Long-Term Operation – Final Environmental Impact Statement

# Appendix P – Terrestrial Biological Resources Technical Appendix

November 2024

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# Acronyms and Abbreviations

| | |
|---|---|
| Bay-Delta | San Francisco Bay/Sacramento–San Joaquin Delta |
| CDFW | California Department of Fish and Wildlife |
| DWR | California Department of Water Resources |
| CNDDB | California Natural Diversity Database |
| CNPS | California Native Plant Society |
| CRPR | California Rare Plant Rank |
| CVP | Central Valley Project |
| DPS | distinct population segment |
| EIS | environmental impact statement |
| ESA | Endangered Species Act |
| NWR | National Wildlife Refuge |
| PBF | physical and biological feature |
| PCE | primary constituent element |
| Reclamation | Bureau of Reclamation |
| SRS | Sacramento River Settlement |
| SWP | State Water Project |
| TAF | Thousand acre-feet |
| USACE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |

# Appendix P Terrestrial Biological Resources Technical Appendix

## P.1 Background Information

This appendix documents the biological resources technical analysis to support the impact analysis in the environmental impact statement (EIS). The study area includes the aquatic areas and associated aquatic margins of CVP reservoirs, rivers, and wetlands, including the Bay-Delta. Additionally, the study area includes irrigated agricultural lands of the Sacramento River Settlement (SRS) Contractors due to changes in the operation of Shasta Reservoir that make less water available for SRS actions.

### P.1.1 Trinity River

The Trinity River region includes 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.

#### *P.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 (North Coast Regional Water Quality Control Board and Bureau of Reclamation 2009; U.S. Fish and Wildlife Service 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.1.1.2 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 (North Coast Regional Water Quality Control Board and Bureau of Reclamation 2009; U.S. Fish and Wildlife Service 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 (North Coast

Regional Water Quality Control Board and Bureau of Reclamation 2009; U.S. Fish and Wildlife Service 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 (North Coast Regional Water Quality Control Board and Bureau of Reclamation 2009; North Coast Regional Water Quality Control Board 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 (North Coast Regional Water Quality Control Board and Bureau of Reclamation 2009; North Coast Regional Water Quality Control Board 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 (U.S. Fish and Wildlife Service 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 (North Coast Regional Water Quality Control Board and Bureau of Reclamation 2009).

#### *P.1.1.3 Lower Klamath River 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 (U.S. Fish and Wildlife Service et al. 1999). Wildlife species in the lower Klamath River watershed are similar to those found in the Trinity River watershed.

### P.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 (Bureau of 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 (Bureau of 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 (Bureau of 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 (Bureau of 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 (Bureau of 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.

Lands affected by the SRS Contracts consist of agricultural lands in the vicinity of Sacramento River. Rice fields within this area provide habitat for giant garter snake, western pond turtle, tricolored blackbird, and a variety of migratory waterfowl and wading birds such as snow goose, tundra swan, greater white-fronted goose, black-necked stilt, and least sandpiper. Row crops and alfalfa (if present) in this area provide habitat for a variety of birds and mammals including Swainson’s hawk, white-tailed kite, meadow vole, and California ground squirrel. Freshly cultivated fields, before crop development, provide habitat for mountain plover, horned lark, and Swainson’s hawk.

### P.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 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).

Freshwater 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 (Bureau of Land Management and National Park Service 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 (National Park Service 2014).

### P.1.4 Lower 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 (Bureau of 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 (Bureau of 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 (Bureau of 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 (Bureau of 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 (Bureau of Reclamation et al. 2006). More than 220 species of birds have been recorded along the lower American River and more than sixty 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 thirty 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 (Bureau of 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 (Bureau of Reclamation 2005; Bureau of 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, pampas grass, Spanish broom, Himalayan blackberry, and tamarisk, which can rapidly colonize exposed bar surfaces and stream banks.

### P.1.5 Stanislaus River

Along the Stanislaus River, vegetation is characterized by riparian woodland with cottonwood, willows, white alder, blue elderberry, and Himalayan blackberry. From New Melones Dam, the Stanislaus River flows directly downstream to Tulloch Lake before flowing into Goodwin Lake (Bureau of Reclamation 2010a). 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 Wildlife 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 (California Department of Fish and Wildlife 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 (California Department of Fish and Wildlife 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.1.6 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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 (Bureau of Reclamation and California Department of Water Resources 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 (California Department of Water Resources and Bureau of Reclamation 2002; Bureau of Reclamation and California Department of Water Resources 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.1.7 Bay-Delta Operations

### *P.1.7.1 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). The Delta receives runoff from approximately 40 percent of California's land area and about 50 percent of California's total streamflow (Kreb et al. 2019). 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 (California Department of Water Resources 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 2012).

Substantial areas of the Delta and Suisun Marsh have been modified by agricultural, urban and suburban, and recreational land uses (Bureau of Reclamation et al. 2011; San Francisco Estuary Institute—Aquatic Science Center 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; Kreb et al. 2019). A substantial portion of the emergent wetlands exists as thin strips along the margins of constructed levees (San Francisco Estuary Institute—Aquatic Science Center 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 (San Francisco Estuary Institute—Aquatic Science Center 2012). Adjacent areas of perennial wetlands on the waterside 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. Tidal brackish wetland vegetation includes bulrush, tules, and cattail (U.S. Fish and Wildlife Service 2013). 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 (Bureau of 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 (Bureau of 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). In the Bay Delta, high tidal marsh is now typically confined to natural levees along tidal creek bank and the edges of artificial levees (U.S. Fish and Wildlife Service 2013). The dominant plants are native species, such as saltgrass, pickleweed, marsh gumplant, 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 (Bureau of 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 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 Bay-Delta Program 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 (San Francisco Estuary Institute—Aquatic Science Center 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.1.7.2 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 (California Department of Water Resources 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 Bay-Delta Program et al. 2001; U.S. Fish and Wildlife Service 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 (California Department of Fish and Wildlife 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 Bay-Delta Program et al. 2001; U.S. Fish and Wildlife Service 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 Bay-Delta Program 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 Bay-Delta Program 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 life stages 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 Bay-Delta Program et al. 2001; California Department of Fish and Wildlife 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 (California Department of Fish and Wildlife 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. Permanently 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 Bay-Delta Program et al. 2001). Some of the hunting clubs have implemented wetland management agreements with the 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 Bay-Delta Program 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.1.7.3 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 off-stream storage along the Contra Costa Canal. The 80-acre reservoir is part of 661-acre Contra Loma Regional Park and Antioch Community Park (Bureau of 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 (Bureau of 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 off-stream 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.1.7.4 State Water Project Reservoirs*

The State Water Project (SWP) facilities in the study area include Bethany Reservoir, Patterson Reservoir, and Lake Del Valle and are 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 (California Department of Water Resources 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 (California Department of Water Resources 2005).

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

Lake Del Valle is a 77,100-acre-foot SWP facility located along the South Bay Aqueduct (California Department of Water Resources 2016). Vegetation around Lake Del Valle includes grasslands, chaparral, shrub, oak woodland, and riparian and freshwater habitats (East Bay Regional Park District 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.

**East Bay Municipal Utility District Reservoirs**

The East Bay Municipal Utility District 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 (East Bay Municipal Utility District 1999; East Bay Regional Park District 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 (East Bay Municipal Utility District 1999; East Bay Regional Park District 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 (East Bay Municipal Utility District 1999; East Bay Regional Park District 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 (East Bay Municipal Utility District 1999; East Bay Regional Park District 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.1.7.5 Contra Costa Water District Los Vaqueros Reservoir*

Los Vaqueros Reservoir is a Contra Costa Water District off-stream 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 (Bureau of 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 (Bureau of 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 (Bureau of 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 cattails. 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.

### P.1.8 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 that are formally proposed for federal listing or are candidates for federal listing as threatened or endangered.
- Species identified by the U.S. Fish and Wildlife Service (USFWS) as Birds of Conservation Concern.
- Species considered sensitive by the Bureau of Land Management or U.S. Forest Service.
- Species listed by the state of California as threatened, endangered, or rare (rare status is for plants only).
- 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 the 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 the CDFW and California Native Plant Society (CNPS) to be rare, threatened, or endangered in California. The CNPS's *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 and Table P.1-2. These resource lists were assembled from resources that include the USFWS's IPaC online service and the California Natural Diversity Database (CNDDB) special status plant and animals lists (CDFW 2023a; CDFW 2023b), which were 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 CNDDB was queried for species that are not federally listed.

Table P.1-1. Special-Status Wildlife Species.

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| **Invertebrates** | | | | |
| 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 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 |
| 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | None |
| 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<br>• San Joaquin River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | None |
| Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (X) | 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Stanislaus River<br>• Trinity River | Low (Changes in flow and operations may result in indirect impacts to valley elderberry longhorn beetle habitat.) |
| 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 |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Bay checkerspot butterfly (*Euphydryas editha bayensis*) | FT | Associated with specific host plants that typically grow on serpentine soils. | • Bay-Delta | None |
| 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | None |
| 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. | • Clear Creek<br>• Shasta Lake<br>• Trinity River | Low |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Monarch butterfly (*Danaus plexippus*) | FC | Present throughout California during breeding and migration where blooming nectar and milkweed resources are available. Primarily overwinters in groves along the California coast and Baja California. Associated with its obligate host plant, milkweed (*Asclepias* spp.) (U.S. Fish and Wildlife Service 2020a). | • American River<br>• Bay-Delta<br>• Clear Creek<br>• Sacramento River<br>• San Joaquin River<br>• Stanislaus River<br>• Trinity River | None (Small changes to flow operations are unlikely to affect suitable habitat.) |
| Franklin's bumble bee (*Bombus franklini*) | CE, FE | Nests in abandoned rodent burrows or similar cavities in an extremely limited range from Southern Oregon to Trinity County in Northern California (U.S. Fish and Wildlife Service 2018). | • Trinity River | None |
| Crotch bumble bee (*Bombus crotchii*) | CE | Historically occurred from the northern Central Valley to Baja Mexico. 70% of this species range has been lost in California and now primarily persists in coastal southern California habitats and in a few populations around Sacramento (Hatfield and Jepsen 2021). | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River | None |
| Western bumble bee (*Bombus occidentalis*) | CE | Historically found throughout the Pacific coastal areas of California but has experienced a range decline of at least 80% in the state (Hatfield and Jepsen 2021). | • Bay-Delta<br>• San Joaquin River<br>• Stanislaus River<br>• Trinity River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Mission blue butterfly (*Icaricia 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 |
| 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 |
| 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 |
| **Amphibians** | | | | |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| California tiger salamander (*Ambystoma californiense*) | FT, ST, WL | 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Stanislaus River | None |
| Western spadefoot (*Spea hammondii*) | SSC, PT | 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 (U.S. Fish and Wildlife Service 2005). | • American River<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Stanislaus River | None |
| 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 |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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. | • Battle Creek (upper reaches)<br>• Mill Creek<br>• Paynes Creek<br>• Shasta Lake<br>• Trinity River | None |
| Foothill yellow-legged frog (*Rana boylii*) - South Sierra DPS (X) | FE, SE | 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. | • Lower American River<br>• Stanislaus River | Moderate (Changes in flow and operations may result in direct impacts to foothill-yellow legged frog.) |
| Foothill yellow-legged frog (*Rana boylii*) - North Coast DPS | 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. | • Battle Creek (upper reaches)<br>• Bay-Delta<br>• Clear Creek<br>• Mill Creek<br>• Paynes Creek<br>• Sacramento River<br>• Shasta Lake<br>• Trinity River | Moderate (Changes in flow and operations may result in direct impacts to foothill-yellow legged frog.) |
| California red-legged frog (*Rana draytonii*) | FT, SSC | Permanent and semipermanent aquatic habitats such as creeks and coldwater ponds, with emergent and submergent vegetation; may aestivate in rodent burrows or cracks during dry periods. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| **Reptiles** | | | | |
| Northwestern pond turtle (*Actinemys marmorata*) (X) | SSC, PT | 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. | • American River<br>• Bay-Delta<br>• Clear Creek<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River | Moderate (Changes in flow and operations may result in direct impacts to northwestern pond turtle.) |
| Blunt-nosed leopard lizard (*Gambelia sila*) | FE, FP, SE | 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 |
| 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 |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) | FE, FP, 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 |
| Giant garter snake (*Thamnophis gigas*) (X) | 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | Low |
| **Birds** | | | | |
| Tricolored blackbird (nesting colony) | SSC, ST[1] | Nests colonially in tules, cattails, willows, thistles, blackberries, and other dense vegetation. Forages in grasslands and agricultural fields. Reclamation | • American River<br>• Bay-Delta<br>• Sacramento River<br>• Stanislaus River | None |

[1] Emergency protection under the California Endangered Species Act granted on December 3, 2014, by the California Fish and Game Commission, which voted to list as Threatened on April 19, 2018, official notice pending.

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| (*Agelaius tricolor*) | | (2010b) 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. | • Sutter Bypass<br>• Yolo Bypass | |
| 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. | • Bay-Delta<br>• Sacramento River | None |
| Long-eared owl (*Asio otus*) | BCC, 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). | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Yolo Bypass | None |
| Oak titmouse (*Baeolophus inornatus*) | BCC | Oak woodlands, including scrub oak woodland, from southwest Oregon to northwest Baja California (Cornell Lab of Ornithology 2017). | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| | | | • Yolo Bypass | |
| Northern harrier (*Circus hudsonius*) | BCC, SSC | Forages in marshes, grasslands, and ruderal habitats; nests in extensive marshes and wet fields. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Yolo Bypass | None |
| 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. | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River<br>• Yolo Bypass | None |
| Short-eared owl (nesting) (*Asio flammeus*) | BCC, 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, | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| | | the Bay-Delta, northeastern Modoc plateau, the east side of the Sierra from Lake Tahoe south to Inyo County, and the San Joaquin Valley. | | |
| Burrowing owl (nesting and wintering sites) (*Athene cunicularia*) | BCC, CE | 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Stanislaus River<br>• Sutter Bypass<br>• Yolo Bypass | None |
| Marbled murrelet (*Brachyramphus marmoratus*) | FT, SE | Pacific Ocean, but nesting occurs in old growth forest. | • Bay-Delta | None |
| 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Stanislaus River<br>• Sutter Bypass<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Western snowy plover (*Charadrius nivosus 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 | Low |
| 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | None |
| Western yellow-billed cuckoo (nesting) (*Coccyzus americanus occidentalis*) (X) | 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 (2010b) concluded this species could potentially occur near New Melones Reservoir. Detected by Bay-Delta Conservation Plan surveys in 2009 near Walnut Grove. Likely to nest and forage in the upper Sacramento River area. | • Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin Reservoir<br>• Trinity River | Low |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Yellow warbler (nesting) (*Setophaga petechia*) | SSC | Nests in riparian woodland and riparian scrub habitats. Forages in a variety of wooded and shrub habitats during migration. Reclamation (2010b) 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. | • Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• Shasta River/Shasta Lake<br>• Trinity River | Low |
| 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. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Sutter Bypass<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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 | Low |
| Greater sandhill crane (nesting and wintering) (*Antigone canadensis tabida*) | FP, ST | 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<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | Low |
| Bald eagle (nesting and wintering) (*Haliaeetus leucocephalus*) | BCC, FD, FP, SE | 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. | • American River<br>• Bay-Delta<br>• Clear Creek<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Sutter Bypass<br>• Trinity River<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | Low |
| California black rail (*Laterallus jamaicensis coturniculus*) | BCC, FP, ST | 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 | Low |
| Least tern (*Sternula antillarum browni*) | FE, FP, SE | Sandy or gravelly areas along bays, estuaries, lagoons, within the Bay-Delta. | • Bay-Delta | Low |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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). | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River<br>• Yolo Bypass | Low |
| Suisun song sparrow (*Melospiza melodia maxillaris*) | BCC, SSC | Brackish marshes around Suisun Bay. | • Bay-Delta | Low |
| 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 (2010b) concluded this species occurs near New Melones Reservoir. Known to nest along the Sacramento River. | • American River<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• Shasta River/Shasta Lake<br>• Sutter Bypass<br>• Trinity River<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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. | • American River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | Low |
| California Clapper rail (*Rallus longirostris obsoletus*) | FE, FP, SE | Dense marshy areas of the Bay-Delta region. | • Bay-Delta | Low |
| Bank swallow (nesting) (*Riparia riparia*) (X) | 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 River in the northern Central Valley. | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Trinity River<br>• Yolo Bypass | Low (This species is vulnerable to changes in flow regimes.) |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Least Bell's vireo (nesting) (*Vireo bellii pusillus*) (X) | 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | Low |
| **Mammals** | | | | |
| 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. | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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. | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River<br>• Yolo Bypass | None |
| 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). | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Stanislaus River<br>• Yolo Bypass | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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). | • American River<br>• Bay-Delta<br>• Clear Creek<br>• New Melones Reservoir<br>• Sacramento River<br>• San Joaquin River<br>• San Luis Reservoir<br>• Shasta River/Shasta Lake<br>• Stanislaus River<br>• Trinity River<br>• Yolo Bypass | None |
| Nelson's antelope squirrel (*Ammospermophilus nelson*) | 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 |
| 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Shasta River/Shasta Lake | None |
| Fresno kangaroo rat (*Dipodomys nitratoides exilis*) | FE, SE | Nearly level, light, friable soils in chenopod scrub and grassland communities. | • San Joaquin River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Southern sea otter (*Enhydra lutris nereis*) | FP, FT | 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 |
| California wolverine (*Gulo gulo*) | FP, PT, ST | 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). | • Battle Creek<br>• Butte Creek<br>• Mill Creek<br>• Paynes Creek<br>• Shasta River/Shasta Lake<br>• Trinity River | None |
| Humboldt marten (*Martes caurina humboldtensis*) | CE, FT, 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 |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| 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 2012. Likely still extant. | • Bay-Delta<br>• San Joaquin River<br>• Stanislaus River | Low |
| Fisher (*Pekania pennanti*) | SSC, ST | 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. | • Battle Creek<br>• Deer Creek<br>• Mill Creek<br>• Paynes Creek<br>• Tributaries to upper Sacramento<br>• Trinity River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| Salt marsh harvest mouse (*Reithrodontomys raviventris*) | FE, FP, SE | 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 | None |
| 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 | None |
| 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 | • Bay-Delta<br>• San Joaquin River<br>• Stanislaus River | None |

| Species[a] | Status[b] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[c] |
|---|---|---|---|---|
| | | the southern part of the Delta), and a recent reintroduction on private lands adjacent to the San Joaquin River NWR. | | |
| San Joaquin kit fox (*Vulpies macrotis mutica*) | FT, ST | Saltbush scrub, grassland, oak, savanna, and freshwater scrub. | • Bay-Delta<br>• San Joaquin River | None |
| 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. | • Battle Creek (upper reaches)<br>• Butte Creek<br>• Dear Creek<br>• Mills Creek<br>• Paynes Creek | None |

Reclamation = Bureau of Reclamation; NWR = National Wildlife Refuge

[a] Species denoted with "(X)" are addressed in the Reinitiation of Consultation and environmental impact statement.

[b] *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

[c] *Potential for Effect:*
None = No operational changes are proposed or likely to occur within suitable habitat in the known range of the species.
Low = Suitable habitat for this species has the potential to overlap with the project area and/or is present in some areas proposed for operational changes.
Moderate = Operational changes are proposed in areas that support or could support suitable habitat for this species.

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

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| Adobe sanicle (*Sanicula maritima*) | SR, 1B.1 | Clay and serpentine soils in chaparral, coastal prairie, meadow and seeps, and annual grassland. | • Bay-Delta | None |
| Beach layia (*Layia carnosa*) | FE, SE, 1B.1 | Coastal dunes and coastal scrub on sandy soils. | • Bay-Delta | None |
| Antioch Dunes evening-primrose (*Oenothera deltoides* ssp. *howellii*) | FE, SE, 1B.1 | 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. | • Bay-Delta | None |
| Bensoniella (*Bensoniella oregona*) | SR, 1B.1 | Bogs and fens, meadows and seeps, and mesic areas in lower montane coniferous forest. | • Trinity River | None |
| 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. | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River<br>• Sutter Bypass<br>• Yolo Bypass | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| 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. | • Bay-Delta<br>• Sacramento River<br>• Suisun Marsh | None |
| Butte County meadowfoa m (*Limnanthes floccosa* ssp. *californica*) | FE, SE, 1B.1 | Vernal pools and swales in annual grassland. | • Sacramento River and its tributaries in Butte County | None |
| Legenere (*Legenere limosa*) | 1B.1 | Vernal pools and swales in annual grassland. | • Bay-Delta<br>• Sacramento River | None |
| Sanford's arrowhead (*Saggitaria sanfordii*) | 1B.2 | Freshwater mashes and swamps | • Bay-Delta<br>• Sacramento River<br>• San Joaquin River | None |
| California jewelflower (*Caulanthus californicus*) | FE, SE, 1B.1 | Sandy soils on chenopod scrub, Pinyon and juniper woodland, and annual grassland. | • San Joaquin River | None |
| California seablite (*Suaeda californica*) | FE, 1B.1 | Margins of tidal salt marsh. | • Bay-Delta | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| Chinese Camp brodiaea (*Brodiaea pallida*) | FT, SE, 1B.1 | Ephemeral streams, often on serpentine, in cismontane woodland and annual grassland. | • Stanislaus River | None |
| Colusa grass (*Neostapfia colusana*) | FT, SE, 1B.1 | Adobe soils of vernal pools. | • Sacramento River<br>• San Joaquin River<br>• Stanislaus River<br>• Sutter Bypass<br>• Yolo Bypass | None |
| Coulter's goldfields (*Lasthenia glabrata* ssp. *coulteri*) | 1B.1 | Coastal salt marshes and swamps, playas, vernal pools | • Sacramento River<br>• San Joaquin River | None |
| 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. | • Bay-Delta<br>• Sacramento River | None |
| Contra Costa wallflower (*Erysimum capitatum* var. *angustatum*) | FE, SE, 1B.1 | 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. | • Bay-Delta | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| 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 |
| 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 (2010b) concluded this species could potentially occur near New Melones Reservoir. | • Bay-Delta<br>• New Melones Reservoir<br>• San Joaquin River<br>• Stanislaus River | None |
| 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. | • Bay-Delta<br>• Sutter Bypass<br>• Yolo Bypass | None |
| Fleshy owl's-clover (*Castilleja campestris* ssp. *Succulenta*) | FT, SE, 1B.2 | Vernal pools. Historically occurred throughout the southern Sierra Nevada foothills vernal pool complexes. CNDDB documents occurrences near Millerton Lake and near the San Joaquin River | • San Joaquin River | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| 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 |
| Greene's tuctoria (*Tuctoria greenei*) | FE, SR, 1B.1 | Dry vernal pools. | • American River<br>• Sacramento River<br>• San Joaquin River<br>• Shasta River/Shasta Lake | None |
| Hairy Orcutt grass (*Orcuttia pilosa*) | FE, SE, 1B.1 | Vernal pools. | • New Melones Reservoir<br>• San Joaquin River | None |
| Hartweg's golden sunburst (*Pseudobahia bahiifolia*) | FE, SE, 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. | • San Joaquin River<br>• Stanislaus River | None |
| Hoover's spurge (*Euphorbia hooveri*) | FT, 1B.2 | Below the high-water mark of large northern hardpan and volcanic vernal pools. | • American River<br>• Sacramento River<br>• San Joaquin River | None |
| Keck's checkerbloom (*Sidalcea keckii*) | FE, 1B.1 | Serpentine clay soils in cismontane woodland, valley, and foothill grassland. | • American River<br>• Bay-Delta<br>• Sacramento River<br>• San Joaquin River | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| Large-flowered fiddleneck (*Amsinckia grandiflora*) | FE, SE, 1B.1 | Cismontane woodland, valley, and foothill grassland slopes. | • Bay-Delta | None |
| Livermore tarplant (*Deinandra bacigalupii*) | SE, 1B.1 | Alkaline meadows and seeps. | • Bay-Delta | None. |
| Marin western flax (*Hesperolinon congestum*) | FT, ST, 1B.1 | Serpentinite chaparral, serpentinite grassland. | • Bay-Delta | None |
| 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 | None |
| 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 |
| Pacific manzanita (*Arctostaphylos pacifica*) | SE, 1B.1 | Chaparral and coastal scrub. Known only from San Bruno Mountain in San Mateo County. | • Bay-Delta | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| 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 |
| Palmate-bracted bird's-beak (*Chloropyron palmatum*) | FE, SE, 1B.1 | Alkaline sites in grassland and chenopod scrub. | • Bay-Delta | None |
| Pitkin marsh lily (*Lilium pardalinum* ssp. *Pitkinense*) | FE, SE, 1B.1 | Mesic, sandy soils in cismontane woodland, meadows and seeps, freshwater marshes, and swamps. | • Bay-Delta | None |
| 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 |
| Presidio manzanita (*Arctostaphylos montana* 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 |
| 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 |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| Sacramento Orcutt grass (*Orcuttia californica* var. *viscida*) | FE, SE, 1B.1 | Vernal pools. | • Sacramento River | None |
| San Bruno Mountain manzanita (*Arctostaphylos imbricata*) | SE, 1B.1 | Rocky areas in chaparral and coastal scrub habitat. | • Bay-Delta | None |
| San Francisco lessingia (*Lessingia germanorum*) | FE, SE, 1B.1 | Coastal scrub on remnant dunes. | • Bay-Delta | None |
| San Francisco popcornflower (*Plagiobothrys diffusus*) | SE, 1B.1 | Coastal prairie and annual grassland. | • Bay-Delta | None |
| San Joaquin Valley Orcutt grass (*Orcuttia inaequalis*) | FT, SE, 1B.1 | Vernal pools. | • San Joaquin River | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| 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 |
| 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 |
| 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 |
| Shasta fawn Lily (*Erythronium shastense*) | 1B.2 | North-facing, shaded limestone outcrops in forest openings. | • Shasta Lake | None |
| Shasta huckleberry (*Vaccinium shastense* ssp. *shastense*) | 1B.3 | Stream banks, conifer forest understory, crevices or seeps among rock outcrops, chaparral. | • Shasta Lake | None |
| Shasta limestone monkeyflower (*Erythranthe taylorii*) | 1B.1 | Limestone outcrops and cliff faces. | • Shasta Lake | None |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| Shasta snow-wreath (*Neviusia cliftonii*) | ST, 1B.2 | Cismontane woodland, lower montane coniferous forest, and riparian woodland. Known only to occur near Shasta Lake. | • Shasta Lake | Low (Operational changes will not exceed_the existing capacity of Shasta Reservoir, therefore the maximum reservoir elevation would be within the historical range and no new land would be inundated.) |
| Slender Orcutt grass (*Orcuttia tenuis*) | FT, SE, 1B.1 | Vernal pools. | • Sacramento River | None |
| 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 | Low |
| 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. | • Bay-Delta<br>• Suisun Marsh<br>• Sutter Bypass<br>• Yolo Bypass | None |
| 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 | Low |

| Species | Status[a] | Habitat/Distribution | Areas with Potential for Occurrence | Potential for Effect[b] |
|---|---|---|---|---|
| Tiburon jewelflower (*Streptanthus niger*) | FE, SE, 1B.1 | Serpentine grasslands. Known from only two occurrences on the Tiburon Peninsula. | • Bay-Delta | None |
| Tiburon mariposa lily (*Calochortus tiburonensis*) | FT, ST, 1B.1 | Serpentine grasslands. Known only from one occurrence on Ring Mountain Preserve. | • Bay-Delta | None |
| Tiburon paintbrush (*Castilleja affinis* var. *neglecta*) | FE, ST, 1B.2 | Serpentine grasslands. | • Bay-Delta | None |
| Two-fork clover (*Trifolium amoenum*) | FE, 1B.1 | Low elevation grasslands, including swales and disturbed areas, sometimes on serpentinite soils. | • Bay-Delta | None |
| Viburnum (*Viburnum ellipticum*) | 2B.3 | North-facing slopes in chaparral and yellow-pine forest | • Shasta Lake | None |
| White-rayed pentachaeta (*Pentachaeta bellidiflora*) | FE, SE,1B.1 | Annual grassland, often on serpentinite. | • Bay-Delta | None |

Reclamation = Bureau of Reclamation; CNDDB= California Natural Diversity Database; CRPR = California Rare Plant Rank

[a] *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)

[b] *Potential for Effect:*

None = No operational changes are proposed within suitable habitat in the known range of the species.

Low = Operational changes are proposed within suitable habitat in the known range of the species.

## P.1.9 Critical Habitat

*Critical habitat* refers to areas designated by the USFWS (16 U.S.C § 1533) 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, the 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 provisions of section 4 of this 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 the USFWS where the action has potential to adversely modify the habitat for terrestrial species.

The federally listed animal 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.

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

| Common Name | Scientific Name | Year Designated | Jurisdiction |
|---|---|---|---|
| Soft bird's-beak | *Chloropyron molle* ssp. *molle* | 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* | 2021 | USFWS |

USFWS = U.S. Fish and Wildlife Service

## P.1.10 Wetlands and Open Water

Wetlands and open water that occur in the study area are described below.

### *P.1.10.1 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.

**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 osprey 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 (California Department of Water Resources 2004).

### *P.1.10.2 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.

**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.

**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 the USACE (California Department of Water Resources 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 (California Department of Water Resources 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 California Department of Fish and Game 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 (California Department of Water Resources 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 2012, the USACE issued an updated policy guidance letter, *Process for Requesting a Variance from Vegetation Standards for Levees and Floodwalls; Additional Filings* (77 FR 9637-9650) that included procedures for state and local agencies to request variances on a site-specific basis. The California Department of Water Resources has been in negotiations with the 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.1.10.3 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 NWR Complex, and around the Thermalito Afterbay. Both tidal and nontidal, perennial wetlands are found in the Delta and Suisun Marsh.

### 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 (California Department of Fish and Game 1988). 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.

Perennial freshwater wetlands are among the most productive wildlife habitat in California (California Department of Fish and Game 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.

### 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 Bay-Delta Program 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.

**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 (Bureau of 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 (Bureau of 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.

**Agricultural Wetlands**

Some of the agricultural lands in the study area, along the Sacramento River, may qualify as wetlands if inundated for a sufficient period of time and supporting appropriate soils. Rice is the crop type most likely to qualify as wetlands. Rice is a flood-irrigated crop that is a seed-producing annual grass. It is generally grown in leveled fields that are flooded for most of the spring/summer growing period and then dried to mature and facilitate harvesting. Rice fields provide valuable habitat that varies seasonally for a range of wetland and upland wildlife species. Rice is a particularly important food source for wintering migratory waterfowl.

# P.2 Evaluation of Alternatives

This section describes the methods and tools for the evaluation of environmental consequences associated with the action alternatives and the No Action Alternative. This section also describes the results of the impact analysis for each action alternative and the No Action Alternative. Flow changes from operational actions may affect terrestrial species, as discussed below.

## P.2.1 Methods and Tools

The impact assessment considers changes in terrestrial biological resources related to changes in CVP and SWP operations under the action alternatives as compared to the No Action Alternative. This section details methods and tools used to evaluate those effects. It should be noted that Alternative 2 consists of four phases that could be utilized under its implementation. All four phases are considered in the assessment of Alternative 2 to bracket the range of potential impacts.

The CalSim 3 model simulation was utilized to analyze and compare the No Action Alternative and action alternatives. The CalSim 3 model (overview, methods) and associated results are summarized and fully described in Appendix F, *Modeling*.

#### P.2.1.1 Land Cover

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

- Aerial Information Systems. 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 Department of Water Resources. 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 Table P.1-1 and Table P.1-2.

To determine which project components could affect the federally listed terrestrial species identified in Table P.1-1 and Table 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.
- Witham, C. W., R. F. Holland, and J. 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 for federally listed species with the first goal being to avoid effects on the 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 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 the 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 2023c). These species are listed in Table P.1-1 and Table 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 Table P.1-1 and Table 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 qualitatively described rather than quantified.

#### *P.2.1.4 Wetlands and Open Water*

Wetlands and open water 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 open water at a 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

Under the No Action Alternative, Reclamation would operate the CVP consistent with the 2020 Record of Decision, implementing the Proposed Action consulted upon for the 2019 Biological Opinions and the reasonable and prudent measures in the incidental take statements. DWR would operate the SWP consistent with the 2020 Record of Decision and its 2020 Incidental Take Permit. Pursuant to 43 Code of Federal Regulations Section 46.30, the 2020 Record of Decision for the CVP and SWP and the 2020 Incidental Take Permit for the SWP represent current management direction or intensity for the purposes of the No Action Alternative. The No Action Alternative was thoroughly analyzed in Reclamation's previous EIS, which provides a basis for evaluating new alternatives. Reclamation would continue to operate each tributary with the same primary purposes as described in the Common Components seasonal operations in EIS *Chapter 3, Alternatives*.

### P.2.3 Alternative 1

Alternative 1 (Water Quality Control Plan) operates the CVP and SWP to D-1641 and tributary specific water right requirements and agreements. Alternative 1 does not include the operational restrictions in the USFWS and NMFS 2008 and 2009 Biological Opinions Reasonable and Prudent Alternatives or 2019 Biological Opinions for the management of exports, Delta salinity, and releases from upstream facilities. Comparisons using analyses of Alternative 1 inform the effectiveness of non-flow measures versus addressing stressors by restrictions on water operations. Large investments in habitat restoration have occurred and continue. Reclamation would continue to operate each tributary with the same primary purposes as described in the Common Components seasonal operations in EIS *Chapter 3*, *Alternatives*.

#### *P.2.3.1 Potential Changes to Terrestrial Resources from Seasonal Operations*

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 harm the species, directly alter habitat availability or quality, or result in vegetation changes that would alter habitat availability or quality. The 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. In 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 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.

**Trinity River**

Different alternatives may import water from the Trinity River to the Sacramento River to a different extent in different years and on different patterns. Flows under the Trinity River Restoration Program Record of Decision (2000) are common to all alternatives; therefore, impacts occur as a result of different reservoir levels and rare safety of dam releases. Alternative 1 flow changes in the Trinity River are the same as the No Action Alternative. However, CalSim 3 modeling indicates that average monthly flow released below Lewiston Dam under Alternative 1 would generally be higher than or similar to flow under the No Action Alternative, except in below normal water years in March when Alternative 1 flows would be lower than the No Action Alternative flows. The highest flows for both alternatives occur primarily in May and June of all water year types and during winter, spring, and early summer of wet and above normal water years. Throughout the full simulation period, flows on average are higher under Alternative 1 in December through March, with the greatest increases (greater than 5%) in flow in February. The simulated results are attributed to modeling assumptions for Alternative 1 described in Appendix F. Furthermore, as explained in the Summary Chapter, Section 0.1.7.2, *Trinity River Division,* changes or impacts described for resources associated with the Trinity Reservoir levels and Trinity River flows have been previously analyzed.

*Northwestern Pond Turtle*

Alternative 1 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to northwestern pond turtle.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Alternative 1 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to foothill yellow-legged frog.

**Sacramento River**

Under all the action alternatives, flows in the upper Sacramento River result from controlled releases from Shasta and Keswick reservoirs, as well as transfers from the Trinity River and natural accretions. The releases and transfers are determined by a suite of laws, regulations, contracts, and agreements to address demands of water users, requirements for water quality, and needs of fish populations throughout the river and the Delta. In particular, operations of all the action alternatives are regulated by SWRCB’s D-1641 decision, requiring flow releases to meet Delta standards, and WRO 90-5 decision, requiring coldwater releases to meet water temperature targets at compliance points in the upper Sacramento River. Flow releases are high during the summer to satisfy downstream demands of water users and Delta water quality, and to meet water temperature requirements of incubating winter-run Chinook salmon eggs and alevins downstream of Keswick Dam.

Alternative 1 (Water Quality Control Plan) operates the CVP and SWP to D-1641 and tributary specific water right requirements and agreements. Reclamation will operate minimum instream flows under Alternative 1 at 2,300 cubic feet per second (cfs) from March through August and 3,250 cfs from September through February, with a schedule providing for flow reductions in critically dry years (WRO Order 90-5). Alternative 1 does not include specific winter or spring pulse flows. Under Alternative 1, Reclamation would make releases based on Delta requirements under D-1641, settlement contracts, and making use of available water supply for deliveries to CVP water service contractors while reducing the potential for spill. Reclamation would operate the Temperature Control Device on Shasta Dam, consistent with WRO Order 90-5, to target 56°F at the most downstream location feasible from May 15 through October 30 each year.

CalSim 3 modeling indicates that average flow released at Keswick Dam under Alternative 1 would generally be higher than or similar to flow under the No Action Alternative in December through July, except in critically dry water years in February, when the Alternative 1 flow would be lower than the No Action Alternative flows. The largest increases under Alternative 1 compared to the No Action Alternative occur in June and December of an above normal water year, with increases of 1,522 cfs and 1,517 cfs, respectively. The largest decreases under Alternative 1 compared to the No Action Alternative occur in August and September of an above normal water year, with decreases of 1,277 cfs and 1,733 cfs, respectively. Throughout the full simulation period, flows on average are higher under Alternative 1 in October and December through June, with the greatest increases in flow in June and the greatest decreases in flow in August.

CalSim 3 modeling indicates that average flow released at Red Bluff Diversion Dam under Alternative 1 would generally be higher than or similar to flow under the No Action Alternative from December through July, and generally lower or similar to flow under the No Action Alternative from August through November. The largest increases in flow under Alternative 1 occur in December of an above normal year (1,402 cfs), in June of wet, above normal, and below normal water years (523 cfs, 1,249 cfs, and 1,000 cfs, respectively), and in July of critically dry years (1,045 cfs). The largest decreases in flow under Alternative 1 occurs in August, September, and November of wet, above normal, and below normal water years. Throughout the full simulation period, flows on average are higher under Alternative 1 in December through June, with the greatest increases in flow in June and the greatest decreases in flow in August.

*Northwestern Pond Turtle*

Aquatic habitat used by Northwestern pond turtle is for breeding, feeding, overwintering, and sheltering, while adjacent upland areas are used for nesting and overwintering/aestivation. Preferred aquatic habitat includes areas with abundant basking sites for thermoregulation, such as logs, rocks, and emergent vegetation; underwater shelter sites such as undercut banks, submerged vegetation, mud, rocks, and logs; and slow-moving or standing water (USFWS 2023a). Compared to the No Action Alternative, Alternative 1 would result in relatively minor increased flows which may cause some inundation of upland nesting, basking, overwintering, aestivation, and movement habitat, and may increase water depth to the extent that some aquatic breeding and basking habitat becomes unsuitable.

Northwestern pond turtles generally move less than 1,640 feet between aquatic habitat and terrestrial upland habitat, and connectivity between these habitats is important for short-term movement, migration, and dispersal. Nesting habitat is typically fairly exposed with limited, if any, canopy cover, and sparsely covered in short grasses and forbs. Nests are located an average of 167 feet from water, with a range of 9.8 to 1,312 feet from water, in dry, compact soils with a high clay or silt component, and are usually situated 3.5 to 4.7 inches below the surface. Overwintering/aestivation sites occur above the ordinary high-water line or beyond the riparian zone, are often characterized by the presence of leaf litter, and are less exposed compared to breeding sites (U.S. Fish and Wildlife Service 2023a).

If higher flows under Alternative 1 result in increased velocity and water levels, this may directly kill eggs if nests are inundated and/or kill hatchlings, and make hatchlings more vulnerable to predation by causing shallower areas to become more accessible to aquatic predators. Increased flows relative to the No Action Alternative may also result in lower water temperatures, which can slow growth rates of developing juveniles. Decreased flows relative to the No Action Alternative could limit availability of aquatic breeding, and may increase distances juveniles would need to traverse between areas of aquatic and upland habitat, making them more vulnerable to predation. Lower flows relative to the No Action Alternative may also cause aquatic habitat to become unsuitable for hatchlings and force them to move into deeper areas that are more accessible to aquatic predators. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. In the Sacramento River watershed, northwestern pond turtle can also utilize irrigation ditches and rice fields as aquatic habitat in addition to the habitat criteria described above. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-1.

*Foothill Yellow-Legged Frog (North Coast DPS)*

The primary threats to foothill yellow-legged frog include altered hydrology due to dams, pulse flows, water diversions, and channel modification; nonnative species; disease and parasites, including chytridiomycosis; agriculture; recreation; mining; urbanization; drought; high-severity wildfire; extreme flood events; and climate change (U.S. Fish and Wildlife Service 2023b). Changes in flows, may dislodge, isolate, or kill egg masses, and strand and/or kill tadpoles and metamorphs. Higher flows and resulting increases in velocity and water levels may kill adults feeding or residing (e.g., for breeding or overwintering) in the Sacramento River downstream of Shasta Dam and through Keswick reservoir, and may lead to sedimentation of cobbled substrates. Cobbled substrates are used for oviposition and tadpole and metamorph development; thus, sedimentation would decrease the suitability and availability of habitat for these three life stages. High flows in the summer will decrease water temperatures, which can preclude breeding, slow development of eggs, tadpoles, and metamorphs and make these life stages more vulnerable to predation and changing habitat conditions and may make tadpoles and metamorphs more susceptible to pathogens (U.S. Fish and Wildlife Service 2023b). Seasonal operations under Alternative 1 may reduce natural variability in water releases, beyond major flood events, which will create more stable conditions (i.e., more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and increase sedimentation) and provide some potential benefits for foothill yellow-legged frogs. A summary of the positive and adverse impacts to foothill yellow-legged frog is provided in Table P.2-2.

*Giant Garter Snake*

Alternative 1 does not propose to decrease water diversions to SRS Contractors in agricultural areas. Therefore, temporary loss of habitat for giant garter snake as a result of cropland idling/shifting actions would not occur.

*Bank Swallow*

Flow change could potentially affect nesting habitat for bank swallows on the Sacramento River. Because of resulting limited available habitat and the reduction of natural river processes, the species is highly sensitive to reductions in winter flows necessary to erode banks for habitat creation, and high flows during the breeding season (generally April 1–August 31) resulting in 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 River that occur after March when the swallows have nested and laid eggs in the burrows could adversely impact bank swallows and 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 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 bank swallow 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).

CalSim 3 model results illustrate that, relative to the No Action Alternative, flows on the Sacramento River would be higher under Alternative 1 for the majority of bank swallow breeding season (April through June) while flows would be lower than the No Action Alternative towards the end of the breeding season (July to August). Projected flows would be higher under Alternative 1 during part of the non-breeding season, where higher flows would occur from December to March. The increased flows in the Sacramento River during a majority of the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat and therefore could result in a beneficial effect on bank swallow.

Average flows on the Sacramento River downstream of Keswick Reservoir, at Bend Bridge, and below Red Bluff Diversion Dam would increase under Alternative 1 for the majority of the breeding season from April through June, while flows would be lower than the No Action Alternative towards the end of the breeding season from July to August. CalSim 3 model results predict average flow staying below 14,000 cfs in normal water years. Average flows on the Sacramento River at Hamilton City, at Wilkins Slough, and at Verona under Alternative 1 would generally decrease during the bank swallow breeding season except in April through June, where flow increases are relatively minor. Monthly flows during normal water years are highest at Verona during the bank swallow breeding season, with predicted monthly flows between 11,000 and 19,161 cfs under Alternative 1. Flows greater than 14,000 cfs during breeding season such as at Verona, where flows in below normal years are predicted to be over 14,600 cfs in April (approximately 181 cfs more than the No Action Alternative), could result in localized bank collapses that result in partial or complete colony failure in April through June as described above. Downstream of the Sacramento River at Verona, the river becomes channelized by levee banks which do not provide suitable bank habitat for nesting, therefore there is no potential for

Alternative 1 to impact this species downstream of the confluence of the Sacramento and Feather Rivers. A summary of the positive and adverse impacts to bank swallow is provided in Table P.2-3.

*Western Yellow-Billed Cuckoo*

Seasonal operations will on average maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration. Seasonal operations under Alternative 1 may reduce natural variability beyond major flood events and will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat 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. However, habitat conditions with implementation of Alternative 1 are expected to be similar to habitat conditions experienced by western yellow-billed cuckoo under the No Action Alternative. A summary of the positive and adverse impacts is provided in Table P.2-4.

*Least Bell's Vireo*

Least Bell's vireo does not currently occupy breeding habitat in the upper Sacramento River and is unlikely to recolonize the area during the timeframe of all action alternatives. However, changes to the riparian habitat throughout the vireo's historic breeding range in central California could adversely impact the population's ability to disperse and colonize new areas beyond the current breeding habitats occupied in southern California. Changes in flow and operations could adversely impact least Bell's vireo through changes in riparian habitats if the species recolonizes the Sacramento River Valley during the timeframe of all action alternatives. The proposed changes, however, are unlikely to produce a measurable change in quantity or quality of least Bell's vireo habitat in the upper Sacramento watershed due to the minimal change in hydrological conditions associated with the action alternatives, and there is no apparent mechanism by which these changes could result in harm to individual least Bell's vireos. In addition, the action alternatives may provide benefits to the species through high fall flows, avoiding drought stress in riparian or wetland vegetation, and by keeping more constant spring flows and avoiding erosion at restoration sites. A summary of the positive and adverse impacts to both Western Yellow-Billed cuckoo and Least Bell's vireo is provided in Table P.2-4.

**Clear Creek**

Under all the action alternatives, flows in Clear Creek result from controlled releases from Whiskeytown Dam, as well as transfers from the Trinity River and natural accretions. The releases and transfers are determined by a suite of laws, regulations, contracts, and agreements to address demands of water users, requirements for water quality, and needs of fish populations throughout the river and the Delta. Under all the action alternatives, operations are regulated by CVP and fisheries management priority decisions which require water temperature regulation. Commitment to additional priorities vary depending on the alternative. Dry hydrologic conditions often lead to inadequate storage in Whiskeytown Reservoir for operators to provide suitable conditions for salmonids and other native species in Clear Creek. In most cases, however, water temperature rather than flow is the limiting factor creating unsuitable conditions.

Flow releases are strategically high at summer and fall to satisfy downstream demands of irrigation and other beneficial uses including hydroelectric power generation, re-establishment of Central Valley spring-run Chinook salmon and California Central Valley steelhead, recreation, and upper Sacramento River temperature control. Starting in November, Reclamation will draw down Whiskeytown Reservoir to create flood management space, generally refilling in April or May. On occasion, imports of Trinity River water to Whiskeytown Lake may be suspended to avoid aggravating high flow conditions in the Sacramento Basin. During the summer and early fall, Reclamation operates to provide reservoir elevations as full as practical for recreation. Summer and fall imports help maintain Whiskeytown Reservoir elevations, provide cool water for releases to Clear Creek for water temperature control objectives, decrease residence time in Lewiston Reservoir for Trinity River temperature control, and help maintain water temperature objectives in the Sacramento River by supplying water to Keswick Reservoir.

Alternative 1 (Water Quality Control Plan) operates the CVP and SWP to D-1641 and tributary specific water right requirements and agreements. Reclamation will operate minimum instream flows at 50 cfs from January through October and 100 cfs in normal water years and 70 cfs on critical water years from November through December as directed by the Instream Flow Preservation Agreement. Alternative 1 does not include specific winter or spring pulse flows. while there is no specific requirement in any SWRCB WROs under Alternative 1, Reclamation would target Whiskeytown Dam releases to not exceed the mean daily temperatures at Igo gauge of 61°F from June 1 through August 15, 60°F from August 16 through September 15, and 56°F from Sept 15 through Nov 15. In dry, critical, or import curtailment years, Reclamation may not be able to meet these water temperatures and will operate Whiskeytown Dam as close to these water temperatures as practicable within the constraints of minimum instream flows.

CalSim 3 modeling indicates that average flow released at Whiskeytown Dam under Alternative 1 would generally be lower than or similar to flow under No Action Alternative regardless of water year type. The largest decrease under Alternative 1 compared to the No Action Alternative occur in February, April through June, and October.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 1 would result in decreased flows of up to 181 cfs which could adversely impact availability of aquatic breeding habitat and may increase distances juveniles would need to traverse between areas of aquatic and upland habitat, making them more vulnerable to predation. Lower flows relative to the No Action Alternative may also cause aquatic habitat to become unsuitable for hatchlings and force them to move into deeper areas that are more accessible to aquatic predators. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-1.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Alternative 1 proposed flow changes in Clear Creek could adversely impact aquatic habitat for the North Coast DPS of the foothill yellow-legged frog similar to those as described above in Section P.2.3.1.2, *Sacramento River*. A summary of the positive and adverse impacts to foothill yellow-legged frog is provided in Table P.2-2**.**

**Lower American River**

Under all alternatives, flows in the lower American River result from controlled releases from Folsom Reservoir and Lake Natoma, as well as natural accretions. The releases and transfers are determined by a suite of laws, regulations, contracts, and agreements to address demands of water users, requirements for water quality, and needs of fish populations throughout the river and the Delta. In particular, operations of all the alternatives are regulated by SWRCB's D-1641 decision, which requires flow releases to meet Delta standards, which requires coldwater releases to meet water temperature targets at compliance points and salmonid life cycle needs. However, additional management commitments may be incorporated depending on the alternative. Dry hydrologic conditions often lead to inadequate storage in Folsom Reservoir and Lake Natoma for operators to provide suitable conditions for salmonids and other native species in the San Joaquin River. In most cases, however, water temperature rather than flow is the limiting factor creating unsuitable conditions, as discussed below. Flow releases are high during the summer to satisfy downstream demands of flood control, M&I and agricultural water supplies, hydroelectric power generation, steelhead and fall-run Chinook salmon, recreation, and Delta water quality.

CalSim 3 modeling indicates that the average of all simulated flow releases in the lower American River would be generally highest in June and lowest in September under Alternative 1 compared to the No Action Alternative. The largest increases in flow occur in June of below normal years (870 cfs) and in April of critically dry years (711 cfs) when compared to the No Action Alternative. The largest flow decreases would occur in September of dry and critically dry years (-612 cfs) when compared to the No Action Alternative.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 1 would result in increased flows in the lower American River which may contribute to similar adverse effects to northwestern pond turtle as described above in Section P.2.3.1.2. Lower flows resulting from Alternative 1 may also cause similar adverse effects to aquatic habitat as described above in Section P.2.3.1.2. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-1.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

Under all the action alternatives, flows would not affect the South Sierra DPS of foothill yellow-legged frog in the lower American River, as there would be no actions that affect suitable habitat.

*Western Yellow-Billed Cuckoo*

Similar to Section P.2.3.1.2, *Sacramento River*, seasonal operations will on average maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration. Seasonal operations under Alternative 1 may reduce natural variability beyond major flood events. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, habitat conditions with implementation of Alternative 1 are expected to be similar to habitat conditions experienced by western yellow-billed cuckoo under the No Action Alternative. A summary of the positive and adverse impacts to Western Yellow-Billed cuckoo is provided in Table P.2-4.

**Stanislaus River**

Under all the alternatives, flows in the Stanislaus River result from controlled releases from New Melones Dam and Goodwin Dam, as well as natural accretions. The releases and transfers are determined by a suite of laws, regulations, contracts, and agreements to address demands of water users, requirements for water quality, and needs of fish populations throughout the river and the Delta. In particular, operations of all the action alternatives are regulated by SWRCB's D-1641 decision, which requires flow releases to meet Delta standards and coldwater releases to meet temperature targets at compliance points in the lower San Joaquin River. Additional water regulation commitments may be incorporated depending on the alternative. Dry hydrologic conditions often lead to inadequate storage in New Melones Reservoir for operators to provide suitable conditions for salmonids and other native species in the lower San Joaquin River. In most cases, however, water temperature rather than flow is the limiting factor creating unsuitable conditions, as discussed below. Flow releases are high during the spring and late October to satisfy downstream demands of water users, Central Valley steelhead protection, and water quality. Alternative 1 does not include specific fall through spring pulse flows.

CalSim 3 modeling indicates that average flow released below Goodwin Dam under Alternative 1 compared to No Action Alternative would generally be higher November, December, February, and June in most water year types. The largest increases under Alternative 1 compared to the No Action Alternative occur in December of above normal years (100 cfs), in November of below normal years (147 cfs), and May of dry years (257 cfs). The largest decreases under Alternative 1 compared to the No Action Alternative occur in October of all water year types. Throughout the full simulation period, flows on average are higher under Alternative 1 in November, December, February, and April through June, and would be lower in October.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 1 would result in relatively minor increased flows in the Stanislaus River, which may contribute to similar adverse effects to northwestern pond turtle as described above in Section P.2.3.1.2. Lower flows resulting from Alternative 1 may also cause similar adverse effects to aquatic habitat as described above in Section P.2.3.1.2. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-1.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

Under all the alternatives, flows would not affect the South Sierra DPS of foothill yellow-legged frog upstream of New Melones Reservoir, as there would be no actions that affect suitable habitat in that area. While there are no currently documented South Sierra DPS foothill yellow-legged frog populations below New Melones Reservoir, suitable breeding habitat potentially exists along the river, and the absence of foothill yellow-legged frog cannot be confirmed as survey data is lacking in this area for the species. Hayes et al. (2016) reports that breeding can take place on the Stanislaus River below New Melones Reservoir as late as July, indicating presence of the species, but does not go into further detail about the current population. Given the best available data, Reclamation is assuming presence of this species for all relevant life stages in the action area but the species' presence has not been definitively proven in the action area.

Compared to the No Action Alternative, Alternative 1 would result in relatively minor increased flows in the Stanislaus River, which may contribute to similar adverse effects to foothill yellow-legged frog as described above in Section P.2.3.1.2. Lower flows resulting from Alternative 1 may also cause similar adverse and beneficial impacts to aquatic habitat as described above in Section P.2.3.1.2. Seasonal operations under Alternative 1 may reduce natural variability in water releases, beyond major flood events, which would create more stable conditions (i.e., more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and increase sedimentation) and provide some potential benefits for foothill yellow-legged frogs. Ultimately the limited discretion on flow releases from New Melones Reservoir into the Stanislaus River will result in a limited version of the impacts described in Section P.2.3.1.2 on the relevant life stages for this species. Those limited impacts could adversely affect all the applicable life stages for the foothill yellow legged frog associated with lower water temperatures in the summer, higher flow water releases during developmental periods, and a minor increase in sedimentation of cobbled substrates. A summary of the positive and adverse impacts to foothill yellow-legged frog is provided in Table P.2-2.

*Western Yellow-Billed Cuckoo and Least Bell's Vireo*

The seasonal operations in the Stanislaus River and generally higher flows will have a negligible impact on the existing riparian vegetation. Additionally, elevated water flows are not anticipated to rise to the level that would cause impacts to nesting western yellow-billed cuckoos or least Bell's vireo.

**San Joaquin River**

There would be no changes in average flows that would affect suitable habitat for northwestern pond turtle, giant garter snake or the South Sierra DPS of foothill yellow-legged frog.

**Bay-Delta**

Reclamation would continue to operate Delta facilities by season with the same primary purposes as described in the Common Components in Appendix E, Section E.2.4, *Delta*. The Suisun Marsh Salinity Control Gates (SMSCG) are the only component in the Bay-Delta where proposed flow changes were found to have the potential to impact terrestrial resources based on flow modeling, therefore, the terrestrial analysis is centered around SMSCG reoperations.

*Northwestern Pond Turtle*

The SMSCG reoperations proposed under Alternative 1 would not include Delta smelt summer and fall habitat actions to improve Delta smelt food supply and habitat. This could incrementally increase marsh salinities in the summer and fall compared to the No Action Alternative. Northwestern pond turtles are a primarily freshwater species, and higher basking activity has been observed in Suisun Marsh in areas with low salinity, indicating an increase in habitat suitability when salinity is decreased and vice versa. Northwestern pond turtles were also found to have higher abundance, survival, and growth rates in areas with reduced salinities (Agha et al. 2020; USFWS 2023a). Thus, a seasonal increase in salinity in summer and fall may result in decreased habitat suitability and contribute to adverse impacts on Northwestern pond turtle. A summary of these impacts to northwestern pond turtle is provided in Table P.2-1.

*Soft Bird's Beak and Suisun Thistle*

SMSCG reoperations under Alternative 1 could incrementally increase marsh salinities in the summer and fall, creating a vegetation shift in Suisun Marsh. Effects on soft bird's beak and Suisun thistle from changes in tidal stage, flow, or erosion are uncertain at this time.

#### *P.2.3.2 Potential Changes to Critical Habitat from Seasonal Operations*

Alternative 1 includes proposed flow changes in the Sacramento River within western yellow-billed cuckoo critical habitat. The proposed changes are unlikely to produce measurable change in quantity or quality of western yellow billed cuckoo habitat, including riparian vegetation, in the upper Sacramento watershed.

Critical habitat for valley elderberry longhorn beetle is present along the American River. However, under the alternatives, proposed flow changes are unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle critical habitat in the American River watershed, as the riparian vegetation of the surrounding habitat would not be measurably altered.

Critical habitat for soft bird's-beak and Suisun thistle is present in the Delta region. SMSCG reoperations under Alternative 1 could incrementally increase marsh salinities in the summer and fall, creating a vegetation shift in Suisun Marsh. However, salinity levels of the habitat in which soft bird's-beak or Suisun thistle are found would not be substantially increased

#### **P.2.3.3** ***Summary of Species Impacts***

The following tables provide a summary of the anticipated positive and adverse impacts to each species analyzed under Alternative 1.

Table P.2-1. Impacts to Northwestern Pond Turtle under Alternative 1

| **Northwestern Pond Turtle** | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Decreased water depth could expand basking areas | Inundation of upland basking, sheltering, overwintering, aestivation, and movement habitat |

| Northwestern Pond Turtle | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| | Increased dispersal distance between aquatic and upland habitat due to decreases in flow |
| | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Increased water depth could cause aquatic breeding and basking habitat to become unsuitable |
| Warmer water temperatures may improve growth of juveniles | Direct mortality or injury due to increased flow velocity |
| | Cooler water temperatures may slow growth of juveniles |
| | Increased predation of hatchlings and juveniles |

Table P.2-2. Impacts to Foothill Yellow-Legged Frog under Alternative 1

| Foothill Yellow-Legged Frog | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Reduce natural variability in water releases, creating more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and less likely to increase sedimentation | Direct mortality or injury due to increased flow velocity |
| | Sedimentation of cobbled substrates from increased flow velocity, decreasing habitat suitability |
| | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Cooler water temperatures in summer may preclude breeding, slow egg development, and growth of tadpoles and metamorphs |
| | Increased predation of tadpoles and metamorphs |
| | Increased susceptibility to pathogens due to change in habitat conditions |

Table P.2-3. Impacts to Bank Swallow under Alternative 1

| Bank Swallow | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Increased flows in the Sacramento River during a majority of the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat in the form of cut banks. | Localized bank collapse that result in partial or complete colony failure from flows greater than 14,000 cfs during the breeding season |

Table P.2-4. Impacts to Western Yellow-Billed Cuckoo and Least Bell's Vireo under Alternative 1

| Western Yellow-Billed Cuckoo and Least Bell's Vireo | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Seasonal operations will on average maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration | 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. |
| | Reduced and degraded habitat for foraging, nesting, and cover |
| High fall flows may reduce drought stress in riparian or wetland vegetation, keep more constant spring flows and avoid erosion at restoration sites | Changes in flow and operations could adversely impact least Bell's vireo through changes in riparian habitats if the species recolonizes the Sacramento River Valley during the timeframe of all action alternatives. |

### P.2.4 Alternative 2

Alternative 2 (Multi-Agency Consensus), represents actions, approaches, and tradeoffs made to reach consensus among five agencies that include Reclamation, CDFW, DWR, NMFS, and USFWS. Alternative 2 consists of four "phases" which are all evaluated to present the maximum possible effects resulting from operations under any singular phase. It should be noted that the four phases of Alternative 2 could be utilized under its implementation. The four phases of Alternative 2 include a combination of implementation of a Temporary Urgency Change Petition (TUCP) and adoption of the Voluntary Agreements (VA) and are as follows:

- Alternative 2 Without TUCP With Delta VA
- Alternative 2 Without TUCP Without VA
- Alternative 2 Without TUCP With All VA
- Alternative 2 With TUCP Without VA

The phase that confers the maximum effect may vary (e.g., by resource area, species, and life stage) so results are presented for all four phases. All four phases are considered in the assessment of Alternative 2 to demonstrate the range of potential impacts. A complete description of the phases of Alternative 2 that result in flow changes and the differences between the four phases is presented in Appendix F.

#### *P.2.4.1 Potential Changes to Terrestrial Resources from Seasonal Operations*

For the purposes of the wildlife and plant species analyses, *flow changes* constitute the expected effects of implementing the four phases of Alternative 2 in comparison with the No Action Alternative. Differences in flow management between the four phases of Alternative 2 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 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. In 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 the four phases of Alternative 2 would generally result in 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.

**Trinity River**

Different alternatives may import water from the Trinity River to the Sacramento River to a different extent in different years and on different patterns. Flows under the Trinity River Restoration Program Record of Decision (2000) are common to all alternatives; therefore, impacts occur as a result of different reservoir levels and rare safety of dam releases. Under the four phases of Alternative 2, flow changes in the Trinity River are the same as the No Action Alternative. However, CalSim 3 modeling indicates that average monthly flow released below Lewiston Dam under Alternative 2 With TUCP Without VA would be lower than or similar to flow under No Action Alternative with decreases greater than 5% in wet years in February and March; above normal years in November; and below normal years in December. The highest flows for both alternatives occur primarily in May and June of all water year types and during winter, spring, and early summer of wet and above normal water years. Throughout the full simulation period, flows on average are slightly lower under Alternative 2 With TUCP Without VA November through April.

CalSim 3 modeling indicates that average monthly flow released below Lewiston Dam under Alternative 2 Without TUCP Without VA would be lower than or similar to flow under the No Action Alternative, except in above normal water years in February when the Alternative 2 Without TUCP Without VA flows would be substantially higher (greater than 5% increase) than the No Action Alternative flows. Average monthly flows would be substantially lower (greater than 5% decrease) under Alternative 2 Without TUCP Without VA in wet years in February and March; above normal years in November, and below normal years in December. The highest flows for both alternatives occur primarily in May and June of all water year types and during winter, spring, and early summer of wet and above normal water years. Throughout the full simulation period, flows on average are slightly lower under Alternative 2 Without TUCP Without VA November through April.

CalSim 3 modeling indicates that average monthly flow released below Lewiston Dam under Alternative 2 Without TUCP With Delta VA would be lower than or similar to flow under the No Action Alternative with decreases greater than 5% in wet years in February and March; above normal years in November; and below normal years in December. The highest flows for both alternatives occur primarily in May and June of all water year types and during winter, spring, and early summer of wet water years and January through March and May through July of above normal water year types. Throughout the full simulation period, flows on average are slightly lower under Alternative 2 Without TUCP With Delta VA November through April.

CalSim 3 modeling indicates that average monthly flow released below Lewiston Dam under Alternative 2 Without TUCP With All VA would be lower than or similar to flow under the No Action Alternative except in above normal water years in February when the Alternative 2 Without TUCP With All VA flows would be substantially higher (greater than 5%) than the No Action Alternative flows. Alternative 2 Without TUCP With All VA would have substantially lower (greater than 5%) flows in wet years in February and March; in above normal years in November; and in below normal years in December. The highest flows for both alternatives occur primarily in May and June of all water year types and during winter, spring, and early summer of wet water years and January through March and May through July of above normal water year types. Throughout the full simulation period, flows on average are slightly lower under Alternative 2 Without TUCP With All VA November through April.

These simulated results are attributed to modeling assumptions for the four phases of Alternative 2 described in Appendix F. Furthermore, as explained in the Summary Chapter, Section 0.1.7.2, changes or impacts described for resources associated with the Trinity Reservoir levels and Trinity River flows have been previously analyzed.

*Northwestern Pond Turtle*

Alternative 2 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to northwestern pond turtle.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Alternative 2 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to foothill yellow-legged frog.

**Sacramento River**

CalSim 3 modeling indicates that average flows released at Keswick Dam under Alternative 2 With TUCP Without VA (Alt 2v1 w/TUCP) would generally be higher than or similar to flows under the No Action Alternative, except January through March and May through September in critically dry water years when flows are expected to be lower than the No Action Alternative flows. The largest increases in flows under Alternative 2 With TUCP Without VA compared to the No Action Alternative occur in November of a critically dry water year type (637 cfs). The largest decreases in flows under Alternative 2 With TUCP Without VA compared to the No Action Alternative occur in June and July of a critically dry water year type, with decreases of 814 cfs and 1,162 cfs, respectively. Throughout the full simulation period, flows on average are similar (less than a 5% difference) under Alternative 2 With TUCP Without VA compared to the No Action Alternative.

CalSim 3 modeling indicates that average flows released at Keswick Dam under Alternative 2 Without TUCP Without VA (Alt 2v1wo/TUCP) would generally be higher than or similar to flows under the No Action Alternative, except May through September in critically dry water years, in May of dry years, and March of above normal water years. The largest increases in flows under Alternative 2 Without TUCP Without VA compared to the No Action Alternative occur in April and November of a critically dry water year type, with increases of 986 cfs and 654 cfs, respectively. The largest decreases in flows under Alternative 2 With TUCP Without VA compared to the No Action Alternative occur in May and August of a critically dry water year type, with decreases of 692 cfs and 918 cfs, respectively. Throughout the full simulation period, flows on average are similar (less than a 5% difference) under Alternative 2 Without TUCP Without VA compared to the No Action Alternative.

CalSim 3 modeling indicates that average flows released at Keswick Dam under Alternative 2 Without TUCP With Delta VA (ALT2v2) would generally be higher than or similar to flows under the No Action Alternative, except May through September in critically dry water years. The largest increases in flows under Alternative 2 Without TUCP With Delta VA compared to the No Action Alternative occur in April and November of a critically dry water year type, with increases of 1,181 cfs and 631 cfs, respectively. The largest decreases in flows under Alternative 2 With TUCP Without VA compared to the No Action Alternative occur in February and August of a critically dry year, with decreases of 660 cfs and 809 cfs, respectively. Throughout the full simulation period, flows on average are similar (less than a 5% difference) under Alternative 2 Without TUCP With Delta VA compared to the No Action Alternative.

CalSim 3 modeling indicates that average flows released at Keswick Dam under Alternative 2 Without TUCP With All VA (Alt2v3) would generally be higher than or similar to flows under the No Action Alternative September through February and in April, and generally lower than or similar to flows under the No Action Alternative May through August. The largest increases in flows under Alternative 2 Without TUCP With All VA compared to the No Action Alternative occur in April of a critically dry year (1,084 cfs). The largest decreases in flows under Alternative 2 Without TUCP With All VA compared to the No Action Alternative occur in June of a critically dry year (-781 cfs). Throughout the full simulation period under Alternative 2 Without TUCP With All VA compared to the No Action Alternative, flows on average are increased with a greater than 5% difference in November and April, and flows on average are decreased with a greater than -5% difference in June.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, the four phases under Alternative 2 would result in generally higher flows which may contribute to similar adverse impacts to northwestern pond turtle as described above in Section P.2.3.1.2, *Sacramento River*. Lower flows in June, July, and August of a critically dry year resulting from the four phases of Alternative 2 could adversely impact availability of aquatic breeding and aquatic basking habitat and may increase distances juveniles would need to traverse between areas of aquatic and upland habitat, making them more vulnerable to predation. Lower flows relative to the No Action Alternative may also cause aquatic habitat to become unsuitable for hatchlings and force them to move into deeper areas that are more accessible to aquatic predators. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. Any reduced water deliveries to CVPIA wildlife refuges in the Sacramento River watershed under the four phases of Alternative 2 would have impacts on the availability of aquatic habitat, however, Reclamation does not control the distribution of water to CVPIA wildlife refuges beyond initial water year allocations. Therefore, the changes or impacts to northwestern pond turtle associated with CVPIA refuges are outside the scope of this alternatives analysis. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-5.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Proposed flow changes in the upper Sacramento River downstream of Shasta Dam and through Keswick Reservoir under the four phases of Alternative 2 could adversely impact aquatic habitat for the North Coast DPS of the foothill yellow-legged frog as described above in Section P.2.3.1.2. A summary of the positive and adverse impacts to foothill yellow-legged frog is provided in Table P.2-6.

*Giant Garter Snake*

Sacramento Valley populations of giant garter snake depend on rice fields and associated irrigation and drainage channels, leaving them vulnerable to wide-scale habitat loss in the event of changes in agricultural management such as changes in crops or fallowing large areas of rice fields (Paquin et al. 2006). While giant garter snakes are known to use rice fields seasonally, the species is strongly associated with the canals that supply water to and drain water from rice fields; these canals provide more stable habitat than rice fields because they maintain water longer and support marsh-like conditions for most of the giant garter snake active season (Reyes et. al. 2017). The giant garter snake active season extends approximately April through September and giant garter snake requires aquatic habitat during this phase. When rice fields are left out of production there is a reduction or elimination in the use of the surrounding and nearby water conveyance structures by snakes where water supply is dependent upon surface or ground water from non-adjacent or on-site sources (USFWS 2012).

Reyes et al. (2017) observed a negative relationship between the amount of rice on the landscape and the survival rates of adult (mostly female) giant garter snakes. While the mechanism underlying this decrease in survival is unclear; sources of mortality such as starvation, malnutrition, impaired physiological or immunological function, or increased exposure to pathogens or predators are likely explanations. Predation, in particular, might be facilitated when giant garter snakes and their predators, such as otters, wading birds, and raptors, are foraging in the same constrained linear waterways. Therefore, long-term fallowing of rice fields can reduce or eliminate habitat and individual giant garter snakes could be subjected to a greater risk of predation while seeking new habitat (Reyes et al. 2017; USFWS 2020b). In addition, they may not return even if the area is later returned to rice, due to limited dispersal and home range fidelity (Reyes et al. 2017). However, the analyses of home range, rice availability, and species movement were limited to the giant garters snake active season. Additionally, the study was limited to sites with known populations of giant garter snakes and to sites where permission to trap and radio track snakes was obtained. Thus, the effects of lower water availability than observed at the study sites may have effects on giant garters snakes that were unable to be measured.

As described in EIS Chapter 3, *Alternatives*, operational decision-making will occur for Shasta Reservoir annual operations during drier water years. Proposed reductions in total water diversions to SRS Contractors is anticipated to result in fallowed rice lands during dry and critical years. As described in Table E-16 (Appendix E, *Draft Alternatives*), SRS Contractors will fallow 25,000 acres of rice which is credited with 110 TAF. Maximum fallowing as a result of Alternative 2 would be approximately 5.3% of the annual rice acreage grown in the Sacramento Valley in 2023 (U.S. Department of Agriculture [USDA], National Agricultural Statistics Service 2024). The new flow contributions from the Sacramento River Basin under

Alternative 2 are not intended to result in idling more than 35,000 acres of rice land in the Sacramento River Basin. Any level of cropland idling/shifting would reduce the availability of aquatic habitat and increase the risk of predation on individual giant garter snakes.

Giant garter snakes in the action area are within an active rice growing region that experiences variability in rice production and farming activities, therefore they are already subject to the risks of fallowing under the No Action Alternative. Under all phases of Alternative 2, CalSim 3 model results indicate that total SRS Contractor diversions would remain the same or decrease relative to the No Action Alternative. In dry and critical years, some of the largest reductions in average diversions would be over 5% relative to the No Action Alternative, with SRS Contactor agricultural diversions reduced up to 11% during some months of the active season for giant garter snake under Alternative 2 Without TUCP With Delta VA. Proposed decreases in water diversions to SRS Contractors in agricultural areas during dry and critical years under the four phases of Alternative 2 could result in temporary loss of aquatic habitat for giant garter snake through the conversion of rice to dryland farming or fallowed lands. Additionally, reduced water deliveries to CVPIA wildlife refuges in the Sacramento River watershed under the four phases of Alternative 2 would have impacts on the availability of aquatic habitat, however, Reclamation does not control the distribution of water to CVPIA wildlife refuges beyond initial water year allocations. Therefore, the changes or impacts to giant garter snake associated with CVPIA refuges are outside the scope of this alternatives analysis. A summary of the impacts to giant garter snake is provided in Table P.2-7.

*Bank Swallow*

CalSim 3 model results illustrate that, relative to the No Action Alternative, flows on the Sacramento River would generally be higher under Alternative 2 Without TUCP With Delta VA and Alternative 2 Without TUCP With All VA during the early part of the bank swallow breeding season in April. Flows under Alternative 2 Without TUCP Without VA would generally be higher from April to June and lower for the rest of the breeding season. Projected differences between the No Action Alternative and Alternative 2 Without TUCP With Delta VA and Alternative 2 Without TUCP With All VA would occur from October to April; during this period, average flows on the Sacramento River under 2 without TUCP With All VA would be slightly greater (5% difference) than under the No Action Alternative. Flows under Alternative 2 With TUCP Without VA are variable, but generally flows will decrease during much of the breeding season. The increased flows in the Sacramento River during the non-breeding season may provide the necessary bank erosion functions needed for new bank swallow breeding habitat and therefore could result in a beneficial effect on bank swallow. A summary of the impacts to bank swallow is provided in Table P.2-7.

Average flows on the Sacramento River downstream of Keswick Reservoir, at Bend Bridge, and below Red Bluff Diversion Dam would generally decrease under all four phases of Alternative 2 for at least two months of bank swallow breeding season except in April, where average flows are expected to be greater than the No Action Alternative. CalSim 3 model results predict average flows will stay below 15,000 cfs at these locations in normal water years. Average flows on the Sacramento River at Hamilton City, at Wilkins Slough, and at Verona under three phases of Alternative 2 would generally decrease during the bank swallow breeding season but increased flows at the beginning of the breeding season are present under Alternative 2 Without TUCP With All VA. Monthly flows during normal water years are highest at Verona during the bank swallow breeding season, with predicted monthly flows between 10,738 and 20,187 cfs under the four phases of Alternative 2. Flows greater than 14,000 cfs during breeding season, such as at Verona under Alternative 2 Without TUCP With All VA, where flows are predicted to be at 20,187 cfs (an approximate increase of 1,224 cfs compared to the No Action Alternative), could result in localized bank collapses that result in partial or complete colony failure as described in Section P.2.3.1.2, *Sacramento River*. Downstream of the Sacramento River at Verona, the river becomes channelized by levee banks which do not provide suitable bank habitat for nesting, therefore there is no potential for Alternative 2 to impact this species downstream of the confluence of the Sacramento and Feather Rivers. A summary of the positive and adverse impacts to bank swallow is provided in Table P.2-8.

*Western Yellow-Billed Cuckoo*

It can be assumed that seasonal operations will on average maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration. Seasonal operations under the four phases of Alternative 2 may reduce natural variability beyond major flood events. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, habitat conditions with implementation of the four phases under Alternative 2 are expected to be similar to habitat conditions experienced by western yellow-billed cuckoo under the No Action Alternative. The spring pulse flows under the four phases of Alternative 2 may benefit western yellow-billed cuckoo in the Sacramento River by supporting the recruitment of important riparian tree species, primarily willows, but the extent of this benefit is likely minor. The spring pulse flows may result in floodplain activation that could lead to the regeneration of riparian vegetation. Alternative 2 does not include the incorporation of flow recession during the germination and seedling establishment for riparian over-story species (particularly Fremont cottonwood).

*Least Bell's Vireo*

The proposed changes to least Bell's vireo habitat in the Sacramento River as a result of Alternative 2 are similar to those described above in Section P.2.3.1.2. A summary of the positive and adverse impacts to both western yellow-billed cuckoo and least bell's vireo is provided in Table P.2-9.

**Clear Creek**

CalSim 3 modeling indicates that average flow released at Whiskeytown Dam under Alternative 2 throughout the four phases compared to the No Action Alternative would generally be lower June through October and higher November through January and March through May in most water year types simulated. The largest decrease under all four phases of Alternative 2 compared to the No Action Alternative occurs in June through August of all water year types, except critically dry years when it would occur in June and September. The largest increases under all four phases of Alternative 2 compared to the No Action Alternative occur in December, January, March, and May in all water year types, except critically dry years when it would occur in January, February, and May. Under all four phases of Alternative 2 compared to the No Action Alternative, the average of all water year flow simulations project flow decreases in February and June through October, and increases November through January and March through May.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, the four phases under Alternative 2 would result in variable increases and decreases in flow depending on the time of year. Generally higher flows may contribute to similar adverse impacts to northwestern pond turtle as described above for the *Sacramento River*. Lower flows resulting from the four phases of Alternative 2 may also cause similar adverse and beneficial impacts to aquatic habitat. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-5.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Proposed flow changes in Clear Creek under the four phases under Alternative 2 may also cause adverse effects to aquatic habitat for the North Coast DPS of the foothill yellow-legged frog as described above in Section P.2.3.1.2. A summary of the adverse impacts to foothill yellow-legged frog is provided in Table P.2-6.

**Lower American River**

Differences between the No Action Alternative and Alternative 2 are attributed to the influence of other management actions and priorities. However, these differences tend to be minimal or similar to the simulated flows of the No Action Alternative. CalSim 3 modeling indicates that the simulated flow releases along the lower American River would generally be similar under the four phases of Alternative 2 compared to the No Action Alternative in all months of wet years and the most different in critically dry years. In critically dry years, increases and decreases are anticipated nearly year-round. During implementation of Alternative 2 With TUCP Without VA, simulations show there may be an increase in flows in December and July of critically dry years, with increases of 282 cfs and 92 cfs, respectively. Decreases in flow may occur August through November and January through April of critically dry years (between -37 and -169 cfs); other water year types would experience similar variations in flows most months out of the year. Under all other phases of Alternative 2, simulations show there may be an increase in flows in March (between 196 and 275 cfs), April (between 790 and 1,094 cfs), and June (between 188 and 247 cfs), while decreases may occur August through February (between -44 and -344 cfs) and May of critically dry type years (between -204 and -314 cfs); all other year types would be similar or the same as the No Action Alternative most months out of the year. However, all Alternative 2 phases projected for all water year types show average results may be the same or similar projections of the No Action Alternative.

*Northwestern Pond Turtle*

Model results illustrate that average flows under the four phases of Alternative 2 will be similar to the No Action Alternative, therefore there are no anticipated adverse impacts to northwestern pond turtle.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

There would be no actions under all the alternatives that affect suitable habitat for the South Sierra DPS of foothill yellow-legged frog in the lower American River.

*Western Yellow-Billed Cuckoo*

Seasonal operations under all phases of Alternative 2 will, on average, maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration. Seasonal operations under the four phases of Alternative 2 may reduce natural variability beyond major flood events. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, habitat conditions with implementation of the four phases of Alternative 2 are expected to be similar to habitat conditions experienced by western yellow-billed cuckoo under the No Action Alternative. Moreover, under all phases of Alternative 2, there would be potential beneficial impacts associated with the spring pulse flows on the existing riparian vegetation. Finally, elevated water flows are not anticipated to rise to the level that would cause impacts to nesting western yellow-billed cuckoos. A summary of the positive and adverse impacts to western yellow-billed cuckoo is provided in Table P.2-9.

**Stanislaus River**

Alternative 2 releases would be in accordance to the 2019 New Melones SRP, as modified to increase the potential outmigration response of juvenile steelhead from Winter Instability Flows (Figure 3.4-2 Chapter 3, *Alternatives*). The SRP includes the ability to shape monthly and seasonal flow volumes. Reclamation, through the Stanislaus Watershed Team, schedules the winter instability flow volume, including by combining the additional January and February releases, in consideration of timing flows to coincide with a natural storm event which may naturally cue outmigration. Modifications would use a single pulse and increase peak releases from 400 cfs to 1,500 cfs. In addition to description of the No Action Alternative, Reclamation may release additional pulse flows in November.

CalSim 3 modeling below Goodwin Dam under all phases of Alternative 2 compared to the No Action Alternative indicates that average flow released would generally be higher July through September, in December, and in February and lower March through June and October of all water year types; all phases of Alternative 2 are projected to have the most variation in below normal water years when most months are expected to have higher or lower flows and the least variation in wet year types when most months are expected to have similar flows to the No Action Alternative. All water year type projections for Alternative 2 show average flow projections may be higher in December, February, July, and August and lower in April (between -22 and -70 cfs) compared to the No Action Alternative.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, the four phases under Alternative 2 would result in average flows that are generally higher. Higher flows may contribute to similar adverse effects to northwestern pond turtle as described above in Section P.2.3.1.2. A summary of the positive and adverse impacts from higher flows to northwestern pond turtle is provided in Table P.2-5.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

There would be no actions under all the alternatives that affect suitable habitat for the South Sierra DPS of foothill yellow-legged frog upstream of New Melones Reservoir. Compared to the No Action Alternative, the four phases of Alternative 2 would result in relatively minor increased flows which may contribute to similar adverse impacts to foothill yellow-legged frog as described in Section P.2.3.1.2 and Table P.2-6. Lower flows resulting from Alternative 2 may also cause similar adverse and beneficial impacts to aquatic habitat as described in Section

P.2.3.1.2 and Table P.2-6. Seasonal operations under the four phases of Alternative 2 may reduce natural variability in water releases, beyond major flood events, which will create more stable conditions (i.e., more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and increase sedimentation) and provide some potential benefits for foothill yellow-legged frogs. Ultimately the limited discretion on flow releases from New Melones reservoir into the Stanislaus River will result in lower water temperatures in the summer, high pulse flow water releases during developmental periods, and a minor increase in sedimentation of cobbled substrates. A summary of the positive and adverse impacts from flow changes to foothill yellow-legged frog is provided in Table P.2-6.

*Western Yellow-Billed Cuckoo and Least Bell's Vireo*

The seasonal operations in the Stanislaus River associated with all phases of Alternative 2, including potential beneficial impacts associated with spring pulse flows will have a negligible impact on the existing riparian vegetation. Moreover, elevated water flows are not anticipated to rise to the level that would cause impacts to nesting western yellow-billed cuckoos or least Bell's vireo.

### San Joaquin River

There would be no actions under all phases of Alternative 2 that affect suitable habitat for the South Sierra DPS of foothill yellow-legged frog, northwestern pond turtle or giant garter snake in the San Joaquin watershed.

### Bay-Delta

Reclamation would continue to operate Delta facilities by season with the same primary purposes as described in the Common Components in Appendix E, Section E.2.4. The SMSCG are the only component in the Bay-Delta where proposed flow changes were found to have the potential to impact terrestrial resources based on flow modeling, therefore, the terrestrial analysis is centered around SMSCG reoperations. Initial Bay-Delta SCHISM modeling of the proposed operation of the SMSCG associated with the four phases of Alternative 2 found salinity decreases up to 5 practical salinity units (PSU) on a three day running average of salinity at Belden's landing from June through October in above-normal, below-normal, and dry years following wet or above-normal water years (Ateljevich 2022).

*Northwestern Pond Turtle*

The SMSCG are being proposed to direct more fresh water into the Suisun Marsh to improve habitat conditions for Delta smelt in the region under the four phases of Alternative 2. Northwestern pond turtles are a primarily freshwater species, and higher basking activity has been observed in Suisun Marsh in areas with low salinity, indicating an increase in habitat suitability when salinity is decreased. Northwestern pond turtles were also found to have higher abundance, survival, and growth rates in areas with reduced salinities (Agha et al. 2020; USFWS 2023a). Thus, the four phases under Alternative 2 will likely have a beneficial impact on northwestern pond turtle. A summary of the positive impacts to northwestern pond turtle is provided in Table P.2-5.

*Soft Bird's Beak and Suisun Thistle*

SMSCG reoperations under the four phases of Alternative 2 are expected to lower marsh salinities, creating a potential vegetation shift in Suisun Marsh. Effects on soft bird's beak and Suisun thistle from changes in tidal stage, flow, or erosion are uncertain at this time. Because salinity levels of the habitat in which soft bird's-beak or Suisun thistle are found would not be substantially altered due to the variability of existing salinities as well as the variability created between years when Alternative 2 would be implemented, the proposed operation of the SMSCG associated with the four phases of Alternative 2 would likely be negligible to either soft bird's beak or Suisun thistle.

#### *P.2.4.2 Potential Changes to Critical Habitat from Seasonal Operations*

Alternative 2 includes proposed flow changes in the Sacramento River within western yellow-billed cuckoo critical habitat. The proposed changes are unlikely to produce measurable change in quantity or quality of western yellow billed cuckoo habitat, including riparian vegetation, in the upper Sacramento watershed.

Critical habitat for valley elderberry longhorn beetle is present along the American River. However, under the four phases of Alternative 2, proposed flow changes are unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle critical habitat in the American River watershed, as the riparian vegetation of the surrounding habitat would not be measurably altered.

Critical habitat for soft bird's-beak and Suisun thistle is present in the Delta region. SMSCG reoperations under the four phases of Alternative 2 are expected to lower marsh salinities, creating a potential vegetation shift in Suisun Marsh. However, this change in marsh salinities are expected to be minimal.

#### *P.2.4.3 Summary of Species Impacts*

The following tables provide a summary of the anticipated positive and adverse impacts to each species analyzed under Alternative 2.

Table P.2-5. Impacts to Northwestern Pond Turtle under Alternative 2

| Northwestern Pond Turtle | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Decreased water depth could expand basking areas | Inundation of upland basking, sheltering, overwintering, aestivation, and movement habitat |
| | Increased dispersal distance between aquatic and upland habitat due to decreases in flow |
| Directing more freshwater to Bay-Delta may decrease salinity levels, improving suitability of aquatic habitat | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Increased water depth could cause aquatic breeding and basking habitat to become unsuitable |
| | Direct mortality or injury due to increased flow velocity |

| | |
|---|---|
| Warmer water temperatures may improve growth of juveniles | Cooler water temperatures may slow growth of juveniles |
| | Increased predation of hatchlings and juveniles |

Table P.2-6. Impacts to Foothill Yellow-Legged Frog under Alternative 2

| Foothill Yellow-Legged Frog | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Reduce natural variability in water releases, creating more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and less likely to increase sedimentation | Direct mortality or injury due to increased flow velocity |
| | Sedimentation of cobbled substrates from increased flow velocity, decreasing habitat suitability |
| | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Cooler water temperatures in summer may preclude breeding, slow egg development, and growth of tadpoles and metamorphs |
| | Increased predation of tadpoles and metamorphs |
| | Increased susceptibility to pathogens due to change in habitat conditions |

Table P.2-7. Impacts to Giant Garter Snake under Alternative 2

| Impacts |
|---|
| Temporary reduction in the availability of aquatic habitat through conversion of rice to dryland farming or fallowed land |
| Increased risk of predation of individual of snakes due to loss of aquatic habitat |

Table P.2-8. Impacts to Bank Swallow under Alternative 2

| Bank Swallow | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Increased flows in the Sacramento River during a majority of the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat in the form of cut banks. | Localized bank collapse that results in partial or complete colony failure from flows greater than 14,000 cfs during the breeding season |

Table P.2-9. Impacts to Western Yellow-Billed Cuckoo and Least Bell's Vireo under Alternative 2

| **Western Yellow-Billed Cuckoo and Least Bell's Vireo** | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Spring pulse flows may benefit western yellow-billed cuckoo in the Sacramento River by supporting the recruitment of important riparian tree species, primarily willows | 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. |
| | Reduced and degraded habitat for foraging, nesting, and cover |
| High fall flows may reduce drought stress in riparian or wetland vegetation, keep more constant spring flows and avoid erosion at restoration sites | Changes in flow and operations could adversely impact least Bell's vireo through changes in riparian habitats if the species recolonizes the Sacramento River Valley during the timeframe of all action alternatives. |

## P.2.5 Alternative 3

Alternative 3 (Modified Natural Hydrograph) combines additional Delta outflow with measures to improve drought protection and water temperature management through increased reservoir carryover storage.

### *P.2.5.1 Potential Changes to Terrestrial Resources from Seasonal Operations*

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 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. In 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 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.

#### Trinity River

Different alternatives may import water from the Trinity River to the Sacramento River to a different extent in different years and on different patterns. Flows under the Trinity River Restoration Program Record of Decision (2000) are common to all alternatives; therefore, impacts occur as a result of different reservoir levels and rare safety of dam releases. Alternative 3 flow changes in the Trinity River are the same as the No Action Alternative. However, CalSim 3 modeling indicates that average flow released below Lewiston Dam under Alternative 3 would generally be higher than the No Action Alternative in December through March and similar to flows under the No Action Alternative the remaining months of the year, except in below normal years in March and wet years in April when the Alternative 3 flows would be substantially lower (greater than 5% decrease) than the No Action Alternative flows. Average monthly flows under Alternative 3 would be substantially higher (greater than 5% increase) in wet years December through February; above normal years in February; and below normal years in December. The highest flows for both alternatives occur primarily in May and June of all water year types and during winter, spring, and early summer of wet water years and January through March and May through July of above normal years. Throughout the full simulation period, flows on average are higher under Alternative 3 in November through March, with the greatest increases in flow (greater than 5%) December through February and a slight average decrease in flow in April. The simulated results are attributed to modeling assumptions for Alternative 3 described in Appendix F. Furthermore, as explained in the Summary Chapter, Section 0.1.7.2, changes or impacts described for resources associated with the Trinity Reservoir levels and Trinity River flows have been previously analyzed.

*Northwestern Pond Turtle*

Alternative 3 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to northwestern pond turtle.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Alternative 3 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to foothill yellow-legged frog.

**Sacramento River**

Under all the alternatives, flows in the upper Sacramento River result from controlled releases from Shasta and Keswick reservoirs, as well as transfers from the Trinity River and natural accretions. The releases and transfers are determined by a suite of laws, regulations, contracts, and agreements to address demands of water users, requirements for water quality, and needs of fish populations throughout the river and the Delta. In particular, operations of all the alternatives are regulated by SWRCB’s D-1641 decision, requiring flow releases to meet Delta standards, and WRO 90-5 decision, requiring coldwater releases to meet water temperature targets at compliance points in the upper Sacramento River. Flow releases are high during the summer to satisfy downstream demands of water users and Delta water quality, and to meet water temperature requirements of incubating winter-run Chinook salmon eggs and alevins downstream of Keswick Dam. Potential reductions in water deliveries to CVPIA wildlife refuges in the Sacramento River watershed under Alternative 3 could also have impacts on the availability of aquatic habitat, however, Reclamation does not control the distribution of water to CVPIA wildlife refuges beyond initial water year allocations. Therefore, the changes or impacts described for terrestrial resources associated with CVPIA refuges are outside the scope of this alternatives analysis.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 3 would result in increased flows in August of below normal, and dry and critically dry years (between 140 and 1,913 cfs), and in December through May of wet and above normal years (between 39 and 2,400 cfs) which may contribute to adverse impacts described in Table P.2-10. Lower flows in February through July of dry and critically dry years (between -39 and -989 cfs) resulting from Alternative 3 may also cause similar adverse effects to aquatic habitat as described in Section P.2.3.1.2 and Table P.2-10. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. A full summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-10.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Proposed flow changes in the upper Sacramento River downstream of Shasta Dam and through Keswick Reservoir under Alternative 3 could impact aquatic habitat for the North Coast DPS of the foothill yellow-legged frog as summarized in Table P.2-11.

*Giant Garter Snake*

Proposed reductions in total water diversions to SRS Contractors under Alternative 3 will fallow rice lands, which could temporarily reduce the availability of aquatic habitat in the spring through fall. Under Alternative 3, CalSim 3 model results indicate that total SRS Contractor diversions would decrease in the spring through fall and would remain the same in the winter months relative to the No Action Alternative. In dry and critical years, some of the largest reductions in average diversions would be over 5% relative to the No Action Alternative, with SRS Contactor agricultural diversions being reduced by 34% from 100 TAF to 66 TAF in April and approximately 11% during the remaining months of the active season for giant garter snake under Alternative 3. Proposed decreases in water diversions to SRS Contractors in agricultural areas during dry and critical years under Alternative 3 could result in the temporary loss of aquatic habitat for giant garter snake through the conversion of rice to dryland farming or fallowed lands. The risks to giant garter snake associated with variability in rice production and farming activities are the same as those they are already subject under the No Action Alternative, whereby temporary losses in aquatic habitat could occur. A summary of the impacts to giant garter snake is provided in Table P.2-12.

*Bank Swallow*

CalSim 3 model results illustrate that, relative to the No Action Alternative, flows on the Sacramento River under Alternative 3 would be variable month to month during normal water years. Flows under Alternative 3 would be up to 1,990 cfs higher than the No Action Alternative in May in above normal and wet years and up to 1,913 cfs higher in August in dry years during bank swallow breeding season. Flows under Alternative 3 would be up to 954 cfs lower from April to June in below normal, dry, and critically dry years, and up to 2,218 cfs lower in July of above normal years. Projected flows would also be variable under Alternative 3 during the non-breeding season, where higher flows would occur in October and from December to March. The increased flows in the Sacramento River during a majority of the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat and therefore could result in a beneficial effect on bank swallow.

Average flows on the Sacramento River downstream of Keswick Reservoir, at Bend Bridge, and below Red Bluff Diversion Dam would increase under Alternative 3 in May and August during bank swallow breeding season but would be lower in April, June, and July. CalSim 3 model results predict flows staying below 13,000 cfs in normal water years at these locations. Average flows on the Sacramento River at Hamilton City, at Wilkins Slough, and at Verona under Alternative 3 would be up to 2,216 cfs higher than the No Action Alternative in May during the bank swallow breeding season, with variable minor increases and decreases in flow in other months of the breeding season at these locations. Monthly flows during normal water years are highest at Verona during the bank swallow breeding season, with predicted monthly flows between 8,747 and exceeding 20,577 cfs under Alternative 3. Flows greater than 14,000 cfs such as at Verona, where flows can average 20,577 cfs in April (more than 1,600 cfs above the No Action Alternative), could result in localized bank collapses that result in partial or complete colony failure. Downstream of the Sacramento River at Verona, the river becomes channelized by levee banks which do not provide suitable bank habitat for nesting, therefore there is no potential for Alternative 3 to impact this species downstream of the confluence of the Sacramento and Feather Rivers. A summary of the positive and adverse impacts to bank swallow is provided in Table P.2-13.

*Western Yellow-Billed Cuckoo and Least Bell's Vireo*

The proposed changes to least Bell's vireo and western yellow-billed cuckoo habitat in the Sacramento River and potential impacts as a result of Alternative 3 is provided in Table P.2-9.

**Clear Creek**

CalSim 3 modeling indicates that at Whiskeytown Dam under Alternative 3 compared to the No Action Alternative average flow released would increase November through January and March through May, and decrease February and June through October, except during dry and critically dry years. In dry years, December through May would have higher flows, and October, November, January through March, and May in critically dry years. The largest decrease under Alternative 3 compared to the No Action Alternative occurs June through August in dry and critically dry years, with decreases between 38 and 86 cfs. Under Alternative 3 compared to the No Action Alternative, when all water year type simulations are averaged, flow releases would increase November through January by up to 77 cfs and March through May by up to 79 cfs, and decrease by 21 cfs in February and by 37 to 86 cfs from June through October.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 3 would result in relatively minor increased flows which may contribute to adverse impacts to northwestern pond turtle as described above in Section P.2.3.1.2 and Table P.2-10. Lower flows resulting from Alternative 3 may also cause both adverse and beneficial impacts to aquatic habitat and is also presented in Table P.2-10. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Proposed flow changes in Clear Creek under Alternative 3 could adversely impact aquatic habitat for the North Coast DPS of the foothill yellow-legged, a summary of which is presented in Table P.2-11.

## Lower American River

CalSim 3 modeling indicates that flow released for Folsom Reservoir storage under Alternative 3 compared to the No Action Alternative would generally be similar or increase December and February through April, and decrease June, July, and October of all water year types. Under Alternative 3 compared to the No Action Alternative, the largest increases in flow would occur in April (566 cfs) and decreases up to 773 cfs would occur in June of almost all water year types except wet and critically dry water year types. Wet years could generally be similar most months except June and September would be lower under Alternative 3 compared to the No Action Alternative; in critically dry years, the largest increases in flow occur in December (559 cfs) and decreases would occur in November (-389 cfs). Under Alternative 3 compared to the No Action Alternative, when all water year type simulations are averaged, most month's average flow rates were similar, except in April and August when flows would be 566 cfs and 238 cfs higher, and June and July would be 773 cfs and 416 cfs lower compared to the No Action Alternative.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 3 would result in relatively minor increased flows which may contribute to adverse impacts to northwestern pond turtle by as described above in Section P.2.3.1.2 and in Table P.2-10. Lower flows resulting from Alternative 3 may also cause both adverse and beneficial impacts to aquatic habitat which are summarized in Table P.2-10. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

There would be no actions under Alternative 3, that affect suitable habitat for the South Sierra DPS of foothill yellow-legged frog in the lower American River.

*Western Yellow-Billed Cuckoo*

Seasonal operations will, on average, maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration. Seasonal operations under Alternative 3 may reduce natural variability beyond major flood events. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, habitat conditions with implementation of Alternative 3 are expected to be similar to habitat conditions experienced by western yellow-billed cuckoo under the No Action Alternative.

## Stanislaus River

Consistent with the 2018 Bay-Delta Water Quality Control Plan, this component of Alternative 3 is consistent with the No Action Alternative in the summer and fall and it requires reservoir releases to meet 40% of unimpaired inflow on a 7-day running average to the confluence with the San Joaquin River in February through Jun. In these months, Reclamation also would make releases from New Melones Dam as necessary to contribute its share (29%) of meeting the 1,000 cfs minimum flow at Vernalis.

Reclamation would reduce deliveries to all contractors to achieve a minimum end of September storage in New Melones Reservoir of 700 thousand acre-feet (TAF). Reclamation through Governance would schedule fall pulse flow volumes consistent with the volumes in the SRP and potentially release additional flows in October and November.

CalSim 3 modeling under Alternative 3, compared to No Action Alternative, indicates that average flow released below Goodwin Dam would generally be higher February through June and lower August, September, October, December and January of most water year types. Under Alternative 3 compared to the No Action Alternative, the largest increases in average flow are in February through June, with increases between 163 and 223 cfs. The largest decreases would occur in December of almost all water year types (-96 cfs on average). Under Alternative 3 compared to the No Action Alternative, critically dry years are projected to have similar flow conditions in almost all months except June, when these would be higher. Under Alternative 3 compared to the No Action Alternative, when all water years are averaged, projections show increased flows February through June and decreased flows August, September, December, and January.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 3 would result in increased flows which may contribute to similar adverse impacts to northwestern pond turtle. Lower flows resulting from Alternative 3 may also cause similar adverse effects to aquatic habitat as described above in Section P.2.3.1.2. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-10.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

There would be no actions under Alternative 3 that affects the suitable habitat of South Sierra DPS of foothill yellow-legged frog upstream of New Melones Reservoir. Proposed flow changes in the lower Stanislaus River downstream from New Melones Reservoir under Alternative 3 could adversely impact aquatic habitat for the South Sierra DPS of foothill yellow-legged frog. Compared to the No Action Alternative, Alternative 3 would result in relatively minor increased flows, which may contribute to adverse impacts to foothill yellow-legged frog as described above in Section P.2.3.1.2 and in Table P.2-11. Lower flows resulting from Alternative 3 may also cause adverse impacts to aquatic habitat as presented in Table P.2-11. Seasonal operations under Alternative 3 may reduce natural variability in water releases, beyond major flood events, which will create more stable conditions (i.e., more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and increase sedimentation), and provide some potential benefits for foothill yellow-legged frogs. Ultimately the limited discretion on flow releases from New Melones Reservoir into the Stanislaus River will result in a limited version of the impacts described in Section P.2.3.1.2 on the relevant life stages for this species. These limited impacts could include possible dislodging, isolation, or mortality of egg masses, and possibly strand and/or kill tadpoles and metamorphs. Incrementally higher flows and water levels could impact adults' ability to feed or reside in the Stanislaus River and may lead to sedimentation of cobbled substrates. These impacts could adversely impact all the applicable life stages for the foothill yellow legged frog associated with lower water temperatures in the summer, high pulse flow water releases during developmental periods and a minor increase in sedimentation of cobbled substrates. A full summary of the positive and adverse impacts to foothill yellow-legged frog is provided in Table P.2-11.

#### *Western Yellow-Billed Cuckoo and Least Bell's Vireo*

The seasonal operations in the Stanislaus River and generally higher flows will have a negligible impact on the existing riparian vegetation. Additionally, elevated water flows are not anticipated to rise to the level that would cause impacts to nesting western yellow-billed cuckoos or least Bell's vireo.

### San Joaquin River

Under Alternative 3, average flows are expected to be lower across all water years than the No Action Alternative in the San Joaquin River watershed, with decreases between 30 cfs and 123 cfs. Reduced average flows under Alternative 3 may cause adverse effects to aquatic habitat for northwestern pond turtle described below in Table P.2-10. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas.

The last remaining reproductive population of the giant garter snake in the San Joaquin Valley exists in CVPIA refuges. Reduced water deliveries to CVPIA wildlife refuges in the San Joaquin River under Alternative 3 could have impacts on the availability of aquatic habitat for giant garter snake and northwestern pond turtle, however, Reclamation does not control the distribution of water to CVPIA wildlife refuges beyond initial water year allocations. Therefore, the changes or impacts to giant garter snake and northwestern pond turtle associated with CVPIA refuges are outside the scope of this alternatives analysis.

### Bay-Delta

Reclamation would continue to operate Delta facilities by season with the same primary purposes as described in the Common Components in Appendix E, Section E.2.4. The SMSCG are the only component in the Bay-Delta where proposed flow changes were found to have the potential to impact terrestrial resources based on flow modeling, therefore, the terrestrial analysis is centered around SMSCG reoperations.

#### *Northwestern Pond Turtle*

The SMSCG are being proposed to direct more fresh water into the Suisun Marsh to improve habitat conditions for Delta smelt in the region under Alternative 3. Northwestern pond turtles are a primarily freshwater species, and higher basking activity has been observed in Suisun Marsh in areas with low salinity, indicating an increase in habitat suitability when salinity is decreased. Northwestern pond turtles were also found to have higher abundance, survival, and growth rates in areas with reduced salinities (Agha et al. 2020; USFWS 2023a). Thus, Alternative 3 will likely have a beneficial impact on northwestern pond turtle. A summary of the positive impacts to northwestern pond turtle is provided in Table P.2-10.

#### *Soft Bird's Beak and Suisun Thistle*

SMSCG reoperations under Alternative 3 are expected to lower marsh salinities. Effects on soft bird's beak and Suisun thistle from changes in tidal stage, flow, or erosion are uncertain at this time. However, because salinity levels of the habitat in which soft bird's-beak or Suisun thistle are found would not be substantially altered due to the variability of existing salinities as well as the variability created between years when Alternative 3 would be implemented, the proposed operation of the SMSCG associated with Alternative 3 would likely be negligible to either soft bird's beak or Suisun thistle.

### *P.2.5.2 Potential Changes to Critical Habitat from Seasonal Operations*

Alternative 3 includes proposed flow changes in the Sacramento River within western yellow-billed cuckoo critical habitat. The proposed changes are unlikely to produce measurable change in quantity or quality of western yellow billed cuckoo habitat, including riparian vegetation, in the upper Sacramento watershed.

Critical habitat for valley elderberry longhorn beetle is present along the American River. However, under Alternative 3, proposed flow changes are unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle critical habitat in the American River watershed, including riparian vegetation.

Critical habitat for soft bird's-beak and Suisun thistle is present in the Delta region. SMSCG reoperations under Alternative 3 are expected to lower marsh salinities. These slightly lower salinity levels of the surrounding habitat would not result in measurable effects on the primary constituent elements for soft birds beak and Suisun thistle critical habitat.

### *P.2.5.3 Summary of Species Impacts*

The following tables provide a summary of the anticipated positive and adverse impacts to each species analyzed under Alternative 3.

Table P.2-10. Impacts to Northwestern Pond Turtle under Alternative 3

<table>
<tr><th colspan="2">Northwestern Pond Turtle</th></tr>
<tr><th>Positive Impacts</th><th>Adverse Impacts</th></tr>
<tr><td rowspan="2">Decreased water depth could expand basking areas</td><td>Inundation of upland basking, sheltering, overwintering, aestivation, and movement habitat</td></tr>
<tr><td>Increased dispersal distance between aquatic and upland habitat due to decreases in flow</td></tr>
<tr><td rowspan="2">Directing more freshwater to Bay-Delta may decrease salinity levels, improving suitability of aquatic habitat</td><td>Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta</td></tr>
<tr><td>Increased water depth could cause aquatic breeding and basking habitat to become unsuitable</td></tr>
<tr><td rowspan="3">Warmer water temperatures may improve growth of juveniles</td><td>Direct mortality or injury due to increased flow velocity</td></tr>
<tr><td>Cooler water temperatures may slow growth of juveniles</td></tr>
<tr><td>Increased predation of hatchlings and juveniles</td></tr>
</table>

Table P.2-11. Impacts to Foothill Yellow-Legged Frog under Alternative 3

| Foothill Yellow-Legged Frog | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Reduce natural variability in water releases, creating more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and less likely to increase sedimentation | Direct mortality or injury due to increased flow velocity |
| | Sedimentation of cobbled substrates from increased flow velocity, decreasing habitat suitability |
| | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Cooler water temperatures in summer may preclude breeding, slow egg development, and growth of tadpoles and metamorphs |
| | Increased predation of tadpoles and metamorphs |
| | Increased susceptibility to pathogens due to change in habitat conditions |

Table P.2-12. Impacts to Giant Garter Snake under Alternative 3

| Impacts |
|---|
| Temporary reduction in the availability of aquatic habitat through conversion of rice to dryland farming or fallowed land |
| Increased risk of predation of individual of snakes due to loss of aquatic habitat |

Table P.2-13. Impacts to Bank Swallow under Alternative 3

| Bank Swallow | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Increased flows in the Sacramento River during a majority of the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat in the form of cut banks. | Localized bank collapse that results in partial or complete colony failure from flows greater than 14,000 cfs during the breeding season |

Table P.2-14. Impacts to Western Yellow-Billed Cuckoo and Least Bell's Vireo under Alternative 3

| Western Yellow-Billed Cuckoo and Least Bell's Vireo | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Spring pulse flows may benefit western yellow-billed cuckoo in the Sacramento River by supporting the recruitment of important riparian tree species, primarily willows | 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. |
| | Reduced and degraded habitat for foraging, nesting, and cover |
| High fall flows may reduce drought stress in riparian or wetland vegetation, keep more constant spring flows and avoid erosion at restoration sites | Changes in flow and operations could adversely impact least Bell's vireo through changes in riparian habitats if the species recolonizes the Sacramento River Valley during the timeframe of all action alternatives. |

## P.2.6 Alternative 4

Alternative 4 provides alternative criteria for Shasta Reservoir and incorporates improved real-time analytics for using real-time information to support water deliveries in the Delta while limiting effects on listed species. For more information, see EIS *Chapter 3 Alternatives.*

### *P.2.6.1 Potential Changes to Terrestrial Resources from Seasonal Operations*

#### Trinity River

Different alternatives may import water from the Trinity River to the Sacramento River to a different extent in different years and on different patterns. Flows under the Trinity River Restoration Program Record of Decision (2000) are common to all alternatives; therefore, impacts occur as a result of different reservoir levels and rare safety of dam releases. Alternative 4 flow changes in the Trinity River are the same as the No Action Alternative. However, CalSim 3 modeling indicates that substantial increases (greater than 5%) would occur in above normal years in February and in March of wet years and below normal years. The lowest flows under Alternative 4 compared to the No Action Alternative occurs primarily in below normal water years in December. The simulated results are attributed to modeling assumptions for Alternative 4 described in Appendix F. Furthermore, as explained in the Summary Chapter, Section 0.1.7.2, changes or impacts described for resources associated with the Trinity Reservoir levels and Trinity River flows have been previously analyzed.

*Northwestern Pond Turtle*

Alternative 4 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to northwestern pond turtle.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Alternative 4 flow changes in the Trinity River are the same as the No Action Alternative, therefore, there are no anticipated adverse impacts to foothill yellow-legged frog.

**Sacramento River**

Under all the alternatives, flows in the upper Sacramento River result from controlled releases from Shasta and Keswick reservoirs, as well as transfers from the Trinity River and natural accretions. The releases and transfers are determined by a suite of laws, regulations, contracts, and agreements to address demands of water users, requirements for water quality, and needs of fish populations throughout the river and the Delta. In particular, operations of all the alternatives are regulated by SWRCB's D-1641 decision, requiring flow releases to meet Delta standards, and their WRO 90-5 decision, requiring coldwater releases to meet water temperature targets at compliance points in the upper Sacramento River. Dry hydrologic conditions often lead to inadequate storage in Shasta Reservoir for operators to provide suitable conditions for salmonids and other native species in the upper Sacramento River. In most cases, however, water temperature rather than flow is the limiting factor creating unsuitable conditions, as discussed below. Flow releases are high during the summer to satisfy downstream demands of water users and Delta water quality, and to meet water temperature requirements of incubating winter-run Chinook salmon eggs and alevins downstream of Keswick Dam. Reduced water deliveries to CVPIA wildlife refuges in the Sacramento River watershed under Alternative 4 could also have impacts on the availability of aquatic habitat, however, Reclamation does not control the distribution of water to CVPIA wildlife refuges beyond initial water year allocations. Therefore, the changes or impacts described for terrestrial resources associated with CVPIA refuges are outside the scope of this alternatives analysis.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 4 would result in relatively minor increased flows which may contribute to similar adverse impacts to northwestern pond turtle described below in Table P.2-15. Lower flows resulting from Alternative 4 may also cause adverse impacts to the availability of aquatic breeding habitat, and may increase distances juveniles would need to traverse between areas of aquatic and upland habitat, making them more vulnerable to predation. Lower flows relative to the No Action Alternative may also cause aquatic habitat to become unsuitable for hatchlings and force them to move into deeper areas that are more accessible to aquatic predators. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Proposed flow changes in the upper Sacramento River downstream of Shasta Dam and through Keswick Reservoir could adversely impact aquatic habitat for the North Coast DPS of the foothill yellow-legged frog as summarized in Table P.2-16.

*Giant Garter Snake*

Under Alternative 4, CalSim 3 model results indicate that total SRS Contractor diversions would remain the same or decrease relative to the No Action Alternative. In dry and critical years, some of the largest reductions in average diversions would be over 5% relative to the No Action Alternative, with SRS Contactor agricultural diversions reduced by 11-13% during some months of the active season for giant garter snake under Alternative 4. Proposed decreases in water diversions to SRS Contractors in agricultural areas during dry and critical years under Alternative 4 could result in the temporary loss of aquatic habitat for giant garter snake through the conversion of rice to dryland farming or fallowed lands. The risks to giant garter snake associated with variability in rice production and farming activities relative to the No Action Alternative are described above in Section P.2.4.1.2 and summarized in Table P.2-17.

*Bank Swallow*

Model results illustrate that, relative to the No Action Alternative, flows on the Sacramento River would be higher under Alternative 4 at the beginning of bank swallow breeding season in April and lower for the duration of the breeding season. Projected flows would be higher under Alternative 4 during the non-breeding season, where higher flows would occur from September to March. The increased flows in the Sacramento River during the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat and therefore could result in a beneficial effect on bank swallow.

Average flows on the Sacramento River downstream of Keswick Reservoir, at Bend Bridge, and below Red Bluff Diversion Dam would increase under Alternative 4 at the beginning of the bank swallow breeding season in April and lower for the duration of the breeding season, with model results predicting flow staying below 14,000 cfs in normal years. Average flows on the Sacramento River at Hamilton City, at Wilkins Slough, and at Verona under Alternative 4 would generally decrease during the bank swallow breeding season except in April, where flow increases are minor. Monthly flows are highest at Verona during the bank swallow breeding season, with predicted monthly flows between 10,852 and 19,127 cfs under Alternative 4. Flows greater than 14,000 cfs such as at Verona, where flows can average 19,127 cfs in April, could result in localized bank collapses that result in partial or complete colony failure. However, flow increases are minor compared to the No Action Alternative (approximate increase of 164 cfs), therefore, habitat conditions are expected to be similar to habitat conditions experienced by bank swallow under the No Action Alternative. Downstream of the Sacramento River at Verona, the river becomes channelized by levee banks which do not provide suitable bank habitat for nesting, therefore there is no potential for Alternative 4 to impact this species downstream of the confluence of the Sacramento and Feather Rivers. A summary of the positive and adverse impacts to bank swallow is provided in Table P.2-17.

*Western Yellow-Billed Cuckoo and Least Bell's Vireo*

The proposed changes to least Bell's vireo and western yellow-billed cuckoo habitat in the Sacramento River as a result of Alternative 4 which could have both positive and adverse impacts are summarized in Table P.2-19.

**Clear Creek**

Alternative 4 provides alternative criteria for Shasta Reservoir and incorporates improved real-time analytics for using real-time information to support water deliveries in the Delta while limiting effects on listed species. Reclamation would release water through Whiskeytown Dam to provide intra-annual variation to emulate natural processes. As provided in Figure 3.4 1 and Table 3.4 2 (EIS, Chapter 3), flows would oscillate over a one-year period, with releases transitioning from 300 cfs in the winter, down to 100 cfs in the summer, and back to 300 cfs by the following winter. Reclamation, through the Clear Creek Technical Team, may modify the timing and flow rates provided in Figure 3.4-1 and Table 3.4-2 by February 1 and update through

May on a case-by-case basis; the flow schedule is subject to agreement by Redding Electric Utility for use of their facilities.

Reclamation would release up to 10,000 acre-feet from Whiskeytown Dam for channel maintenance, spring attraction flows, and to meet other physical and biological objectives, except in years with significant uncontrolled flow. In critical years, Reclamation would release up to 5,000 acre-feet. Reclamation, through the Clear Creek Technical Team, would develop pulse flow schedules, which include measures (e.g., nighttime down ramping, slow down ramping rates, coordination with natural precipitation events) to mitigate for potential risks (e.g., potential juvenile fish stranding). Due to unknowns in winter precipitation, Clear Creek pulse flows are not to occur prior to the February SVI reporting. The full pulse flow volume (10,000 acre-feet) will be available if the SVI is greater than 5.4, at the SVI updates (i.e., dry or wetter years). If the SVI updates are equal to or less than 5.4 (critical years), Reclamation would limit releases of pulse(s) flows to 5,000 acre-feet. Reclamation would also target Whiskeytown Dam releases at 61°F from June 1 through August 15, 60°F from August 16 through September 15, and 56°F from September 16 through November 15 to not exceed the mean daily temperatures at Igo gauge. In dry, critical, or import curtailment years, Reclamation may not be able to meet these water temperatures and will operate Whiskeytown Dam as close to these water temperatures as practicable within the constraints of minimum instream flows.

CalSim 3 modeling under Alternative 4 compared to the No Action Alternative indicates that at Whiskeytown Dam average flow released would generally be higher from November through January and March through May, and decrease February and June through October, except during dry and critically dry years; in dry years December through May would have higher flows, and October, November, January through March, and May in critically dry years. The largest decreases in average flows under Alternative 4 compared to the No Action Alternative occurs in June through September. The largest decrease in critically dry water years would occur in June with a decrease of 82 cfs from the No Action Alternative. The largest increase under Alternative 4 compared to the No Action Alternative occurs in January at 79 cfs or May at 69 cfs depending on the water year type. Under Alternative 4 compared to the No Action Alternative, when all water year type simulations are averaged, flow releases would increase November through January and March through May, and decrease February and June through October.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 4 would result in relatively minor increased flows which may contribute to adverse impacts to northwestern pond turtle as described above in Section P.2.3.1.2 and below in Table P.2-15. Lower flows resulting from Alternative 4 may also cause adverse impacts to aquatic habitat by causing aquatic habitat to become unsuitable for hatchlings and force them to move into deeper areas that are more accessible to aquatic predators. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-15.

*Foothill Yellow-Legged Frog (North Coast DPS)*

Proposed flow changes in Clear Creek could adversely impact aquatic habitat for the North Coast DPS of the foothill yellow-legged frog as summarized in Table P.2-16.

**Lower American River**

Alternative 4 provides alternative criteria for Shasta Reservoir and incorporates improved real-time analytics for using real-time information to support water deliveries in the Delta while limiting effects on listed species; Reclamation would seek to develop and operate under a new Automated Temperature Selection Procedure (ATSP), otherwise operations on the American River are the same as the No Action Alternative.

If unable to develop and operate under a new ATSP, management actions for the American River would be the same as the No Action Alternative Reclamation and would implement the minimum release requirement (MRR) proposed by the Sacramento Area Water Forum, based on the month and annual hydrology, Figure 3.2-3 and Figure 3.2-4 (EIS, Chapter 3). Reclamation will use the 90% exceedance from the Sacramento River Index in January and the American River Index in February through December to develop the MRR (with certain spills subtracted). Reclamation will implement a spring pulse in years that the MRR for March is between 1,000 cfs and 1,500 cfs. The peak flow of the pulse flow would be three times the March MRR, even if implemented in April or May, but no higher than 4,000 cfs and lasting two days. Reclamation, through the American River Group, will develop a pulse flow schedule and may facilitate an additional spring pulse flow event if water is made available from non-CVP sources, or if there is flexibility to shape planned releases in a more variable schedule. Reclamation, through Governance, will schedule MRR releases consistent with the implementation of redd dewatering protective adjustments to limit potential redd dewatering January through May.

CalSim 3 modeling of Alternative 4 compared to the No Action Alternative indicates that below Nimbus Dam flow releases would generally be similar all months of wet years and most different in critically dry years. In critically dry years, increases and decreases are generally anticipated nearly year-round. The largest flow increases occur in April of dry years at 139 cfs and July of critically dry years at 225 cfs when compared to the No Action Alternative. The largest flow decreases would occur in August through November (between -18 and -160 cfs), and February through March of critically dry years (between -96 and -265 cfs) when compared to the No Action Alternative. However, under Alternative 4 compared to the No Action Alternative when all water year types projections are averaged, results show the two alternatives are similar year-round.

*Northwestern Pond Turtle*

Model results illustrate that average flows under Alternative 4 will be similar to the No Action Alternative, therefore there are no anticipated adverse impacts to northwestern pond turtle.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

There would be no actions under Alternative 4 that would affect suitable habitat of the South Sierra DPS of foothill yellow-legged frog in the lower American River.

*Western Yellow-Billed Cuckoo*

Seasonal operations under Alternative 4 will on average maintain current vegetation for western yellow-billed cuckoo, with limited floodplain activation to stimulate regeneration. Seasonal operations may reduce natural variability beyond major flood events. Seasonal operations will likely contribute to the further reduction of natural successional processes that result in non-climax stage riparian woodlands and loss of suitable western yellow-billed cuckoo habitat over time. However, habitat conditions with implementation of Alternative 4 are expected to be similar to habitat conditions experienced by western yellow-billed cuckoo under the No Action Alternative.

**Stanislaus River**

Minimum instream flows (i.e., Goodwin Dam releases) under Alternative 4 would be in accordance with the 2019 New Melones SRP as modified to increase the potential outmigration response of juvenile steelhead from Winter Instability Flows, as shown in Figure 3.4-2 (EIS, Chapter 3). The SRP includes the ability to shape monthly and seasonal flow volumes. Reclamation, through the Stanislaus Watershed Team, schedules the winter instability flow volume, including combining the additional January and February releases, in consideration of timing flows to coincide with a natural storm event which may naturally cue outmigration. Modifications would use a single pulse and increase peak releases from 400 cfs to 1,500 cfs. In addition to description of the No Action Alternative, Reclamation may release additional pulse flows in November.

CalSim 3 modeling below Goodwin Dam under Alternative 4 compared to the No Action Alternative indicates that average flow released would generally be higher February and July through September and lower April, May, and October of most water year types; the most variation is likely to occur in below normal water years when most months are expected to have higher or lower flows and the least variation in wet years. The largest decreases under Alternative 4 compared to the No Action Alternative occur in April of below normal (-174 cfs) and dry years (-105 cfs), June of wet years (-121 cfs), and January of above normal (-205 cfs) and critically dry years (-17 cfs). The largest increases under Alternative 4 compared to the No Action Alternative occur in February of below normal and dry years (84 and 104 cfs), August of wet years (39 cfs), and June of critically dry years (155 cfs). When all water year type projections for Alternative 4 are averaged, flow release projections are higher in December, February, July, and August and lower in April compared to the No Action Alternative.

*Northwestern Pond Turtle*

Compared to the No Action Alternative, Alternative 4 would result in incremental increases in flows which may contribute to adverse impacts to northwestern pond turtle. Incremental increases in flows could increase velocity and water levels, which may adversely impact eggs if nests are inundated and/or kill hatchlings, and make hatchlings more vulnerable to predation by causing shallower areas to become more accessible to aquatic predators. Lower flows resulting from Alternative 4 may also cause adverse impacts to aquatic habitat by causing aquatic habitat to become unsuitable for hatchlings and force them to move into deeper areas that are more accessible to aquatic predators. While lower flows can lead to adverse impacts to pond turtle, decreased flows can also increase water temperature which could improve the growth of juveniles and lead to expanded basking areas. A summary of the positive and adverse impacts to northwestern pond turtle is provided in Table P.2-15.

*Foothill Yellow-Legged Frog (South Sierra DPS)*

There would be no actions under Alternative 4 that would affect suitable habitat of the South Sierra DPS of foothill yellow-legged frog upstream of New Melones Reservoir. Alternative 4 proposed flow changes in the lower Stanislaus River downstream from New Melones Reservoir could adversely impact aquatic habitat for the South Sierra DPS of foothill yellow-legged frog. Compared to the No Action Alternative, Alternative 4 would result in both incrementally higher average flows and lower average flows varying by month throughout the year. Both incremental flow increases, and lower flows could contribute to positive and adverse impacts to foothill yellow-legged frog as provided in Table P.2-16. Lower average flows in some months of the year under Alternative 4 may also reduce natural variability in water releases, beyond major flood events, which will create more stable conditions (i.e., more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and increase sedimentation) and provide some potential benefits for foothill yellow-legged frogs.

Ultimately the limited discretion on flow releases from New Melones Reservoir into the Stanislaus River will result in possible dislodging, isolation, or mortality of egg masses, and possibly strand and/or kill tadpoles and metamorphs. Incrementally higher flows and water levels under Alternative 4 could impact adults' ability to feed or reside in the Stanislaus River and may lead to sedimentation of cobbled substrates. Lower water temperatures in the summer, high pulse flow water releases during developmental periods and a minor increase in sedimentation of cobbled substrates could adversely impact applicable life stages of the foothill yellow-legged frog.

#### *Western Yellow-Billed Cuckoo and Least Bell's Vireo*

The seasonal operations in the Stanislaus River and generally higher flows will have a negligible impact on the existing riparian vegetation. Elevated flows are not anticipated to rise to the level that would cause impacts to nesting western yellow-billed cuckoos or least Bell's vireo.

### San Joaquin River

There would be no changes in average flows that would affect suitable habitat of the northwestern pond turtle, giant garter snake, or the South Sierra DPS of foothill yellow-legged frog in the San Joaquin River watershed under Alternative 4.

### Bay-Delta

Reclamation would continue to operate Delta facilities by season with the same primary purposes as described in the Common Components in Appendix E, Section E.2.4, *Delta*. The SMSCG are the only component in the Bay-Delta where proposed flow changes were found to have the potential to impact terrestrial resources based on flow modeling, therefore, the terrestrial analysis is centered around SMSCG reoperations.

#### *Northwestern Pond Turtle*

The SMSCG are being proposed to direct more fresh water into the Suisun Marsh to improve habitat conditions for Delta smelt in the region. Northwestern pond turtles are a primarily freshwater species, and higher basking activity has been observed in Suisun Marsh in areas with low salinity, indicating an increase in habitat suitability when salinity is decreased. Northwestern pond turtles were also found to have higher abundance, survival, and growth rates in areas with reduced salinities (Agha et al. 2020; USFWS 2023a). Thus, Alternative 4 will likely have a beneficial impact on northwestern pond turtle. A summary of the positive impacts to northwestern pond turtle is provided in Table P.2-15.

*Soft Bird’s Beak and Suisun Thistle*

SMSCG reoperations under Alternative 4 are expected to lower marsh salinities,  in Suisun Marsh. Effects on soft bird’s beak and Suisun thistle from changes in tidal stage, flow, or erosion are uncertain at this time. Because salinity levels of the habitat in which soft bird’s-beak or Suisun thistle are found would not be substantially altered due to the variability of existing salinities as well as the variability created between years when Alternative 4 would be implemented, the proposed operation of the SMSCG associated with Alternative 4 would likely be negligible to either soft bird’s beak or Suisun thistle.

#### *P.2.6.2 Potential Changes to Critical Habitat from Seasonal Operations*

Alternative 4 includes proposed flow changes in the Sacramento River within western yellow-billed cuckoo critical habitat. The proposed changes are unlikely to produce measurable change in quantity or quality of western yellow billed cuckoo habitat, including riparian vegetation in the upper Sacramento watershed.

Critical habitat for valley elderberry longhorn beetle is present along the American River. However, under the four phases of Alternative 4, proposed flow changes are unlikely to produce measurable changes in quantity or quality of valley elderberry longhorn beetle critical habitat, in the American River watershed, including riparian vegetation.

Critical habitat for soft bird’s-beak and Suisun thistle is present in the Delta region. SMSCG reoperations under Alternative 4 are expected to lower marsh salinities, Given that salinity levels of the surrounding habitat would not be substantially altered due to the variability of existing salinities as well as the variability created between years, potential effects on the primary constituent elements for each species are negligible.

#### *P.2.6.3 Summary of Species Impacts*

The following tables provide a summary of the anticipated positive and adverse impacts to each species analyzed under Alternative 4.

Table P.2-15. Impacts to Northwestern Pond Turtle under Alternative 4

| Northwestern Pond Turtle | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Decreased water depth could expand basking areas | Inundation of upland basking, sheltering, overwintering, aestivation, and movement habitat |
| | Increased dispersal distance between aquatic and upland habitat due to decreases in flow |
| Directing more freshwater to Bay-Delta may decrease salinity levels, improving suitability of aquatic habitat | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Increased water depth could cause aquatic breeding and basking habitat to become unsuitable |
| Warmer water temperatures may improve growth of juveniles | Direct mortality or injury due to increased flow velocity |
| | Cooler water temperatures may slow growth of juveniles |

| Northwestern Pond Turtle | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| | Increased predation of hatchlings and juveniles |

Table P.2-16. Impacts to Foothill Yellow-Legged Frog under Alternative 4

| Foothill Yellow-Legged Frog | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Reduce natural variability in water releases, creating more stable flow levels that are less likely to flush and/or kill eggs, tadpoles, metamorphs, and adults, and less likely to increase sedimentation | Direct mortality or injury due to increased flow velocity |
| | Sedimentation of cobbled substrates from increased flow velocity, decreasing habitat suitability |
| | Seasonal salinity increases may reduce suitability of aquatic habitat in the Bay-Delta |
| | Cooler water temperatures in summer may preclude breeding, slow egg development, and growth of tadpoles and metamorphs |
| | Increased predation of tadpoles and metamorphs |
| | Increased susceptibility to pathogens due to change in habitat conditions |

Table P.2-17. Impacts to Giant Garter Snake under Alternative 4

| Impacts |
|---|
| Temporary reduction in the availability of aquatic habitat through conversion of rice to dryland farming or fallowed land |
| Increased risk of predation of individual of snakes due to loss of aquatic habitat |

Table P.2-18. Impacts to Bank Swallow under Alternative 4

| Bank Swallow | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Increased flows in the Sacramento River during a majority of the non-breeding season could provide the necessary bank erosion functions needed for new bank swallow breeding habitat in the form of cut banks. | Localized bank collapse that results in partial or complete colony failure from flows greater than 14,000 cfs during the breeding season |

Table P.2-19. Impacts to Western Yellow-Billed Cuckoo and Least Bell's Vireo under Alternative 4

| Western Yellow-Billed Cuckoo and Least Bell's Vireo | |
|---|---|
| **Positive Impacts** | **Adverse Impacts** |
| Spring pulse flows may benefit western yellow-billed cuckoo in the Sacramento River by supporting the recruitment of important riparian tree species, primarily willows | 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. |
| | Reduced and degraded habitat for foraging, nesting, and cover |
| High fall flows may reduce drought stress in riparian or wetland vegetation, keep more constant spring flows and avoid erosion at restoration sites | Changes in flow and operations could adversely impact least Bell's vireo through changes in riparian habitats if the species recolonizes the Sacramento River Valley during the timeframe of all action alternatives. |

### P.2.7 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 alternatives on listed and non-listed species addressed in this appendix. Table P.2-20 briefly summarizes the species-specific measures.

Table P.2-20. Mitigation Measures for Terrestrial Species in the Study Area

| Number | Title | Summary | Applicable Action Alternatives |
|---|---|---|---|
| BIO-1 | Governance group considerations for Foothill Yellow-legged Frog | Develop and implement field evaluations to inform governance groups to minimize impacts to foothill yellow-legged frog and their aquatic habitat. | 1 |
| BIO-2 | Real-time group considerations for Northwestern Pond Turtle | Implement field evaluations to inform real-time groups to minimize impacts to northwestern pond turtle and their aquatic habitat | 2, 3, 4 |
| BIO-3 | Real-time group considerations for Foothill Yellow-legged Frog | Implement field evaluations to inform real-time groups to minimize impacts to foothill yellow-legged frog and their aquatic habitat | 2, 3, 4 |
| BIO-4 | Flow criteria and real-time group considerations for Bank Swallow | Develop flow criteria and consideration within real-time groups 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 | 2, 3, 4 |

| Number | Title | Summary | Applicable Action Alternatives |
|---|---|---|---|
| | | (April 1 through August 31); this includes downstream tributary flows when timing water releases (Bank Swallow Technical Advisory Committee 2013). | |
| BIO-5 | Conservation actions to advance Bank Swallow conservation on the Sacramento River | To the greatest extent possible Reclamation and DWR will contribute to USFWS and CDFW research that supports bank swallow conservation on the Sacramento River | 2, 3, 4 |

**Mitigation Measure BIO-1: Foothill Yellow-Legged Frog – Governance Group Considerations for Foothill Yellow-legged Frog**

Reclamation will develop and implement field evaluations to inform governance groups to minimize impacts to foothill yellow-legged frog and their aquatic habitat. Reclamation will coordinate with other monitoring efforts, as relevant, to reduce the data gap regarding known occupied and predicted occupied habitat of foothill yellow-legged frog in the action area and to identify comprehensive and consistent measures to improve the potential for conservation of these species and associated aquatic habitats.

**Mitigation Measure BIO-2: Real-time Group Considerations for Northwestern Pond Turtle**

Reclamation will develop and implement field evaluations to inform real-time groups to minimize impacts to northwestern pond turtle and their aquatic habitat. Reclamation will coordinate with other monitoring efforts, as relevant, to reduce the data gap regarding known occupied and predicted occupied habitat of northwestern pond turtle in the action area and to identify comprehensive and consistent measures to improve the potential for conservation of these species and associated aquatic habitats. Field evaluations for northwestern pond turtle for flow operations will inform real-time groups to minimize impacts to terrestrial biological resources for operational decisions and will be conducted in coordination with the various technical teams (e.g. SHOT) and the program will be developed in coordination with USFWS and CDFW.

The monitoring approach includes the following principles which would be incorporated into any future changes to monitoring programs addressed in a subsequent consultation:

- Incorporate an aquatic habitat and ecosystem monitoring enterprise for the long-term operations of the CVP and SWP to effectively measure physical conditions, water quality, and species abundance and distribution.
- Provide robust synthesis of data to incorporate results and lessons learned.

Protocols for monitoring northwestern pond turtle (including monitoring intervals) and assessing their habitat will be developed by Reclamation, in conjunction with the USFWS and CDFW, based on the best available scientific methods for this species (e.g., Bury et al.

2001; Oregon Department of Fish and Wildlife 2020). This information will be used to document baseline levels for population monitoring. Surveys will include the following, as needed, to generate a robust synthesis of results for the monitoring program:

- Assess the quality of occupied and unoccupied (typically adjacent to occupied habitat) western pond turtle habitat in stream reaches.
- Document the presence of basking sites that could be monitored repeatedly.
- Assess the relative quality of adjacent upland nesting and overwintering habitat, particularly in areas where nesting has been documented in the past.
- Evaluate the presence of factors that could affect breeding success (e.g., adjacent land use).
- Document whether young turtles are present (as an indication of whether successful reproduction is occurring).

**Mitigation Measure BIO-3: Real-time Group Considerations for Foothill Yellow-legged Frog**

Reclamation will develop and implement field evaluations to inform real-time groups to minimize impacts to foothill yellow-legged frog and their aquatic habitat. Reclamation will coordinate with other monitoring efforts, as relevant, to reduce the data gap regarding known occupied and predicted occupied habitat of foothill yellow-legged frog in the action area and to identify comprehensive and consistent measures to improve the potential for conservation of these species and associated aquatic habitats. Field evaluations for foothill yellow-legged frog for all flow operations will inform real-time groups to minimize impacts to terrestrial biological resources for operational decisions and will be conducted in coordination with the various technical teams (e.g., SHOT) and the program will be developed in coordination with and subject to approval by USFWS and CDFW.

The monitoring approach includes the following principles which would be incorporated into any future changes to monitoring programs addressed in a subsequent consultation:

- Incorporate an aquatic habitat and ecosystem monitoring enterprise for the long-term operations of the CVP and SWP to effectively measure physical conditions, water quality, and species abundance and distribution.
- Provide robust synthesis of data to incorporate results and lessons learned.

Species-specific conservation actions to assess the condition of foothill yellow-legged frog and viability of aquatic habitat in the action area are described below.

Protocols for documenting occurrences of all life-stages of foothill yellow-legged frog (including monitoring intervals) and assessing their habitat will be developed by Reclamation, in conjunction with the Wildlife Agencies, based on the best available protocol for this species (e.g., Seltenrich and Pool 2002). This information will be used to document baseline levels for population monitoring. Surveys will include the following, as needed, to generate a robust synthesis of results for the monitoring program:

- Stream reaches occupied by adult foothill yellow-legged frog and stream reaches used for breeding (e.g., based on presence of egg masses or tadpoles).
- Unoccupied breeding habitat with the potential to support breeding populations (typically upstream or downstream of occupied habitat).
- An assessment of riparian vegetation and stream substrate along occupied and unoccupied stream reaches.
- Presence of non-native bullfrogs, crayfish, and non-native, predatory fish species.
- Presence of other factors that could potentially affect breeding success.

**Mitigation Measure BIO-4: Flow Criteria and Real-time Group Considerations for Bank Swallow**

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).

**Mitigation Measure BIO-5: Conservation Actions to Advance Bank Swallow Conservation on the Sacramento River**

To the greatest extent possible Reclamation and DWR will contribute to CDFW and USFWS research that supports bank swallow conservation on the Sacramento River through the following actions:

- Support the annual USFWS/CDFW surveys of colonies along the Sacramento River and its tributaries. The ongoing bank swallow surveys provide critical data for understanding the status of the population and the effectiveness of conservation actions. By increasing the frequency of surveys in the Redding to Red Bluff (RM 292–243), Colusa to Verona (RM 143–81) reaches, researchers could help eliminate the small but potentially significant data gap. Surveys of these areas would ideally be conducted annually, but if resources are limited, surveys in alternate years may suffice.
- Investigate the relationship between the magnitude, timing, duration, and frequency of real-time operation events and potential impacts to bank swallow colonies and habitat. Given the uncertainty that exists regarding potential water management actions that might reduce the risk of bank swallow impacts described above, assessments should be conducted to inform the flow conditions most likely to cause such impacts.
- Assess and inform USFWS of other potential metrics to quantify the health of the Sacramento population of bank swallow. A number of tools, beyond the burrow counts that have been used to date, could provide valuable information about the status and health of the bank swallow population.

### P.2.8 Summary of Impacts

Table P.2-21 includes a summary of impacts, the magnitude and direction of those impacts, and potential mitigation measures for consideration.

Table P.2-21. Impact Summary

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| Potential changes to wildlife and plant habitat on river banks | No Action Alternative[1] | The No Action Alternative is expected to result in potential changes in terrestrial biological resources at reservoirs that store CVP water, tributaries, and the Delta. These changes were described and considered in the 2020 Record of Decision. | – |
| | Alternative 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 adverse impacts on bank swallow colonies. | |
| | Alternative 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 adverse impacts on bank swallow colonies. | BIO-4: Flow criteria and real-time group considerations for Bank Swallow<br>BIO-5: Conservation actions to advance Bank Swallow Conservation on the Sacramento River |
| | Alternative 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 adverse impacts on bank swallow colonies. | BIO-4: Flow criteria and real-time group considerations for Bank Swallow<br>BIO-5: Conservation actions to advance Bank Swallow Conservation on the Sacramento River |
| | Alternative 4 | Changes in flows compared with the No Action Alternative are expected to be similar to habitat conditions experienced by bank swallow under the No Action Alternative. | BIO-4: Flow criteria and real-time group considerations for Bank Swallow<br>BIO-5: Conservation actions to advance Bank Swallow |

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| | | | Conservation on the Sacramento River |
| Potential changes to existing marshes and associated special-status species in the Bay-Delta region | No Action Alternative | The No Action Alternative is expected to result in potential changes in terrestrial biological resources at reservoirs that store CVP water, tributaries, and the Delta. These changes were described and considered in the 2020 Record of Decision. | – |
| | Alternative1 | A seasonal increase in salinity in Suisun Marsh in summer and fall compared to the No Action Alternative may result in decreased habitat suitability for Northwestern pond turtle. | BIO-1: Governance group considerations for Foothill Yellow-legged Frog |
| | Alternative 2 | Proposed seasonal operations may direct more fresh water into the Suisun Marsh compared to the No Action Alternative which will likely have a beneficial effect on northwestern pond turtle. Proposed operations are expected to lower marsh salinities. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| | Alternative 3 | Proposed seasonal operations may direct more fresh water into the Suisun Marsh compared to the No Action Alternative which will likely have a beneficial effect on northwestern pond turtle. Proposed operations are expected to lower marsh salinities. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| | Alternative 4 | Proposed seasonal operations may direct more fresh water into the Suisun Marsh compared to the No Action Alternative which will likely have a beneficial effect on northwestern pond turtle. Proposed operations are expected to lower marsh salinities. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| Potential changes to existing riparian areas and associated special-status species | No Action Alternative | The No Action Alternative is expected to result in potential changes in terrestrial biological resources at reservoirs that store CVP water, tributaries, and the Delta. These changes were described and considered in the 2020 Record of Decision. | – |

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| | Alternative 1 | Proposed seasonal operations compared with the No Action Alternative may result in lower water temperatures, increased flow velocities, and loss of aquatic and upland habitat that may directly impact all life stages of foothill yellow-legged frog and northwestern pond turtle. | BIO-1: Governance group considerations for Foothill Yellow-legged Frog |
| | Alternative 2 | Proposed seasonal operations compared with the No Action Alternative may result in lower water temperatures, high pulse flow water releases, and loss of aquatic and upland habitat that may directly impact all life stages of foothill yellow-legged frog and northwestern pond turtle. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| | Alternative 3 | Proposed seasonal operations compared with the No Action Alternative may result in lower water temperatures, increased flow velocities, and loss of aquatic and upland habitat that may directly impact all life stages of foothill yellow-legged frog and northwestern pond turtle. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| | Alternative 4 | Proposed seasonal operations compared with the No Action Alternative may result in lower water temperatures, high pulse flow water releases, and loss of aquatic and upland habitat during some months of the year that may directly impact all life stages of foothill yellow-legged frog and northwestern pond turtle. Seasonal operations in other months of the year may also reduce natural variability in water releases, beyond major flood events, which may create more stable flow levels that are less likely to impact eggs, tadpoles, metamorphs, and adults, and could decrease sedimentation, providing some potential benefits for foothill yellow-legged frog. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| Potential changes to habitat for special-status reptiles | No Action Alternative | The No Action Alternative is expected to result in potential changes in terrestrial biological resources and critical habitat at reservoirs that store CVP water, tributaries, | – |

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| | | and the Delta. These changes were described and considered in the 2020 Record of Decision. | |
| | Alternative 1 | No effect compared to the No Action Alternative | – |
| | Alternative 2 | Crop fallowing or idling could result in the loss of giant garter snake habitat compared to the No Action Alternative | – |
| | Alternative 3 | Crop fallowing or idling could result in the loss of giant garter snake habitat compared to the No Action Alternative | – |
| | Alternative 4 | Crop fallowing or idling could result in the loss of giant garter snake habitat compared to the No Action Alternative | – |
| Potential to injure or kill special-status species | No Action Alternative | The No Action Alternative is expected to result in potential changes in terrestrial biological resources and critical habitat at reservoirs that store CVP water, tributaries, and the Delta. These changes were described and considered in the 2020 Record of Decision. | – |
| | Alternative 1 | Flow releases compared to the No Action Alternative will result in minor impacts on the relevant life stages for the foothill yellow-legged frog, northwestern pond turtle, and bank swallow. | BIO-1: Governance group considerations for Foothill Yellow-legged Frog |
| | Alternative 2 | Flow releases compared to the No Action Alternative will result in minor impacts on the relevant life stages for the foothill yellow-legged frog, northwestern pond turtle, and bank swallow. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| | Alternative 3 | Flow releases compared to the No Action Alternative will result in minor impacts on the relevant life stages for the foothill yellow-legged frog, northwestern pond turtle, and bank swallow. | BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for |

| Impact | Alternative | Magnitude and Direction of Impacts | Potential Mitigation Measures |
|---|---|---|---|
| | | | Foothill Yellow-legged Frog |
| | Alternative 4 | Flow releases compared to the No Action Alternative will result in minor impacts on the relevant life stages for the foothill yellow-legged frog, northwestern pond turtle, and bank swallow. | BIO-2: Real-time group considerations for Foothill Yellow-legged Frog;<br>BIO-2: Real-time group considerations for Northwestern Pond Turtle<br>BIO-3: Real-time group considerations for Foothill Yellow-legged Frog |
| Potential changes to wetlands and waters of the United States | No Action Alternative | The No Action Alternative is expected to result in potential changes in terrestrial biological resources at reservoirs that store CVP water, tributaries, and the Delta. These changes were described and considered in the 2020 Record of Decision. | – |
| | Alternative 1 | None compared to the No Action Alternative | – |
| | Alternative 2 | None compared to the No Action Alternative | – |
| | Alternative 3 | None compared to the No Action Alternative | – |
| | Alternative 4 | None compared to the No Action Alternative | – |

[1] The No Action Alternative is compared to the changes to terrestrial biological resources that are assumed to occur by 2040.

### P.2.9 Cumulative Impacts

Past, present, and reasonably foreseeable projects, described in Appendix Y, *Cumulative Impacts Technical Appendix*, may have cumulative effects on terrestrial biological resources and critical habitat, to the extent that changes in vegetation, flow, and alteration to habitat availability or quality could occur.

Past and present actions contribute to the existing condition of the affected environment in the project area while reasonably foreseeable actions are those that are likely to occur in the future that are not speculative. Past, present, and reasonably foreseeable projects include actions to develop water storage capacity, water conveyance infrastructure, water recycling capacity, the reoperation of existing water supply infrastructure, including surface water reservoirs and conveyance infrastructure, and habitat restoration actions. The projects identified in Appendix Y that have the most potential to contribute to cumulative impact on terrestrial biological resources are:

- Maxwell Intertie Project
- Pacheco Reservoir / San Luis Reservoir Low Point Improvement Project
- Los Vaqueros Reservoir Expansion Phase 2
- Prospect Island Tidal Habitat Restoration Project

The No Action Alternative would continue with the current operation of the CVP and may result in changes to terrestrial biological resources in the Central Valley Project and State Water Project. These changes may potentially contribute to cumulative impacts and were described and considered in the 2020 Record of Decision.

**Effects of Climate Change**

Appendix Y lists past, present, and reasonably foreseeable future actions that have or may potentially improve water supplies in California and reduce impacts generated by climate change, sea-level rise, increased water allocated to improve habitat conditions, and future growth.

Climate change is expected to result in many physical changes to the study area. From a terrestrial biology perspective, the 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. Changes in the frequency of drought and extreme rainfall events has not been predicted, but these events may 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 could 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 could 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 in Suisun Bay could be gradually inundated and converted to more subtidal habitat as net sediment deposition is not expected to keep pace with sea level rise (Ganju and Schoellhamer 2010). 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, 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 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, 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 could occur under implementation of the action alternatives, these risks may be reduced by implementation of those project elements identified for the purposes of flood protection in Appendix Y. The negative elements of climate change described above could be a contributing factor to cumulative effects of implementing the projects listed in Appendix Y.

#### *P.2.9.1 Cumulative Effects of the Action Alternatives*

This cumulative analysis discusses Alternatives 1, 2, 3, and 4, all of which would result in minor increases in flows at some point in each water year scenario throughout the study area that could result in impacts on terrestrial biological resources. Based on the analyses presented in earlier parts of this appendix, these changes would generally have moderate or little to 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 many special-status species and their habitats. The positive effects of implementing all Alternatives are similar. There could be relatively small variations in the acres affected by flow regime changes across the alternatives, therefore there is a low to moderate potential to modify natural communities and affect special-status plants and wildlife.

Appendix Y, lists past, present, and reasonably foreseeable actions that have or may potentially contribute to cumulative impacts on terrestrial biological resources. The projects 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, short-term cumulative impacts could occur but could also benefit terrestrial biological resources over the long-term. While flow changes in the short-term period could temporarily or permanently remove some natural communities and modeled habitat for special-status plant and wildlife species, the short-, mid-, and long-term result of flow changes would have limited impact on these species; therefore the action alternatives' contributions to cumulative impacts would be minor.

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