27: Wetlands and Waters of the United States

Reclamation will avoid fill of wetlands and waters of the United States to the extent feasible, and will offset unavoidable effects through wetland creation, restoration, or enhancement with the goal of achieving no net loss of wetland acres and functions.

P.2.8 Summary of Impacts

Table P.2-3, Impact Summary, includes a summary of impacts, the magnitude and direction of those impacts, and potential mitigation measures for consideration.

Table P.2-3. Impact Summary

Impact	Alternative	Magnitude and Direction of Impacts	Potential Mitigation Measures
Potential changes to wildlife and plant habitat on river banks (Project-Level)	No Action	No effect	–
	1	Changes in flows compared with the No Action Alternative are expected to result in very minor effects on plants and wildlife along stream and reservoir banks but could result in substantial adverse effects on bank swallow colonies.	MM BIO-18 Bank Swallow

Impact	Alternative	Magnitude and Direction of Impacts	Potential Mitigation Measures
	2	Changes in flows compared with the No Action Alternative are expected to result in very minor effects on plants and wildlife along stream and reservoir banks but could result in substantial adverse effects on bank swallow colonies.	MM BIO-18 Bank Swallow
	3	Changes in flows compared with the No Action Alternative are expected to result in very minor effects on plants and wildlife along stream and reservoir banks, but could result in substantial adverse effects on bank swallow colonies.	MM BIO-18 Bank Swallow
	4	Changes in flows compared with the No Action Alternative are expected to result in very minor effects on plants and wildlife along stream and reservoir banks, but could result in substantial adverse effects on bank swallow colonies.	MM BIO-18 Bank Swallow
Potential changes to existing marshes and associated special-status species in the Bay-Delta region (Program-Level)	No Action	No effect	–
	1	Habitat restoration may result in short-term loss of tidal marsh habitat.	MM BIO-7 California Black Rail, MM BIO-8 California Ridgway's Rail, MM BIO-22, Salt Marsh Harvest Mouse and Suisun Shrew, MM BIO-25 Suisun Thistle and Soft Bird's-Beak, MM BIO-26 Other Special-Status Plant Species
	2	No effect	–
	3	Habitat restoration may result in short-term loss of tidal marsh habitat.	MM BIO-7 California Black Rail, MM BIO-8 California Ridgway's Rail, MM BIO-22, Salt Marsh Harvest Mouse and Suisun Shrew, MM BIO-25 Suisun Thistle and Soft Bird's-Beak, MM BIO-26 Other Special-Status Plant Species

Impact	Alternative	Magnitude and Direction of Impacts	Potential Mitigation Measures
	4	No effect	–
Potential changes to existing riparian areas and associated special-status species (Program-Level)	No Action	No effect	–
	1	Habitat restoration may result in the loss of riparian habitat.	MM BIO-2 Valley Elderberry Longhorn Beetle, MM BIO-4 Foothill Yellow-Legged Frog, MM BIO-15 Western Yellow-Billed Cuckoo, MM BIO-10 Least Bell's Vireo, MM BIO-12 Swainson's Hawk, MM BIO-16 White-Tailed Kite, MM BIO-11 Suisun Song Sparrow, Saltmarsh Common Yellowthroat, Yellow-Breasted Chat, Yellow Warbler, MM BIO-20 Migratory Nesting Birds, MM BIO-17 Bald Eagle, MM BIO-23 Ring-Tailed Cat, MM BIO-21 Riparian Woodrat and Riparian Brush Rabbit
	2	No effect	–
	3	Habitat restoration may result in the loss of riparian habitat.	MM BIO-2 Valley Elderberry Longhorn Beetle, MM BIO-4 Foothill Yellow-Legged Frog, MM BIO-15 Western Yellow-Billed Cuckoo, MM BIO-10 Least Bell's Vireo, MM BIO-12 Swainson's Hawk, MM BIO-16 White-Tailed Kite, MM BIO-11 Suisun Song Sparrow, Saltmarsh Common Yellowthroat, Yellow-Breasted Chat, Yellow Warbler,, MM BIO-20 Migratory Nesting Birds, MM BIO-17 Bald Eagle, MM BIO-23 Ring-Tailed Cat, MM BIO-21 Riparian Woodrat and Riparian Brush Rabbit
	4	No effect	–
Potential changes to habitat for special-status reptiles (Program-Level)	No Action	No effect	–
	1	Habitat restoration could result in the loss of giant garter snake and western pond turtle habitat.	MM BIO-5 Giant Garter Snake
	2	No effect	–

Impact	Alternative	Magnitude and Direction of Impacts	Potential Mitigation Measures
	3	Habitat restoration could result in the loss of giant garter snake and western pond turtle habitat.	MM BIO-5 Giant Garter Snake
	4	Components to increase water use efficiencies in agricultural areas may result in loss of habitat for giant garter snake.	MM BIO-5 Giant Garter Snake
Potential to injure or kill special-status species (Program-Level)	No Action	No effect	–
	1	Construction activities associated with restoration and installation of facilities could kill or injure special-status species in occupied habitat.	All mitigation measures
	2	No effect	–
	3	Construction activities associated with restoration and installation of facilities could kill or injure special-status species in occupied habitat.	All mitigation measures
	4	Components to increase water use efficiencies in agricultural areas may result in loss of habitat for giant garter snake and valley elderberry longhorn beetle.	MM BIO-2 Valley Elderberry Longhorn Beetle, MM BIO-5 Giant Garter Snake
Potential changes to vernal pools and associated special-status species (Program-Level)	No Action	No effect	–
	1	Occupied vernal pools could be removed or impacted by restoration or fish hatchery construction.	MM BIO-1 Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, MM BIO-3, California Tiger Salamander and Western Spadefoot Toad, MM BIO-26 Other Special-Status Plant Species
	2	No effect	–
	3	Occupied vernal pools could be removed or impacted by restoration or fish hatchery construction.	MM BIO-1 Vernal Pool Fairy Shrimp, Vernal Pool Tadpole Shrimp, Conservancy Fairy Shrimp, Longhorn Fairy Shrimp, MM BIO-3, California Tiger

Impact	Alternative	Magnitude and Direction of Impacts	Potential Mitigation Measures
			Salamander and Western Spadefoot Toad, MM BIO-26 Other Special-Status Plant Species
	4	No effect	-
Potential to affect special-status bat species and their habitat (Program-Level)	No Action	No effect	--
	1	Habitat restoration and construction and could injure or kill bat species and remove their habitat.	MM BIO-24 Special-Status Bats
	2	No effect	-
	3	Habitat restoration and construction and could injure or kill bat species and remove their habitat.	MM BIO-24 Special-Status Bats
	4	No effect	-
Potential changes to wetlands and waters of the United States (Program-Level)	No Action	None	–
	1	Potential short-term decrease or long-term conversion of wetland types and waters of the United States.	MM BIO-27 Wetlands and Waters of the United States
	2	None	–
	3	Potential short-term decrease or long-term conversion of wetland types and waters of the United States.	MM BIO-27 Wetlands and Waters of the United States
	4	Potential short term decrease or long-term conversion of wetland types and waters of the United States.	MM BIO-27 Wetlands and Waters of the United States

P.2.9 Cumulative Effects

The cumulative effects analysis for terrestrial biological resources addresses the potential for the project alternatives to act in combination with other past, present, and reasonably foreseeable future projects, programs, or conditions to create a cumulatively adverse impact. The analysis also considers whether any incremental effect of the alternative is cumulatively considerable.

The projects and programs that have been considered as part of the cumulative analysis have been compiled in Appendix Y, *Cumulative Methodology*. The list of past, present, and reasonably foreseeable future projects and programs has been evaluated to determine which of these activities may have effects on terrestrial habitats and terrestrial species that are known to occur within the study area.

In addition, the effects of climate change have been considered in addressing the cumulative effects of alternatives on terrestrial biological resources. Changes that might occur within the study area related to climate change are considered reasonably foreseeable and part of the cumulative condition that might combine with the effects of the implementation of project alternatives.

To assess whether implementation of the alternatives would contribute to an adverse cumulative effect on the terrestrial biological resources of the study area, a judgment must first be made regarding potential adverse effects of the alternatives. Where adverse effects are anticipated, a determination must be made as to whether these effects would contribute to a cumulative adverse effect on a terrestrial biological resource. If there is a contribution to a cumulative adverse effect, a final judgment must be made as to whether the effect of the alternative represents a considerable contribution to the cumulative effect.

P.2.9.1 *Cumulative Effects of the No Action Alternative*

P.2.9.1.1 Effects of Past, Present, and Reasonably Foreseeable Projects and Programs

The current conditions of study area biological resources are the byproduct of past and ongoing human activity, including declining acreages of natural habitat due to agricultural, urban development, and flood control and water management activities. The various projects and programs listed in Appendix Y will have cumulative effects on the existing biological resources of the study area through the early long-term (year 15) and over the next 50 years. The most relevant elements of these projects and programs are their abilities to modify land use patterns, modify land management practices, and change the patterns of hydrology and vegetation in the study area. Most of the local, state, and federal land use and land management programs that are affecting or will affect the study area are designed to preserve open space and agricultural lands, and to manage the resources of the area for multiple uses, including agriculture, recreation, fish and wildlife habitat, flood protection, and water management. The restoration programs would increase primarily wetland and riparian natural communities by converting agricultural land or managed wetland. The special-status and common plants and wildlife that rely on wetland and riparian habitats for some stage of their life would benefit from these changes over time. Other species that rely on agricultural land and managed wetland but do not benefit from wetland and riparian expansion may decline in the study area. On the upland fringes of the Bay-Delta, plans exist for small expansions of urban development that would remove primarily agricultural land uses. The management of state- and federally owned wildlife areas, including Grizzly Island, Sherman Island, and Yolo Bypass State Wildlife Areas and Stone Lakes NWR, would continue to focus on multiple uses, including wildlife habitat improvement, public access for wildlife viewing, wildlife friendly agricultural production, and hunting opportunities. Natural habitat would be improved and expanded. The principal changes that are likely to result from the various habitat conservation plans that overlap with the study area would be expected to include the restoration and protection of the habitats that support the same special-status species in the study area. These changes would be expected to result in increases of wetland, grassland, and riparian habitats and a decrease in agricultural lands, and possibly managed wetlands in the study area.

Implementation of the water management strategies associated with the programs listed in Appendix Y would not modify the principal species habitat in the study area. These management strategies are designed, in part, to improve aquatic habitat conditions in the study area for the benefit of special-status

fish species. Periodic levee and channel maintenance activities associated with the flood management programs identified in Appendix Y would result in localized disturbances to valley/foothill riparian, grassland, and tidal perennial aquatic natural communities, and to a lesser extent to tidal brackish and tidal freshwater emergent wetlands. To the extent that ongoing levee repair and replacement involves use of reinforcing rock and discouragement of replanting streamside vegetation, there could be a gradual decline in the extent and value of valley/foothill riparian habitat and grassland along minor and major waterways. Several of the water management and transportation projects listed in Appendix Y require localized removal of natural communities and agricultural land for expanding infrastructure.

The overall direction of these existing and ongoing programs and policies that influence land conversion and land management in the study area would continue to be toward maintaining the mix of agricultural, recreational, water management, and wildlife uses in the study area. However, given that the No Action Alternative would not change CVP and SWP operations and would not change flow rates or increase land conversion or land management activities, the No Action Alternative would have no effect on terrestrial biological resources.

P.2.9.1.2 Effects of Climate Change

Climate change is expected to result in many physical changes to the study area. From a terrestrial biology perspective, the most significant changes would include a gradual rise in sea level, increasing water and air temperatures, more frequent drought and extreme rainfall events, and changes in the hydrologic patterns of the rivers and the Bay-Delta channels that influence the terrestrial and aquatic habitats used by terrestrial plant and wildlife. Climate change includes sea level and air temperature increases, as well as changes in the frequency of drought and extreme rainfall events has not been predicted, but these events are expected to be part of future California conditions with climate change. Hydrologic conditions in the rivers and Bay-Delta channels are expected to be altered by changes in precipitation patterns, with a portion of precipitation shifting from snow to rainfall in the winter months. This would increase river flows in winter and early spring, and decrease flows in the remainder of the year as snowmelt runoff decreases. The changes in river flows would generate subsequent changes in west Bay-Delta and Suisun Marsh salinity levels.

The physical changes in conditions in the study area related to the climate change described above, especially the sea level rise, could change the distribution and value of study area habitats. The sea level rise is expected to gradually inundate existing habitats on the periphery of the Bay-Delta, in the lower Yolo Bypass, and the northern and southern edges of Suisun Marsh. Tidal brackish and freshwater marsh could be gradually inundated and converted to more subtidal habitat. In areas where there is no upland barrier (e.g., levees, roads, residential development, agricultural fields), some portion of the tidal marsh may re-establish upslope with the higher water levels if there is sufficient sediment available to provide an appropriate substrate. However, decreases in sediment availability that have occurred in the Bay-Delta and Suisun Marsh over time and that may continue may not keep pace if the higher estimated rates of sea level rise occur (Barnard et al. 2013). The result could be a gradual loss of these tidal marshes. Where barriers exist upslope of existing marsh, the tidal marsh habitat could be gradually inundated and subtidal areas would remain. Subtidal habitat is less valuable to the special-status and common terrestrial plants and wildlife of the study area. Low-lying upland grassland and riparian areas that border the study area waterways could also be gradually converted to tidal marsh, but would be expected to re-establish upslope where open ground exists and there are no physical barriers. Where these deeper water incursions bisect existing wildlife corridors, the ability of certain species to move and interact with adjacent populations would decrease. Population numbers of riparian, grassland, and tidal marsh species would be likely to decrease and population distribution would be altered. The habitats adjacent to study area waterways

would also be exposed to more frequent inundation and desiccation as precipitation levels show greater fluctuation.

Land subsidence, sea level rise, gradual or catastrophic levee failure, or a combination of these conditions, should they occur, would result in flooding and inundation that could significantly damage existing facilities and infrastructure, uproot and kill vegetation to an unknown extent, permanently flood Bay-Delta islands, and drastically alter the salinity of Bay-Delta waterways and wetlands. Depending on the extent and duration of flooding, significant short- and long-term changes could occur in the availability of shallow tidal wetlands, riparian and grassland habitats and managed lands useful to certain special-status and common species (e.g., cultivated lands, managed wetland). Depending on the amount of human intervention to drain islands and rebuild levees, there may be a gradual succession of habitats less valuable to the plant and animal species currently relying on the Delta for growth and seed production, cover, breeding, nesting, resting, movement corridors and foraging.

While similar risks would occur under implementation of the action alternatives, these risks may be reduced by project-related levee improvements, along with implementation of those project elements identified for the purposes of flood protection in Appendix Y. The negative elements of climate change described above would be a contributing factor to any cumulative effects of implementing the projects and programs that are part of the No Action Alternative (Appendix Y). Any negative effects on terrestrial biological resources associated with the action alternatives (see below), when considered with all of the above effects of the No Action Alternative, could create adverse cumulative effects on these terrestrial biological resources.

P.2.9.2 *Cumulative Effects of the Action Alternatives*

This cumulative analysis discusses Alternatives 1, 2, 3, and 4, all of which would result in slight increases in flows throughout the study area. Alternatives 1 and 3 also include restoration and other construction-related activities that could result in impacts on terrestrial biological resources. However, based on the analyses presented in earlier parts of this appendix, these changes would have little or no negative effect on the terrestrial biological resources of concern in the study area and would be expected to improve the long-term viability of special-status species and their habitats. The positive effects of implementing Alternatives 1 and 3 are similar, while Alternatives 2 and 4 include no additional restoration activities but would change flow regimes in the study area. There would be relatively small variations in the acres affected by flow regime changes across the alternatives but larger variations in the acres affected by restoration; thus restoration has the greatest potential to modify natural communities and affect special-status plants and wildlife.

The past, present, and reasonably foreseeable projects, described in Appendix Y, may have effects on terrestrial biological resources. The cumulative projects include actions across California to develop new water storage capacity, new water conveyance infrastructure, new water recycling capacity, and the reoperation of existing water supply infrastructure, including surface water reservoirs and conveyance infrastructure. The cumulative projects also include ecosystem improvement and habitat restoration actions to improve conditions for special status species whose special status in many cases constrains water supply delivery operations.

Collectively, these cumulative projects would have short-term effects but would benefit terrestrial biological resources over the long-term. While flow changes, construction activities, and restoration activities in the short-term period of cumulative projects could temporarily or permanently remove natural communities and modeled habitat for special-status plant and wildlife species, the short-, mid- and long-

term result of construction and restoration activities would replace, enhance, and in most cases expand habitat acres and value for these species; therefore the action alternatives' contributions would not be substantial.

In addition, for Alternatives 1, 2, 3, and 4, the avoidance and minimization measures presented are sufficient to avoid cumulative effects from the combined losses due to flow changes, construction, and restoration

P.3 References

Bank Swallow Technical Advisory Committee. 2013. *Bank Swallow (*Riparia riparia*) Conservation Strategy for the Sacramento River Watershed, California.* June.

Barclay, J. H. 2008. A Simple Artificial Burrow Design for Burrowing Owls. *Journal of Raptor Research* 42(2):53–57.

Barnard, P. L., D. H. Schoelhamer, B. E. Jaffe, L. J. McKee. 2013. Sediment Transport in the San Francisco Bay Coastal System: An Overview. *Marine Geology*. Available: http://dx.doi.org/10.1016/j.margeo.2013.04.005. Accessed: June 11, 2019.

Broderick, S. 2010. *Habitat Use of MSCP Bat Species at Riparian Restoration Areas—Results of 3 Years of Intensive Acoustic Monitoring. Presentation*. Bureau of Reclamation and Lower Colorado River Multi-Species Conservation Program.

CALFED Bay-Delta Program (CALFED). 2000. *Final Programmatic Environmental Impact Statement/Environmental Impact Report*. July.

CALFED Bay-Delta Program, Yolo Bypass Working Group, and Yolo Basin Foundation. 2001. *A Framework for the Future: Yolo Bypass Management Strategy*. August.

California Department of Fish and Game (CDFG). 1988. *California Wildlife Habitat Relationships System, Fresh Emergent Wetland*. Available: https://www.dfg.ca.gov/biogeodata/cwhr/wildlife_habitats.asp. Accessed: October 6, 2014.

California Department of Fish and Game (CDFG). 1995. *Stanislaus River Basin and Calaveras River Water Use Program Threatened and Endangered Species Report.* March. Available: http://www.dfg.ca.gov/delta/reports/stanriver/ with 56 attachments from this website. Accessed: September 30, 2014.

California Department of Fish and Game (CDFG). 2012. *Staff Report on Burrowing Owl Mitigation.* March 7, 2012. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83843. Accessed: March 8, 2019.

California Department of Fish and Game (CDFG) and Yolo Basin Foundation. 2008. *Yolo Bypass Wildlife Area Land Management Plan*. June.

California Department of Fish and Wildlife (CDFW). 2018. *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities*. March 20.

California Department of Fish and Wildlife (CDFW). 2019. California Natural Diversity Database. RareFind 5.

California Department of Transportation (Caltrans) and California Department of Fish and Game (CDFG). 2010. *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California*. February.

California Department of Water Resources (DWR). 2004. *Draft Final Report SP-T1: Effects of Project Operations and Features on Wildlife and Wildlife Habitat, Oroville Facilities Relicensing FERC Project No. 2100*. April.

California Department of Water Resources (DWR). 2005. *Department of Water Resources South Bay Aqueduct Improvement and Enlargement Project, Conformed EIR.* June.

California Department of Water Resources (DWR). 2007a. *Draft Environmental Impact Report Oroville Facilities Relicensing*—FERC Project No. 2100. May.

California Department of Water Resources (DWR). 2007b. *Monterey Plus Draft Environmental Impact Report*. October.

California Department of Water Resources (DWR). 2009. *The California Water Plan Update 2009, Bulletin 160-09*. December.

California Department of Water Resources (DWR). 2011. *Effects of U.S. Army Corps of Engineers' Policy on Levee Vegetation in California*. Available: water.ca.gov/floodsafe/leveeveg/. Accessed: September 26, 2011.

California Department of Water Resources (DWR). 2012. *2012 Central Valley Flood Protection Plan Consolidated Final Program Environmental Impact Report*. July.

California Department of Water Resources (DWR). 2013. *Upper Feather River Lakes*. April.

California Department of Water Resources (DWR). 2014. *Initial Study/Proposed Mitigated Negative Declaration, Bethany Reservoir Sediment Removal Project*. May.

California Department of Water Resources (DWR). 2016. *South Bay Aqueduct (Bethany Reservoir and Lake Del Valle).* September. Available: https://water.ca.gov/LegacyFiles/recreation/brochures/pdf/South%20Bay%20Aqueduct%20brochure_final082616.pdf. Accessed: June 12, 2019.

California Department of Water Resources (DWR) and U.S. Bureau of Reclamation (Reclamation). 2002. *Riparian Vegetation of the San Joaquin River*. *Technical Information Record SJD-02-1*. May.

California North Coast Regional Water Quality Control Board (NCRWQCB) and Bureau of Reclamation (Reclamation). 2009. *Channel Rehabilitation and Sediment Management for Remaining Phase 1*

and Phase 2 Sites, Draft Master Environmental Impact Report and Environmental Assessment. June.

California North Coast Regional Water Quality Control Board (NCRWQCB), Bureau of Reclamation (Reclamation), and Bureau of Land Management (BLM). 2013. *Trinity River Channel Rehabilitation Sites: Bucktail, (River Mile 105.3-106.35) and Lower Junction City (River Mile 78.8-79.8), Draft Environmental Assessment/Initial Study*. December.

California Bay-Delta Authority. 2004. *Environmental Water Program Pilot Flow Augmentation Project: Concept Proposal for Flow Acquisition on Lower Clear Creek.* August.

Cornell Lab of Ornithology. 2017. *Yellow-Breasted Chat.* All About Birds. Cornell University. Available: https://www.allaboutbirds.org/guide/Yellow-breasted_Chat/. Accessed: June 3, 2019.

County of Sacramento. 2008. *American River Parkway Plan 2008.*

Dooling R. J., and A. N. Popper. 2007. *The Effects of Highway Noise on Birds*. Report for The California Department of Transportation, Division of Environmental Analysis, 1120 N Street Sacramento, CA 94274 Available: http://www.dot.ca.gov/hq/env/bio/files/caltrans_birds_10-7-2007b.pdf. Accessed: June 11, 2019.

East Bay Municipal Utility District (EBMUD). 1999. *East Bay Watershed Master Plan*. March.

East Bay Regional Park District (EBRPD). 1996. *Master Plan 1997*. December 17.

East Bay Regional Park District (EBRPD). 2001. *Wildland Management Policies and Guidelines*. June 5.

East Bay Regional Park District (EBRPD). 2012. *Del Valle Regional Park, Checklist of Wild Plants, Sorted Alphabetically by Growth, Form Scientific Name*. February 27.

East Bay Regional Park District (EBRPD). 2013. *Master Plan 2013*. July 16.

Evens J. G., G. W. Page, S. A. Laymon, and R. W. Stallcup. 1991. Distribution, relative abundance and status of the California black rail in western North America. *Condor* 93:952–966.

Federal Energy Regulatory Commission (FERC). 2007. *Final Environmental Impact Statement for Hydropower License, Oroville Facilities – FERC Project No. 2100-052*. May.

Fonken, L. K., and R. J. Nelson. 2014. The effects of light at night on circadian clocks and metabolism. *Endocrine Reviews* 35(4):648–670.

Gauthreaux, S. A., and C. G. Balser. 2006. Effects of Artificial Night Lighting on Migrating Birds. In Ecological Consequences of Artificial Night Lighting. Island Press. Pages 67–94. Available: https://www.fws.gov/migratorybirds/pdf/management/gauthreauxandbelser2006effectsofartificialnightlighting.pdf. Accessed: June 11, 2019.

Goodwin Power, LLC. 2013. Submittal to Federal Energy Regulatory Commission by American Renewables, LLC. Re: Goodwin Dam Hydroelectric Project. FERC Project No. 13728. Transmittal of Notification of Intent and Pre-Application Document, Request for Comments. October 30.

Green Diamond Resource Company. 2006. *Aquatic Habitat Conservation Plan and Candidate Conservation Agreement with Assurances*. October.

Hickson, D., and T. Keeler-Wolf. 2007. *Vegetation and Land Use Classification and Map of the Sacramento-San Joaquin River Delta*. February.

Johnson, D., D. Gillis, M. Gregg, J. Rebholz, J. Lincer, and J. Belthoff. 2010. *Users Guide to Installation of Artificial Burrows for Burrowing Owls*. August.

Kozlowski, T. T., and S. G. Pallardy. 2002. Acclimation and Adaptive Responses of Woody Plants to Environmental Stresses. *The Botanical Review* 68(2): 270–334.

McClure, C. J. W., H. E. Ware, J. Carlisle, G. Kaltenecker, and J. R. Barber. 2013. An experimental investigation into the effects of traffic noise on distributions of birds: Avoiding the phantom road. *Proceedings of the Royal Society B / Biological Sciences* 280(1773): 1–9.

Mering, E., and C. Chambers 2012. Artificial roosts for tree-roosting bats in northern Arizona. *Wildlife Society Bulletin* 36:765–772.

National Park Service (NPS). 1999. *Whiskeytown Unit, Whiskeytown-Shasta-Trinity National Recreation Area General Management Plan and Environmental Impact Statement*. June.

National Park Service (NPS). 2014. *Whiskeytown National Recreation Area, Environmental Assessment and Assessment of Effect, Princess Ditch Trail Construction*. March.

Ouyang, J. Q., S. Davies, and D. Dominoni. 2018. *Hormonally Mediated Effects of Artificial Light at Night on Behavior and Fitness: Linking Endocrine Mechanism with Function.* The Company of Biologists. *Journal of Experimental Biology*. Pages 1–11.

Pagel, J. E., D. M. Whittington, and G. T. Allen. 2010. Interim Golden Eagle Inventory and Monitoring Protocols; and Other Recommendations. Division of Migratory Bird Management, U.S. Fish and Wildlife Service.

Peek, R. A., S. M. Yarnell, and A. J. Lind. 2017. Visual Encounter Survey Protocol for Rana Boylii in Lotic Environments. Center for Watershed Sciences, John Muir Institute of the Environment, and USDA Forest Service.

Plumas County. 2012. *2035 Plumas County General Plan Update Draft Environmental Impact Report*. November.

Poff, N. L., D. J. Allan, M. B. Bain, J. R. Karr, K. L. Prestegaard, B. D. Richter, R. E. Sparks, and J. C. Stromberg. 1997. The Natural Flow Regime. *BioScience* 47(11): 769–784.

San Benito County Water District. 2012. *Initial Study, Zebra Mussel Eradication Project: San Justo Reservoir, Hollister Conduit, & San Benito County Water District Subsystems.* January. Prepared by CH2MHill. Sacramento, CA. San Francisco Estuary Institute—Aquatic Science Center (SFEI). 2012. *Sacramento-San Joaquin Delta Historical Ecology Investigation: Exploring Pattern and Process*. Prepared for the California Department of Fish and Game and Ecosystem Restoration Program. Historical Ecology Program Publication #672. August.

Shuford, W. D., and T. Gardali, editors. 2008. *California Bird Species of Special Concern: A ranked assessment of species, subspecies, and distinct populations of birds of immediate conservation concern in California*. Studies of Western Birds 1. Western Field Ornithologists, Camarillo, California, and California Department of Fish and Game, Sacramento.

Siegel, S., C. Enright, C. Toms, C. Enos, and J. Sutherland. 2010a. Suisun Marsh Tidal Marsh and Aquatic Habitats Conceptual Model. Chapter 1: Physical Processes, Final Review Draft. *Suisun Marsh Habitat Management, Restoration and Preservation Plan*. September 15.

Siegel, S., C. Toms, D. Gillenwater, and C. Enright. 2010b. Suisun Marsh Tidal Marsh and Aquatic Habitats Conceptual Model. Chapter 3: Tidal Marsh, In-progress Review Draft. *Suisun Marsh Habitat Management, Restoration and Preservation Plan*. October 26.

Stebbins, R. C. 1985. *A Field Guide to Western Reptiles and Amphibians*. Second Edition. Boston: Houghton Mifflin Company.

Stillwater Sciences. 2007. *Linking Biological Responses to River Processes: Implications for Conservation and Management of the Sacramento River*. Final. Chapter 7: Bank Swallow. November. Berkeley, CA. Prepared for The Nature Conservancy, Chico, California.

Swainson's Hawk Technical Advisory Committee. 2000. *Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys for the California Central Valley*. Available: https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=83990. Accessed: March 6, 2019.

Transportation Research Board. 2003. *Report 498: Illumination Guidelines for Nighttime Highway Work*. Project number 05-13.

U.S. Department of the Interior, Bureau of Land Management (BLM) and National Park Service (NPS). 2008. *Environmental Assessment for the Lower Clear Creek Anadromous Fish Restoration & Management Project. BLM EA RE-2008-16*. April.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation). 2005. *Central Valley Project Long-Term Water Service Contract Renewal American River Division Environmental Impact Statement*. June.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation). 2010. *2010-2011 Water Transfer Program Draft Environmental Assessmen*t. January.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation). 2013. *Shasta Lake Water Resources Investigation Draft Environmental Impact Statement*. June.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation). 2014. *Draft Resource Management Plan and Draft Environmental Impact Statement, Contra Loma Reservoir and Recreation Area*. May.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and California Department of Water Resources (DWR). 2011. *San Joaquin River Restoration Program Environmental Impact Statement/Report.*

U.S. Department of the Interior, Bureau of Reclamation (Reclamation), U.S. Army Corps of Engineers, California Department of Water Resources, State of California Reclamation Board, and Sacramento Area Flood Control Agency. 2006. *Folsom Dam Safety and Flood Damage Reduction Draft Environmental Impact Statement/Environmental Impact Report*. December.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation), Contra Costa Water District, and Western Area Power Administration. 2009. *Draft Los Vaqueros Reservoir Expansion Project, Environmental Impact Statement Environmental Impact Report*. February.

U.S. Department of the Interior, Bureau of Reclamation (Reclamation), California Department of Fish and Game, and U.S. Fish and Wildlife Service. 2011. *Suisun Marsh Habitat Management, Preservation, and Restoration Plan Final Environmental Impact Statement/Environmental Impact Report*. November.

U.S. Environmental Protection Agency (USEPA). 2008. *Clean Water Act Jursdiction Following the U.S. Supreme Court's Decisions in Rapanos v. United States & Carabell v. United States*. December.

U.S. Fish and Wildlife Service (USFWS). n.d. *Draft Habitat Assessment Guidelines and Survey Protocol for the Riparian Brush Rabbit and the Riparian Woodrat.* Available: https://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/RBR_RWR_draft_habitat_assessment_&_protocol.pdf. Accessed: March 7, 2019.

U.S. Fish and Wildlife Service (USFWS). 1975. *Deer Loss Compensation Program Resulting from Trinity River Division*. April.

U.S. Fish and Wildlife Service (USFWS). 1996. *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants*. September. Available: http://www.fws.gov/ sacramento/es/survey-protocols-guidelines/Documents/Listed_plant_survey_guidelines.pdf

U.S. Fish and Wildlife Service (USFWS). 2002. *Environmental Assessment Proposed North Delta National Wildlife Refuge*.

U.S. Fish and Wildlife Service (USFWS). 2005. *Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon.* Available: http://www.fws.gov/sacramento/es/recovery_plans/vp_recovery_plan_links.htm. Accessed: March 7, 2019.

U.S. Fish and Wildlife Service (USFWS). 2015. *California Clapper Rail Survey Protocol*. San Francisco Bay-Delta Fish and Wildlife Service. June. Available: https://www.fws.gov/sfbaydelta/Documents/June_2015__Final_CCR_protocol.pdf. Accessed: March 7, 2019.

U.S. Fish and Wildlife Service (USFWS). 2016. *Programmatic Environmental Impact Statement for the Eagle Rule Revision*. December. Available: https://www.fws.gov/migratorybirds/pdf/management/FINAL-PEIS-Permits-to-Incidentally-Take-Eagles.pdf. Accessed: March 8, 2019.

U.S. Fish and Wildlife Service (USFWS). 2017. *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle (Desmocerus californicus dimorphus)*. Sacramento, California. 28 pp.

U.S. Fish and Wildlife Service (USFWS), Bureau of Reclamation, Hoopa Valley Tribe, and Trinity County. 1999. *Trinity River Mainstem Fishery Restoration Environmental Impact Statement/Report.* October.

Western Bat Working Group. 2017. *Western Bat Species.* Available: http://wbwg.org/western-bat-species/. Accessed: June 3, 2019.

Yurok Tribe. 2000. *Lower Klamath River Sub-Basin Watershed Restoration Plan*. April.