Barren Barren habitat consists mainly of nonvegetated human-made features. Barren habitat is scattered throughout the Shasta Lake and vicinity portion of the primary study area, including boat ramps, parking lots, and roads. Other barren habitats are a large gravel plain feature at the confluence of Butcher Creek and Shasta Lake (Main Body) and a sealed riprap feature adjacent to Interstate 5 near the upper Sacramento Arm and Shasta Lake confluence. Vegetation is usually not present, although sparse opportunistic grasses/forbs or weedy species may occur.

Birch-Leaf Mountain-Mahogany Chaparral Birch-leaf mountain-mahogany chaparral is a relatively common associate species in many chaparral and woodland plant series types. As a plant series, birch-leaf mountain-mahogany occurs in the Shasta Lake and vicinity portion of the primary study area along the upper McCloud and Sacramento arms. These sites are located on floodplain terraces and are characterized as moderate to dense chaparral stands dominated by birch-leaf mountain-mahogany (*Cercocarpus betuloides*), with occasional buck brush (*Ceanothus cuneatus*), poison oak (*Toxicodendron diversilobum*), western redbud (*Cercis occidentalis*), yerba santa (*Eriodictyon californicum*), and Brewer oak (*Q. garryana* var. b*reweri*).

Black Willow Thicket Although commonly associated with willow and other riparian plant series types, black willow thicket is uncommon in the Shasta Lake and vicinity portion of the primary study area. This plant series is dominated by black willow (*Salix gooddingii*), with spicebush (*Calycanthus occidentalis*), rushes (*Juncus* spp.), and California grape (*Vitis californica*). It occurs at only two locations in the Shasta Lake and vicinity portion of the primary study area, one along the Sacramento Arm and the other in the Jones Valley area (Pit Arm).

Blue Oak Woodland The blue oak plant series occurs mainly as small inclusions within other more prevalent plant series types; however, moderate-sized stands also occur. This plant series occurs at scattered locations along the Main Body, McCloud Arm, and Pit Arm and is characterized by open to moderate woodlands dominated by blue oak (*Quercus douglasii*). Associated tree species include occasional interior live oak (*Q. wislizenii* var. *wislizenii*) and gray pine (*Pinus sabiniana*). The shrub layer is open or absent, and a moderate to dense forb layer dominates the understory.

Brewer Oak Scrub The Brewer oak plant series consists of moderate to very dense stands of Brewer oak, the shrub form of Oregon white oak (*Q. garryana* var. *garryana*). This plant series type is widespread throughout the Shasta Lake and vicinity portion of the primary study area. Brewer oak stands are often nearly pure; occasionally, however, shrub species such as poison oak, white leaf manzanita, yerba santa, buck brush, bush poppy (*Dendromecon rigida*), Fremont's silktassel (*Garrya fremontii*), deer brush (*Ceanothus integerrimus*), skunkbrush (*Rhus trilobata*), and snowdrop bush (*Styrax officinalis*) occur in association with Brewer oak.

Buck Brush Chaparral Buck brush chaparral occurs at scattered locations throughout the Shasta Lake and vicinity portion of the primary study area. This plant series is dominated by moderate to dense stands of buck brush. Associated species include white leaf manzanita, poison oak, western redbud, yerba santa, Brewer oak, birch-leaf mountain-mahogany, and coffeeberry (*Frangula* sp.).

California Annual Grassland California annual grassland is uncommon in the Shasta Lake and vicinity portion of the primary study area, occurring only as small inclusions in other more prevalent plant series types or in areas subjected to previous disturbance. Dominant species include wild oat (*Avena fatua*), downy brome (*Bromus tectorum*), ripgut (*B. diandrus*), yellow star-thistle (*Centaurea solstitialis*), squirreltail (*Elymus elymoides*), and European hairgrass (*Aira caryophyllea*).

California Ash Chaparral California ash (*Fraxinus dipetala*) is a relatively common associate species in many chaparral and woodland plant series types. As a plant series, California ash chaparral occurs in the Shasta Lake and vicinity portion of the primary study area at several locations along the McCloud Arm. This plant series is characterized as a moderate to dense chaparral stand dominated by California ash, with occasional birch-leaf mountain-mahogany, buck brush, poison oak, western redbud, yerba santa, and Brewer oak.

California Black Oak The black oak series is characterized by moderate to dense stands of California black oak (*Quercus kelloggii*). This plant series is relatively common throughout the Shasta Lake and vicinity portion of the primary study area. Understory associates include white leaf manzanita (*Arctostaphylos viscida*), poison oak, snowdrop bush (*Styrax officinalis*), and buck brush. The ground layer is open to dense and is dominated by various grasses and forbs.

California Buckeye Groves Although a common associate in many plant series types in the Shasta Lake and vicinity portion of the primary study area, California buckeye groves are uncommon as a plant series type. This plant series is dominated by California buckeye (*Aesculus californica*). Associated species include poison oak, Brewer oak, buck brush, and various grasses and forbs. It occurs at only several scattered locations in the Sacramento Arm, McCloud Arm, and Pit Arm.

California Yerba Santa Scrub California yerba santa scrub is a relatively common associate species in many chaparral and woodland plant series types. California yerba santa is a pioneer species that readily responds to various disturbances and wildfire. As a plant series, California yerba santa scrub occurs in the Shasta Lake and vicinity portion of the primary study area at two general locations subject to wildfires in 2004 and 2008: the Dry Creek area (Main Body) and the Jones Valley area (Pit Arm). This plant series is characterized as moderate to dense chaparral stands dominated by California yerba santa, with

occasional shrub interior live oak, shrub canyon live oak, buck brush, poison oak, western redbud, and Brewer oak.

Canyon Live Oak Forest The canyon live oak plant series is characterized by moderate to dense stands of canyon live oak (*Quercus chrysolepis*). This plant series is relatively common throughout the Shasta Lake and vicinity portion of the primary study area. Associated tree species include occasional California black oak. Understory associates include white leaf manzanita and poison oak. The ground layer is open to moderate and is dominated by various grasses and forbs.

Deer Brush Chaparral Deer brush chaparral is a relatively common associate in chaparral and forest plant series types in the Shasta Lake and vicinity portion of the primary study area; however, deer brush is uncommon in the study area as a plant series type. This plant series is dominated by deer brush. It occurs at several scattered locations along the Main Body, McCloud Arm, and Pit Arm.

Fremont Cottonwood Forest In the Shasta Lake and vicinity portion of the primary study area, Fremont cottonwood forest is an uncommon plant series type that occurs as single stands of trees along small portions of the upper Sacramento Arm and the Pit Arm. The dominant species is Fremont cottonwood (*Populus fremontii*).

Ghost (Gray) Pine The ghost pine plant series occurs in all parts of the Shasta Lake and vicinity portion of the primary study area except along the Big Backbone Arm. This plant series type is characterized by open to moderate stands of gray pine. Associated species include blue oak, canyon live oak, interior live oak, and California black oak. Shrub species are moderate to dense and include white leaf manzanita, western redbud, buck brush, Brewer oak, poison oak, and yerba santa.

Himalayan Blackberry Brambles Himalayan blackberry (*Rubus armeniacus*) is a common associate in many riparian plant series and in various other plant series with mesic microhabitats and/or previous disturbance. As a plant series, Himalayan blackberry brambles occur in portions of the Dry Creek (Main Body) and Jones Valley (Pit Arm) areas recently disturbed by wildfire. This plant series occurs in and along drainage and stream features and is characterized as dense thickets of Himalayan blackberry. Associated species include spicebush, willow, and rushes.

Interior Live Oak Chaparral In the Shasta Lake and vicinity portion of the primary study area, the interior live oak chaparral plant series is relatively uncommon, occurring mainly along the Sacramento Arm. However, this plant series also occurs at scattered locations along the Main Body, the McCloud Arm, and the Pit Arm. This plant series is dominated by moderate to dense stands of the shrub form of interior live oak. Associated species include Brewer oak, white leaf manzanita, poison oak, and buck brush.

Interior Live Oak Woodland The interior live oak woodland plant series is uncommon in the Shasta Lake and vicinity portion of the primary study area. It occurs in several small areas along the Sacramento Arm, the Pit Arm, the McCloud Arm, and the Main Body.

Knobcone Pine Forest The knobcone pine forest plant series consists of open to dense knobcone pine (*Pinus attenuata*) stands. This plant series is scattered throughout all portions of the Shasta Lake and vicinity portion of the primary study area. Knobcone pine forest often occurs at locations characterized by disturbances, including historic mining activities and past or recent wildfires. Dominant species include knobcone pine, with occasional canyon live oak, California black oak, ponderosa pine (*Pinus ponderosa*), and gray pine. The shrub layer is moderate to dense and is dominated by white leaf manzanita and poison oak. The ground layer varies and is dominated by various grasses and forbs.

Lacustrine Lacustrine habitat consists of the area regularly inundated by Shasta Lake (i.e., areas at and below the 1,070-foot elevation). Most of this area is barren of vegetation and is characterized as exposed soil and/or rock. Portions of the lacustrine habitat do support vegetation, including woody riparian species such as black willow, button willow (*Cephalanthus occidentalis*), Fremont cottonwood, and various grasses and forbs, during draw-down periods.

Mixed Willow Mixed willow is the most common willow plant series type in the Shasta Lake and vicinity portion of the primary study area and occurs throughout the entire area. Dominant species include red willow (*Salix laevigata*), black willow, shining willow (*S. lasiandra*), arroyo willow (*S. lasiolepis*), and narrowleaf willow (*S. exigua*).

Oregon Ash Groves Oregon ash groves are an uncommon plant series type in the Shasta Lake and vicinity portion of the primary study area. This type occurs along the upper McCloud Arm and is dominated by open to moderate stands of Oregon ash (*Fraxinus latifolia*) with willow, California grape, mock orange, brickellbush (*Brickellia* sp.), and poison oak.

Oregon White Oak Woodland The Oregon white oak woodland plant series is uncommon in the Shasta Lake and vicinity portion of the primary study area and occurs as small inclusions in other more prevalent plant series types. This plant series is characterized by open to moderate woodlands dominated by Oregon white oak. Associated tree species include occasional canyon live oak, blue oak, and California black oak. The shrub layer is open or absent, and a moderate to dense forb layer dominates the understory.

Pale Spike Rush Marshes Pale spike rush is an uncommon plant series in the Shasta Lake and vicinity portion of the primary study area; it is known to occur only in a portion of one relocation area near Lakehead (Sacramento Arm). This plant series is characterized as a seasonal wetland dominated by a complex of

annual and perennial upland and wetland plant species. Dominant species include pale spike rush (*Eleocharis macrostachya*), jointed coyote-thistle (*Eryngium articulatum*), pennyroyal (*Mentha pulegium*), panic grass (*Panicum acuminatum*), iris-leaf rush (*Juncus xiphioides*), sedges (*Carex* spp.), rushes, poison oak, white leaf manzanita, western choke-cherry (*Prunus virginiana*), interior rose (*Rosa woodsii*), and Himalayan blackberry.

Ponderosa Pine–Douglas-Fir Ponderosa pine-Douglas-fir is the second-most-common conifer plant series type in the Shasta Lake and vicinity portion of the primary study area, occurring everywhere except along the Big Backbone Arm. This plant series is characterized by open to dense conifer stands dominated by Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine. Associated species include occasional sugar pine (*P. lambertiana*), incense cedar (*Calocedrus decurrens*), canyon live oak, and California black oak. Associated understory species vary and include Pacific dogwood (*Cornus nuttallii*), mock orange (*Philadelphus lewisii*), poison oak, snowdrop bush, and white leaf manzanita. The ground layer is open to moderate and is dominated by various grasses and forbs.

Ponderosa Pine Ponderosa pine is the most common conifer plant series type in the Shasta Lake and vicinity portion of the primary study area and is scattered throughout all portions of the area. This plant series is characterized by open to dense conifer stands dominated by ponderosa pine. Associated species include occasional Douglas-fir, sugar pine, incense cedar, canyon live oak, and California black oak. Associated understory species vary and include redbud, buck brush, mock orange, poison oak, snowdrop bush, and white leaf manzanita. The ground layer is open to moderate and is dominated by various grasses and forbs.

Red Osier Thickets Red osier is a common associate in many riparian plant series types in the Shasta Lake and vicinity portion of the primary study area. As a plant series, red osier thickets are an uncommon plant series type. In the vicinity of Shasta Lake, red osier thickets are found along the upper McCloud Arm. Dominant species include red osier (*Cornus stolonifera*), brown dogwood (*C. glabrata*), mock orange, spicebush, and California grape.

Riverine Riverine habitat includes the free-flowing portions of the larger Shasta Lake tributaries occurring in the Shasta Lake and vicinity portion of the primary study area. The riverine habitat is highly variable and ranges from moderate, low-gradient to steep, well-confined stream reaches.

Sandbar Willow Thickets Sandbar willow thicket is an uncommon plant series that occurs at one location each along the McCloud Arm and the Squaw Creek Arm. Dominant species include narrowleaf willow, with occasional red willow, black willow, shining willow, and arroyo willow.

Spicebush Thickets Spicebush is a common associate in many riparian plant series types in the Shasta Lake and vicinity portion of the primary study area. As a plant series, spicebush thickets are an uncommon plant series type. This plant series occurs at several locations along the McCloud Arm. Dominant species include spicebush, red osier, mock orange, and California grape.

Urban Urban habitat consists of various man-made features scattered throughout the Shasta Lake and vicinity portion of the primary study area, including resorts and a portion of the visitor center complex at Shasta Dam. These features are typically a combination of various buildings, pavement areas with manicured landscaping, and lawns.

Valley Oak Woodland Valley oak woodland is an uncommon plant series and occurs at two small locations in the Lakehead area (Sacramento Arm). Dominant species include valley oak (*Quercus lobata*) with white leaf manzanita, redbud, poison oak, and various grasses and forbs.

White Alder Groves The white alder plant series occurs in the riparian vegetation found in drainages throughout the Shasta Lake and vicinity portion of the primary study area. This plant series is characterized as narrow bands of vegetation occurring in and along the margins of rivers, streams, or other drainages. Dominant species include white alder (*Alnus rhombifolia*) with occasional Oregon ash, red osier, big-leaf maple (*Acer macrophyllum*), narrowleaf willow, red willow, shining willow, and arroyo willow. Associated shrubs include spicebush, mock orange, California blackberry (*Rubus ursinus*), mugwort (*Artemisia douglasiana*), ninebark (*Physocarpus capitatus*), and western azalea (*Rhododendron occidentale*). Common lianas include California grape, pipevine (*Aristolochia californica*), greenbriar (*Smilax californica*), and virgin's bower (*Clematis ligusticifolia*). The ground layer is open to dense and is dominated by sedges with various grasses and forbs.

White Leaf Manzanita Chaparral White leaf manzanita is the most common chaparral plant series type in the Shasta Lake and vicinity portion of the primary study area and is scattered throughout all portions of the area. The dominant species is white leaf manzanita. Associated species include occasional common manzanita (A. manzanita), western redbud, buck brush, deer brush, poison oak, birch-leaf mountain-mahogany, interior live oak (shrub form), Fremont's silktassel, bush poppy, yerba santa, and Brewer's oak.

Upper Sacramento River (Shasta Dam to Red Bluff)

The following section provides a description of the wildlife habitats that exist throughout the primary study area, and a detailed discussion of potential Sacramento River downstream habitat restorations areas.

Plant Communities in the Primary Study Area (Shasta Dam to RBPP) The plant communities present in the primary study area between Shasta Dam and RBPP include common and sensitive communities as described below, and the

relevant aspects of their ecology are discussed in detail in the *Botanical Resources and Wetlands Technical Report*, and summarized below for sensitive communities. These descriptions are generally applicable to the extended study area as well. (Plant community names and descriptions used in this section are based primarily on the Preliminary Descriptions of the *Terrestrial Natural Communities of California* (Holland 1986).)

Common plant communities present within the primary study area include annual grassland, chaparral, and agricultural lands. The upper banks along steep-sided, bedrock-constrained segments of the Sacramento River and its tributaries are characterized primarily by upland communities, including blue oak woodland, foothill pine-oak woodland, and chaparral. These segments occur primarily between Shasta Dam and Redding.

Sensitive plant communities include those that are of special concern to resource agencies or are afforded specific consideration through CEQA, Section 1602 of the California Fish and Game Code, Section 404 of the Federal Clean Water Act (CWA), and the State of California's (State) Porter-Cologne Water Quality Control Act, as discussed in Section 12.2, "Regulatory Framework."

Oak Woodlands Oak woodlands present in the primary study area include blue oak woodland, blue oak savanna, foothill pine-oak woodland, and valley oak woodland. The oaks that dominate the tree layer of oak savannas and woodlands are long-lived trees that are resilient to damage; their stems often survive fire, and when their stems are killed by fire or are cut down, basal sprouts often grow into new stems. (Valley oak also tolerates inundation during winter before it has leafed out.) Nonetheless, there are concerns regarding the status and ongoing trends of tree mortality and recruitment in tree canopies of blue oak- and valley oak-dominated savannas and woodlands (Tyler, Kuhn, and Davis 2006).

Riparian Communities California's riparian communities have experienced the most extensive reductions in their acreage, and in the Sacramento Valley more than 90 percent of riparian vegetation has been converted to agriculture or development, and the remainder substantially altered by dams, diversions, gravel mining, grazing practices, and invasive species (Hunter et al. 1999).

In the primary study area, much of the Sacramento River from Shasta Dam to Redding is deeply entrenched in bedrock, which precludes development of extensive areas of riparian vegetation. The river corridor between Redding and Red Bluff, however, still maintains extensive areas of riparian vegetation.

Riparian communities present within the floodplain of the Sacramento River, within the primary study area, include blackberry scrub, Great Valley willow scrub, Great Valley cottonwood riparian forest, Great Valley mixed riparian forest, and Great Valley valley oak riparian forest. Willow and blackberry scrub and cottonwood- and willow-dominated riparian communities are present along

active channels and on the lower flood terraces whereas valley oak-dominated communities occur on higher flood terraces.

More than 15 native species of deciduous trees and shrubs occur in the riparian forests, woodlands, and scrubs of the Central Valley and the Delta (Conard, MacDonald, and Holland 1977; Vaghti and Greco 2007). Flow regime, disturbance, and species attributes determine the species composition and physical structure of this woody vegetation. Although flow regime influences the dispersal, establishment, growth, and survival of all the woody riparian species, Fremont's cottonwood (*Populus fremontii*) and the willow species (*Salix* sp.) particularly depend on specific hydrologic events for their recruitment. During seed release, flows must be high enough to disperse seed to surfaces where scouring by subsequent flows does not occur, yet not so high that seedlings desiccate after flows recede, and flows must recede gradually to enable germination and seedling establishment while the substrate is still moist (Mahoney and Rood 1998).

Fremont's cottonwood and willow species are rapidly growing, shade intolerant and relatively short-lived (Burns and Honkala 1990, Vaghti and Greco 2007). Within 10 to 20 years, initially shrubby thickets may reach 10–40 feet in height. Other species, such as Oregon ash (*Fraxinus latifolia*) and valley oak (*Quercus lobata*), establish concurrently or subsequent to the willows and cottonwood, grow more slowly but are more tolerant of shade, and are longer-lived (Burns and Honkala 1990, Tu 2000). In the absence of frequent disturbance, these species enter the canopy, particularly after 50 years, as mortality of willows and cottonwood frees space. Conversely, frequent disturbance prevents the transition to mature mixed riparian or valley oak forests.

The operation of Shasta Dam has limited the frequency, magnitude, and duration of intermediate and larger flows during fall and winter since the dam's construction, and flow volumes have been greater during the growing season. The operation of Shasta Dam also produces increasing flow volumes during the period of cottonwood seed dispersal (rather than flow volume decreasing during this period), largely precluding establishment of cottonwoods (and to a lesser extent willows) throughout much of the riparian zone (Roberts et al. 2002). The combined effect of these changes in flow regime has been a decrease in early- and mid-successional communities along the Sacramento River that is still ongoing (Fremier 2003).

Wetland Communities Similar to riparian communities, much of the wetland habitat that once occurred in the Sacramento River Valley has been eliminated as a consequence of land use conversion to agriculture and urbanization. It is estimated that nearly 1.5 million acres of wetlands once occurred in the Central Valley. Today, approximately 123,000 acres remain. Wetland communities that are likely to occur in the primary study area between Shasta Dam and RBPP include freshwater marsh, freshwater seep, northern hardpan vernal pools, northern volcanic mudflow vernal pools, and other seasonal wetlands.

Freshwater marshes are herbaceous wetland plant communities that occur along rivers and lakes and are characterized by dense cover of perennial, emergent plant species. Marshes are typically perennial wetlands, but may dry out for short periods of time. In marsh vegetation, vegetation structure and species richness are strongly influenced by disturbance, changes in water levels, and the range of elevations present at a site (Keddy 2000). Disturbances, and water level drawdowns that expose previously submerged surfaces, provide opportunities for species to establish, which creates diversity in species composition and vegetation structure. With increasing depth of water, the growth of marsh plants is reduced, and thus this vegetation type is typically restricted to shallow water.

Freshwater seep is a wetland plant community characterized by dense cover of perennial herb species usually dominated by rushes, sedges, and grasses. Freshwater seep communities occur on sites with permanently moist or wet soils resulting from daylighting groundwater.

Vernal pools are seasonal wetlands that fill during winter rains and dry up in spring. They occur in undulating or mima mound (i.e., mound-intermound) topography where the soil or underlying rock has layers that are relatively impermeable to water. Vernal pools may be isolated from one another, but more often they are interconnected by swales or ephemeral drainages in vernal pool complexes that may extend for hundreds of acres. Vernal pool complexes generally include water features. The two predominant types of vernal pool communities in the primary study area are northern hardpan vernal pools and northern volcanic mudflow vernal pools.

Pool size and the depth, duration, and seasonal timing of ponding are important factors that influence the composition and diversity of plant and animal species in vernal pools (Solomeshch, Barbour, and Holland 2007). Consequently, the vegetation of vernal pools can vary substantially from year to year in response to interannual fluctuations in climate.

Management activities such as grazing and burning also influence species composition and diversity. In fact, research indicates that the abundance of nonnative grasses, grazing practices, and hydrology are strongly interrelated and can substantially affect the plant communities of vernal pools (Robins and Vollmar 2002, Pyke 2004, Marty 2005).

Seasonal wetlands are ephemeral wetlands that pond or remain flooded for long periods during a portion of the year, generally the rainy winter season, then dry up, typically in spring. They often occur in shallow depressions on flood terraces that are occasionally to infrequently flooded. Seasonal wetlands are herbaceous communities typically characterized by species adapted for growth in both wet and dry conditions, and may contain considerable cover of upland species as well. Seasonal wetlands differ from vernal pools in that they do not have a restrictive hardpan layer and are usually dominated by nonnative plant species, especially nonnative grasses.

Potential Sacramento River Downstream Habitat Restoration Areas Many of the same plant community classifications found in the Shasta Lake and vicinity portion of the primary study area also occur in the potential Sacramento River habitat restoration areas. However, the species composition, structure, and overall function of these areas are significantly different, as these areas are situated in a separate geographic setting and region. Plant communities occurring in the potential Sacramento River habitat restoration areas include broom patches, black locust groves, California yerba santa scrub, cattail marshes, Fremont cottonwood forest, ghost pine woodlands, Hind's walnut stands, Oregon ash groves, sandbar willow thickets, shining willow groves, soft rush marshes, valley oak woodland, Wright's buckwheat patches, water primrose wetlands, white alder groves, and white-root beds. Other plant or habitat communities include California annual grassland, mixed riparian forest, parrot's feather mats, reed canarygrass swards, silver wattle thickets, barren, orchard, and riverine.

The potential Sacramento River downstream habitat restoration areas are characterized by habitats typical of riparian and riverine areas found in the Sacramento River below Shasta Dam. These habitats were also mapped and classified using the MCV. Habitats present in the potential Sacramento River downstream habitat restoration areas are summarized in Table 12-3 and depicted in Figures 12-4a through 12-4f. General habitat descriptions for these locations are also described below.

Table 12-3. Summary of Plant Communities in the Potential Sacramento River Downstream Restoration Areas

Habitat	Area (acres[1])						
	Henderson	Tobiasson Island	Shea Island Complex	Kapusta Island	Anderson River Park	Reading Island	Total
Broom patches	0.00	2.62	13.03	0.92	4.55	0.00	21.13
Black locust groves	0.00	0.00	0.35	0.00	0.00	0.00	0.35
California annual grassland	2.50	13.50	2.61	17.56	7.83	0.00	44.01
California yerba santa scrub	0.00	0.22	0.00	0.00	1.30	0.00	1.53
Cattail marshes	0.37	0.28	0.29	0.11	1.14	0.00	2.18
Foothill pine	0.00	13.26	0.70	1.86	0.00	0.00	15.82
Fremont cottonwood forest	7.05	1.04	0.00	4.79	44.26	0.00	57.14
Hind's walnut stands	0.42	0.00	0.00	0.00	0.00	0.00	0.42
Orchard	0.00	0.00	0.00	0.00	0.00	0.55	0.55

Table 12-3. Summary of Plant Communities in the Potential Sacramento River Downstream Restoration Areas (contd.)

Habitat	Area (acres*)						
	Henderson	Tobiasson Island	Shea Island Complex	Kapusta Island	Anderson River Park	Reading Island	Total
Oregon ash groves	0.00	0.00	0.00	0.00	2.57	0.00	2.57
Sandbar willow thickets	2.77	0.69	6.68	12.84	5.92	0.38	29.28
Shining willow groves	0.00	2.34	4.05	0.00	0.00	0.00	6.39
Silver wattle thickets	0.00	0.34	0.00	0.00	0.59	0.00	0.93
Soft rush marshes	0.00	0.00	0.26	0.00	0.00	0.00	0.26
Valley oak woodland	2.88	2.03	3.50	14.46	26.85	50.48	100.19
Wright's buckwheat patches	0.00	0.00	0.00	0.00	1.49	0.00	1.49
Water primrose wetlands	3.36	0.00	0.00	0.00	5.81	15.33	24.50
White alder groves	0.00	0.00	0.22	4.16	0.00	0.00	4.38
White-root beds	0.00	0.00	0.00	0.18	0.00	0.00	0.18
Mixed riparian forest	0.00	0.00	0.00	0.00	0.00	24.40	24.40
Parrot's feather mats	0.00	0.00	0.00	0.00	2.92	0.00	2.92
Reed canarygrass swards	0.00	0.00	0.44	0.32	1.18	0.00	1.95
Barren[2]	0.31	1.10	0.00	0.00	0.55	0.00	1.96
Riverine[2]	0.66	1.33	3.45	8.13	0.00	0.47	14.04
Total	20.32	38.76	35.57	65.33	106.96	91.61	358.56

Note:
[1] Acreage values are approximate.
[2] California Wildlife Habitat Relationships Wildlife Habitat Type; no corresponding plant series type included in *A Manual of California Vegetation* (Sawyer et al. 2009).

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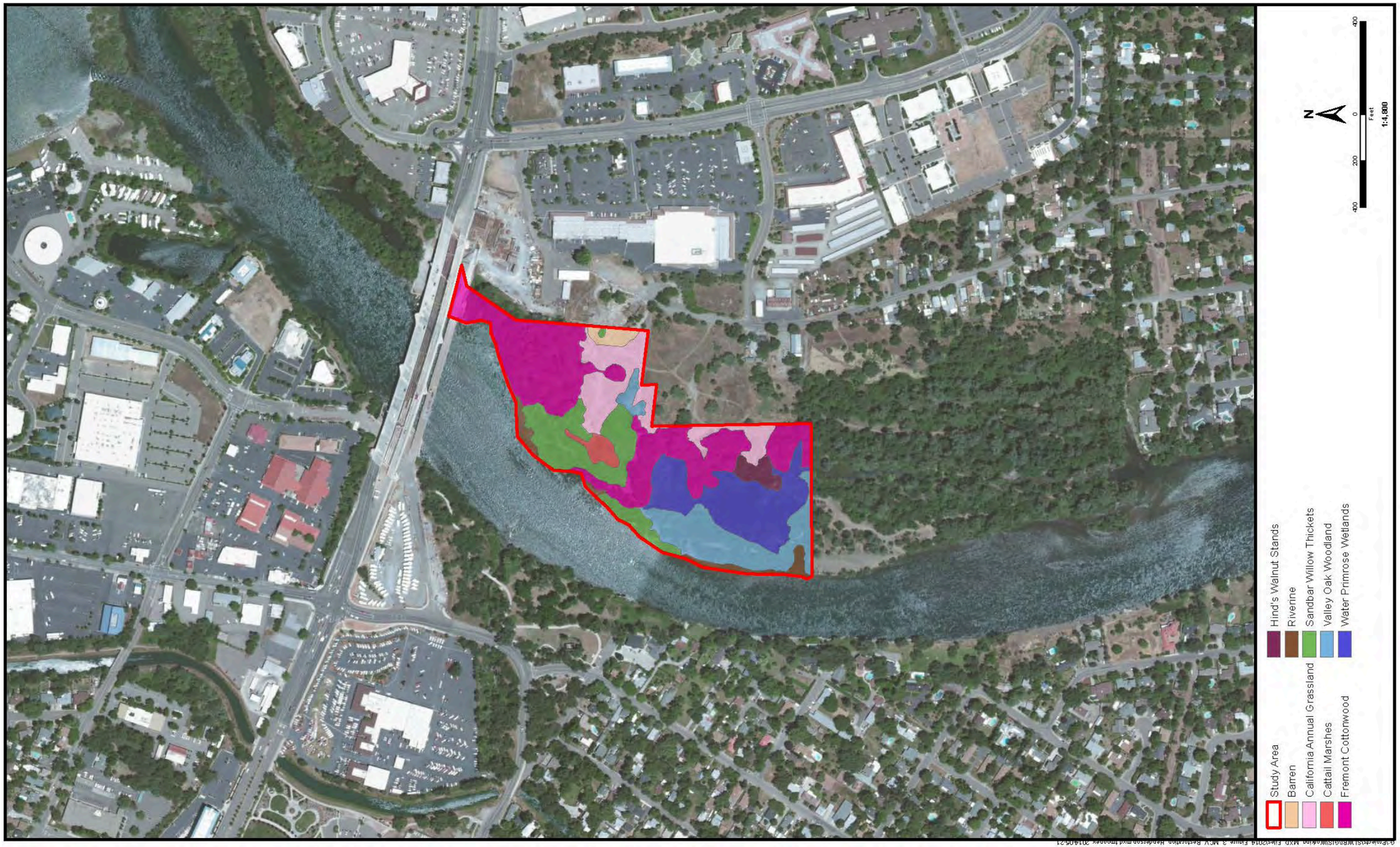

Figure 12-4a. Manual of California Vegetation Types – Henderson Open Space

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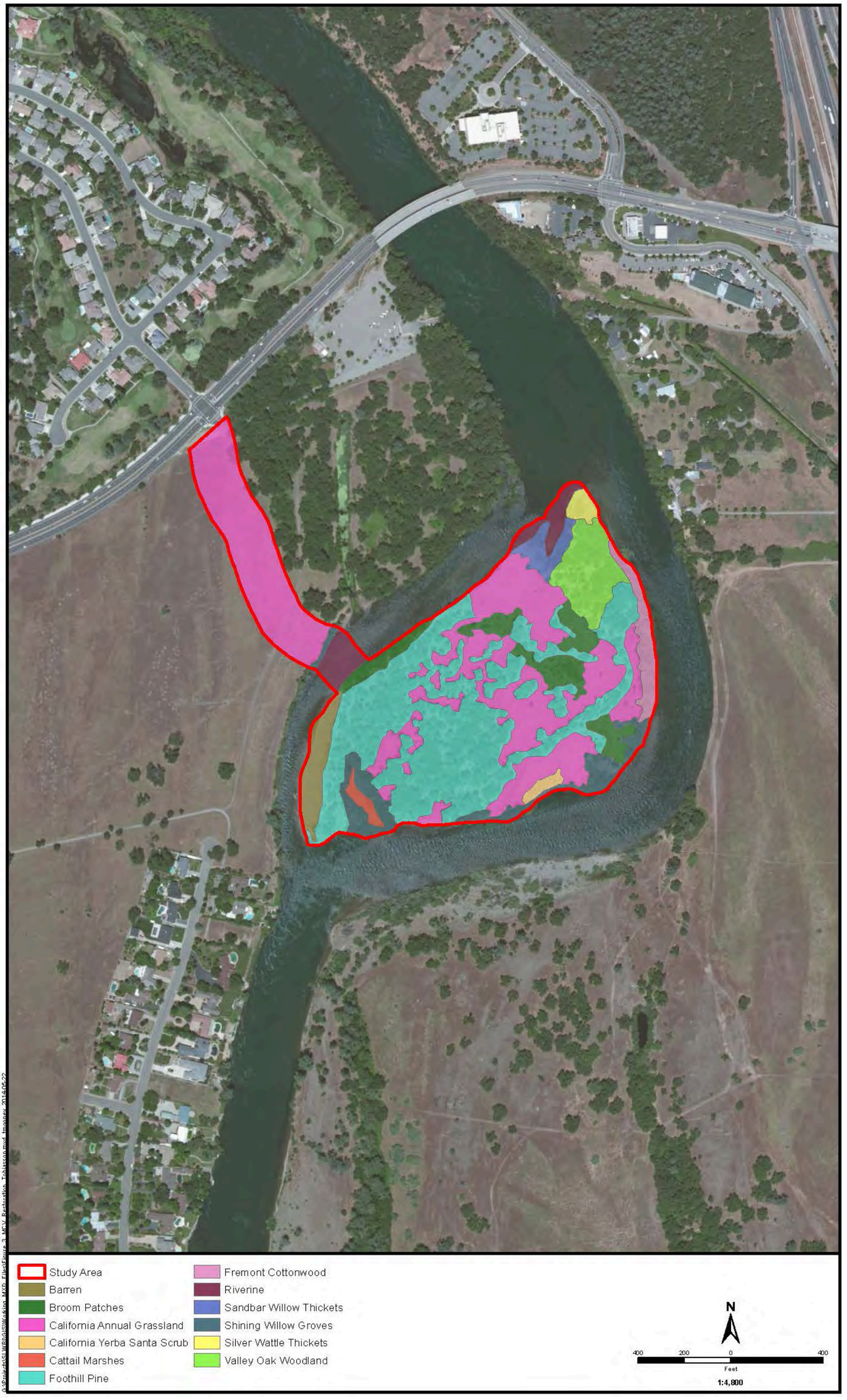

Figure 12-4b. Manual of California Vegetation Types – Tobiasson Island

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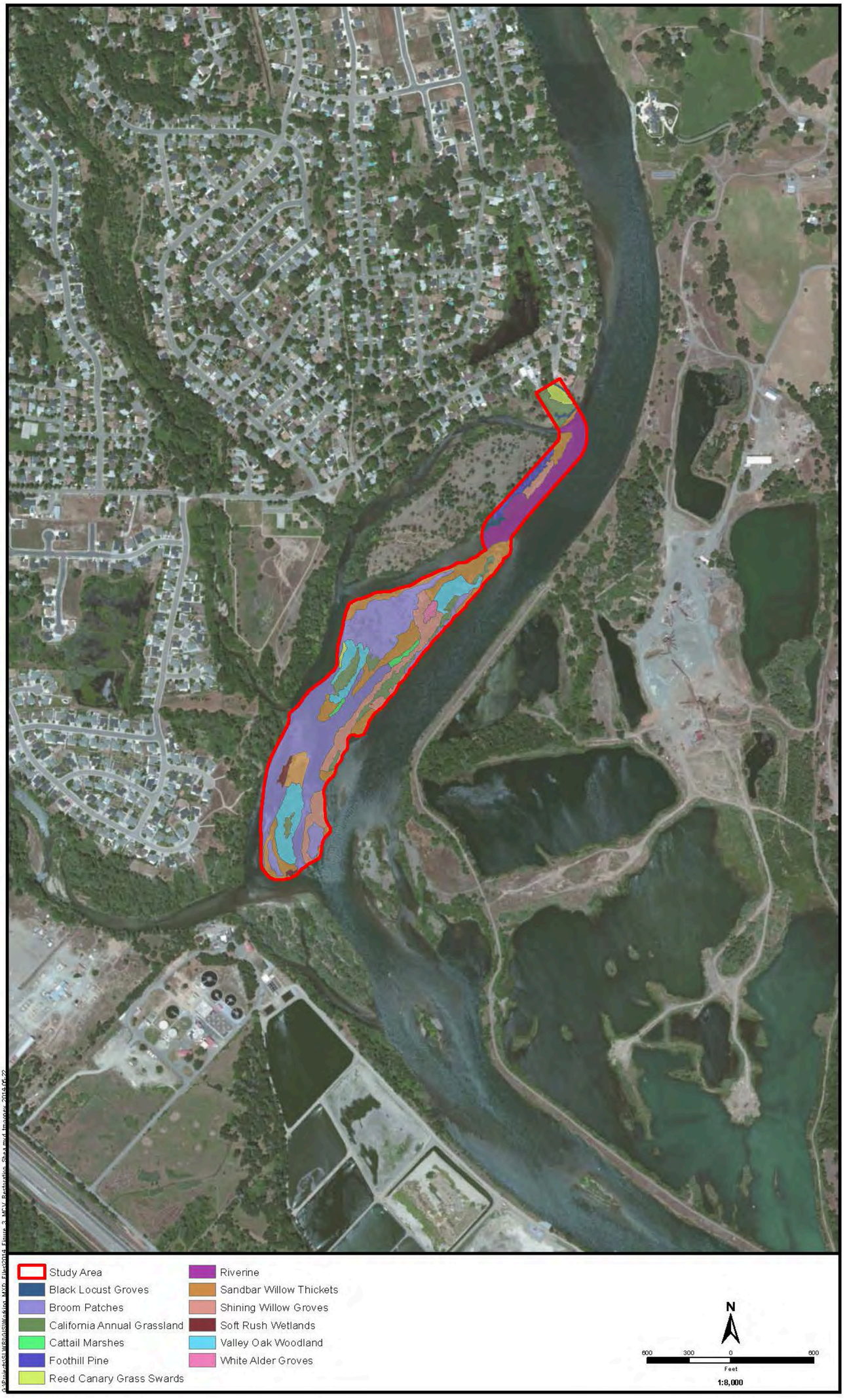

Figure 12-4c. Manual of California Vegetation Types – Shea Island Complex

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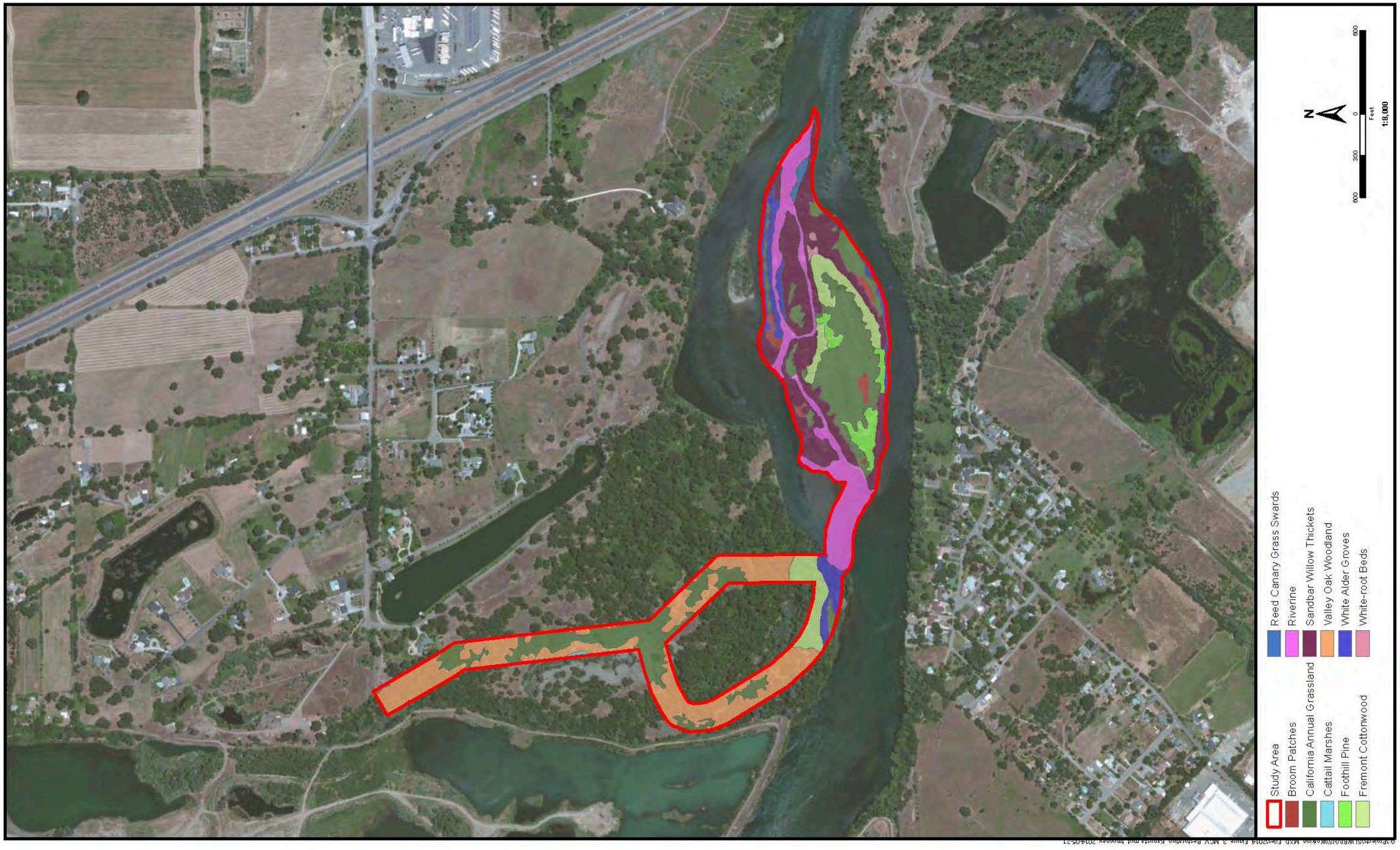

Figure 12-4d. Manual of California Vegetation Types – Kapusta Island

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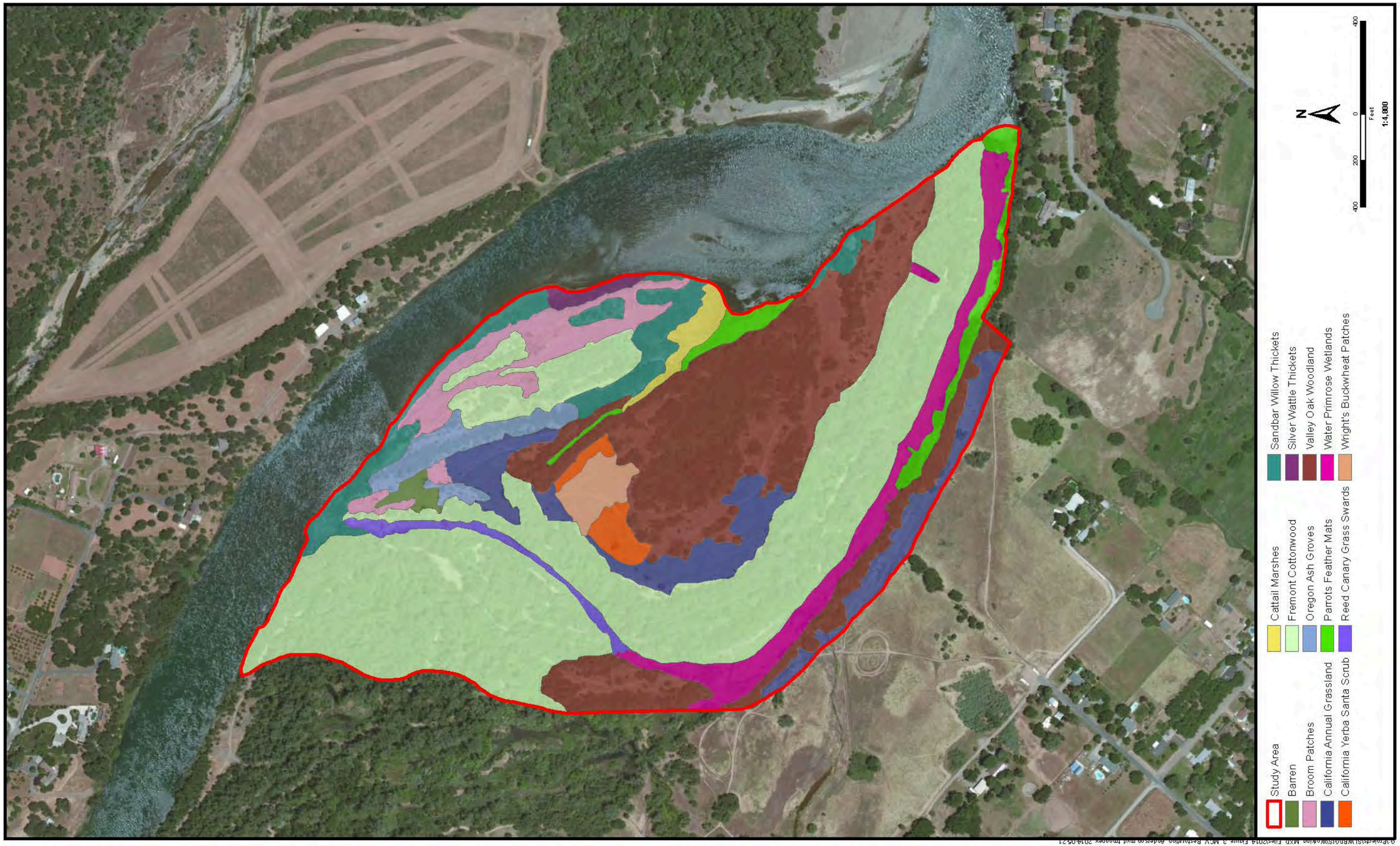

Figure 12-4e. Manual of California Vegetation Types – Anderson River Park

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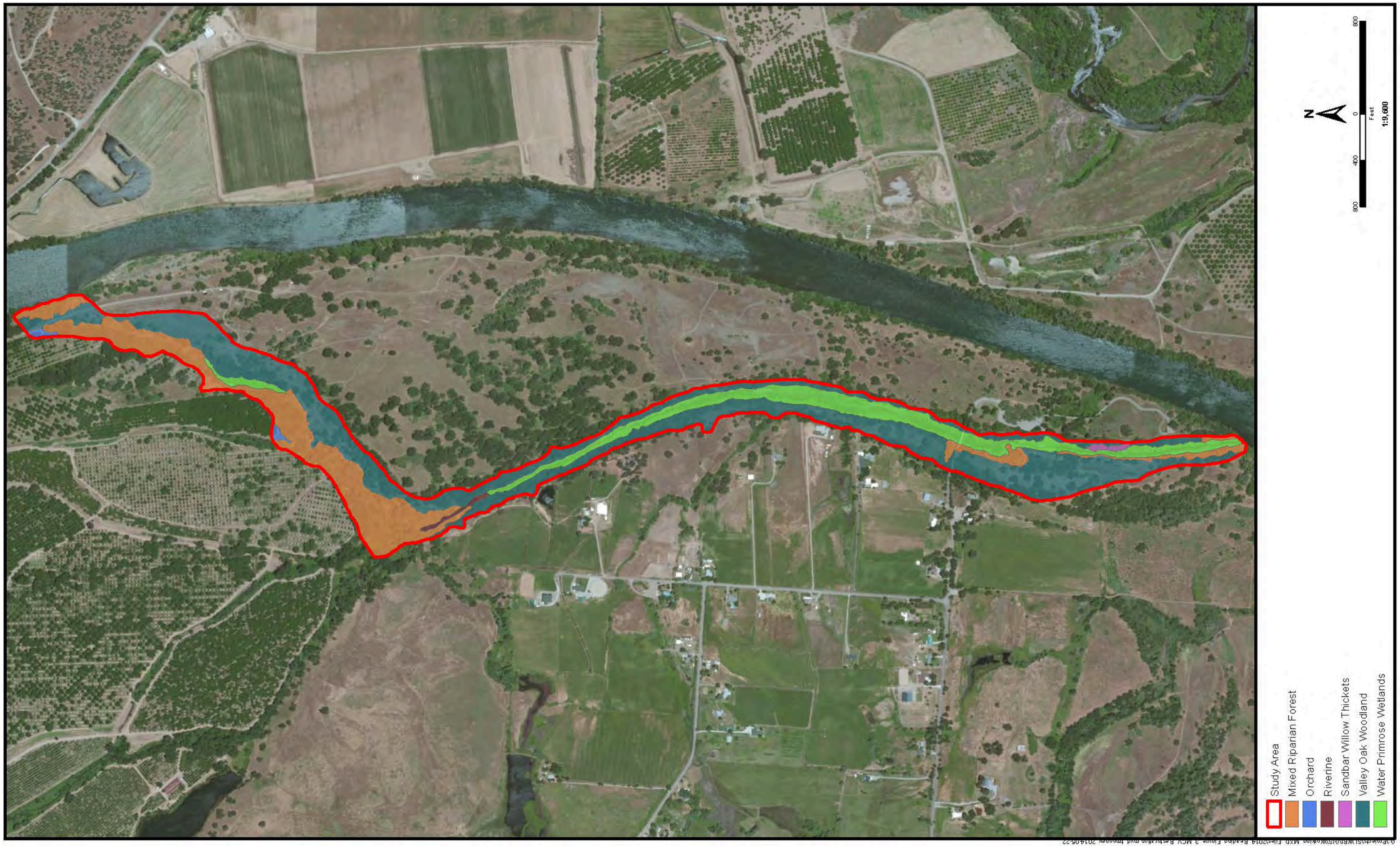

Figure 12-4f. Manual of California Vegetation Types – Reading Island

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Broom Patches Broom patches mainly occur on open gravel bars and are characterized by sparse to dense patches of Spanish broom (*Spartium junceum*). Associated species include Bermuda grass (*Cynodon dactylon*), Oregon golden aster (*Heterotheca oregona*), gumweed (*Grindelia* sp.), and common ragweed (*Ambrosia artemisiifolia*).

Black Locust Groves Black locust groves are an uncommon plant community in the potential restoration sites and occur as small stands at the Shea Island Complex site. This community is characterized by a moderate to dense canopy of black locust with occasional valley oak. The dominant understory vegetation is Himalayan blackberry.

California Yerba Santa Scrub California yerba santa scrub occurs on open rocky areas and is characterized by sparse to moderate cover of California yerba santa. Sparse annual grasses and forb cover also occurs in these areas including Oregon golden aster, wright's buckwheat (*Eriogonum wrightii*), naked buckwheat (*Eriogonum nudum*), slender wild oat (*Avena barbata*), mousetail (*Myosurus* sp.), ripgut grass (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), and red brome (*Bromus madritensis* ssp. *rubens*).

Cattail Marshes Cattail marshes occur along the margins of backwater sloughs, pond margins, and as small inclusions in riparian forests. This plant community is characterized by dense stands of broadleaf cattail (*Typha latifolia*). Within the shallow fringes of these cattail marshes are small patches of reed canarygrass (*Phalaris arundinacea*), horsetail (*Equisetum* sp.), rush (*Juncus* sp.), and dallisgrass (*Paspalum dilatatum*). Parrot's feather (*Myriophyllum aquaticum*), smartweed (*Persicaria* sp.) and water primrose (*Ludwigia peploides*) grow in the deep water areas of the marshes.

Fremont Cottonwood Forest Fremont cottonwood forest occurs as multi-layered riparian forest stands characterized by a moderate to dense canopy of predominantly Fremont cottonwood. Associated species including valley oak, Oregon ash, white alder, narrowleaf willow, shining willow, Goodding's black willow, black locust (*Robinia pseudoacacia*), and silver wattle (*Acacia dealbata*) are also present in the canopy layer. Dominant understory vegetation includes Himalayan blackberry, California grape, Santa Barbara sedge (*Carex barbarae*), giant reed (*Arundo donax*), mugwort (*Artemisia douglasiana*), horsetail, Bermuda grass (*Cynodon dactylon*), and Johnson grass (*Sorghum halepense*).

Ghost Pine Woodland Ghost pine woodlands occur in upland areas above the active floodplain and are characterized by a moderately dense canopy of foothill pine with occasional valley oak and Fremont cottonwood. Dominant understory species include Himalayan blackberry and Spanish broom.

Hind's Walnut Stands Hind's walnut and related stands occur as a small stand of riparian trees in the southeast portion of the Henderson Open Space potential

restoration site. This semi-natural stand is dominated by an overstory of black walnut (*Juglans nigra*) with occasional valley oak and narrowleaf willow. Understory vegetation is moderately dense and includes Himalayan blackberry, California grape, Johnson grass, and Bermuda grass.

Oregon Ash Groves Oregon ash groves are an uncommon plant community in the potential restoration sites and are characterized by a moderately dense canopy of Oregon ash. Associated tree species include Fremont cottonwood, shining willow, and narrowleaf willow. Dominant shrub species include French broom (*Genista monspessulana*), giant reed, and Himalayan blackberry. The herbaceous layer is dominated by Bermuda grass.

Sandbar Willow Thickets Sandbar willow thickets occur in riparian habitats throughout the study area. This plant community is characterized by a moderate to dense canopy of narrowleaf willow. Associated trees and shrubs include shining willow, Fremont cottonwood, Goodding's black willow, Oregon ash, black walnut, black locust, and Himalayan blackberry. The herbaceous layer consists of primarily broomsedge bluestem (*Andropogon virginicus*), horsetail, rushes, nut sedges (*Cyperus* spp.), dallisgrass, and Johnson grass.

Shining Willow Groves Shining willow groves are an uncommon plant community in the potential restoration sites and are characterized by dense stands of shining willow with occasional narrowleaf willow, Himalayan blackberry, and California grape.

Soft Rush Marshes Soft rush marshes are an uncommon wetland plant community in the potential restoration sites and occur in patches along the shallow margins of the Sacramento River. This plant community is characterized by dense cover of soft rush (*Juncus effusus*) with occasional Santa Barbara sedge, reed canarygrass, nut sedge (*Cyperus eragrostis*), and spikerush (*Eleocharis* sp.).

Valley Oak Woodland Valley oak woodland occurs in portions of the potential restoration sites above the active floodplain of the Sacramento River. This plant community is characterized by a moderately dense canopy of valley oak with some interior live oak, foothill pine, narrowleaf willow, shining willow, black locust, Fremont cottonwood, black willow, Oregon ash, and tree of heaven (*Ailanthus altissima*) scattered throughout. Dominant understory vegetation includes western redbud, California coffee berry (*Frangula californica*), mugwort, winter vetch (*Vicia villosa*), Santa Barbara sedge, ripgut grass, common ragweed, California grape, California pipevine, and Bermuda grass.

Wright's Buckwheat Patches Wright's buckwheat patches occur in open rocky areas and are characterized by sparse to moderate cover of Wright's buckwheat. Sparse cover of annual grasses and forbs also occur in these areas including Oregon golden aster, naked buckwheat, slender wild oat, mousetail, ripgut grass, soft chess, and red brome.

Water Primrose Wetlands Water primrose wetlands occur in sloughs, backwater marshes, and along pond margins. These wetlands are characterized by dense mats of water primrose (*Ludwigia peploides*) with parrot's feather, smartweed (*Persicaria* sp.), and broadleaf cattail.

White Alder Groves White alder groves occur as multi-layered stands along the river margins characterized by a moderate to dense canopy of white alder. Associated species include Fremont cottonwood, shining willow, narrowleaf willow, black locust, valley oak, Oregon ash, and box elder. Dominant understory vegetation includes Himalayan blackberry, Santa Barbara sedge, mugwort, horsetail, verbena, water iris, and rush.

White-Root Beds White-root beds occur as small inclusions in riparian forest habitats. This plant community is characterized by dense patches of Santa Barbara sedge with occasional Himalayan blackberry, verbena, horsetail, and goose grass (*Galium aparine*).

California Annual Grasslands California annual grasslands are uncommon in the study area and occur as open ruderal areas and vegetated gravel bars. This plant community is characterized by moderate to dense cover of annual grasses and forbs including black mustard (*Brassica nigra*), California poppy (*Eschscholzia californica*), ripgut grass, soft chess, wild oat, rose clover (*Trifolium hirtum*), long beaked storks bill (*Erodium botrys*), turkey mullein (*Croton setigeris*), Oregon golden aster, and tall sock-destroyer (*Torilis arvensis*).

Mixed Riparian Forest Mixed riparian forest occurs at the Reading Island potential restoration site and consists of moderate to dense stands of riparian trees and shrubs. A diverse assemblage of tree species occur including valley oak, narrowleaf willow, Goodding's black willow, shining willow, white alder, black walnut, tree of heaven, box elder, black locust, California buckeye, and blue elderberry (*Sambucus nigra* ssp. *caerulea*). Dominant understory species include buttonbush, Himalayan blackberry, California grape, California pipevine, mugwort, Santa Barbara sedge, and California man-root (*Marah fabacea*).

Parrot's Feather Mats Parrot's feather mats occur in sloughs and backwater marshes. This vegetation type is characterized by dense patches of parrot's feather with small inclusions of water primrose, smartweed, and broadleaf cattail.

Reed Canarygrass Swards Reed canarygrass swards occur in sloughs and backwater areas in the study area. This semi-natural stand is characterized by moderate to dense cover of reed canarygrass. Associated species include narrowleaf willow, broadleaf cattail, smartweed, sedges, and rushes.

Silver Wattle Thickets Silver wattle thickets are an uncommon plant community in the potential restoration sites and occur as small riparian stands in the northern portion of Tobiasson Island. This plant community is characterized by a moderate to dense canopy of silver wattle. Associated species include Oregon ash, Fremont cottonwood, black locust, giant reed, horsetail, and Bermuda grass.

Barren Barren habitat occurs on gravel bars and is characterized by open areas of gravel and cobble substrates. Vegetation is typically absent, although in some barren areas sparse opportunistic grasses/forbs or weedy species may occur.

Orchard Orchard habitat is uncommon in the potential Sacramento River habitat restoration areas and only occurs at the Reading Island site. This habitat consists of a small portion of a walnut orchard extending into a portion of the northern site boundary. The walnut orchard is mature and well maintained. Vegetation includes an overstory of walnut trees and ground cover of various grasses and forbs.

Riverine Riverine habitat occurs at each potential Sacramento River habitat restoration area and consists of portions of active Sacramento River channel within and/or around each site. The riverbed is dominated by primarily gravel, cobble, and boulder substrates.

Lower Sacramento River and Delta

A large number of natural plant communities occur in the extended study area, and some are described in this section and the "CVP/SWP Service Areas" section, or in the *Botanical Resources and Wetlands Technical Report*. The other natural plant communities are described in the following sections, and in Mayer and Laudenslayer (1988), Sawyer and Keeler-Wolf (1995), and CALFED (2000a). In addition to natural plant communities, plant communities of agricultural and urban areas occupy extensive portions of the extended study area.

The lower Sacramento River can be subdivided into distinct reaches that differ in topography, hydrology, and geomorphology; and thus, in vegetation and associated habitat functions.

Red Bluff Pumping Plant to Colusa

In this reach, the Sacramento River is classified as a meandering river, where relatively stable, straight sections alternate with more sinuous, dynamic sections (Resources Agency 2003). The channel remains active and has the potential to migrate in times of high water. Point bars, islands, high and low terraces, instream woody cover, early-successional riparian plant growth, and other evidence of river meander and erosion are common in this reach. Major physiographic features include floodplains, basins, terraces, active and remnant channels, and oxbow sloughs. These features sustain a diverse array of riparian plant communities.

Colusa to the Delta

The general character of the Sacramento River changes quite drastically downstream from Colusa from a dynamic and active meandering channel to a confined, narrow channel restricted from migration. 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.

Primary Tributaries to the Lower Sacramento River

The primary tributaries of the lower Sacramento River are the Feather River, American River, and Sacramento River floodplain bypasses. The aquatic ecosystem in the lower Feather River, down to the confluence with the Sacramento River at Verona, is influenced by DWR's Oroville Facilities. The upper extent is fairly confined by levees as the river flows through the city of Oroville. Downstream from Oroville, the Feather River is fairly active and meanders its way south to Marysville. However, this stretch is bordered by active farmland, which confines the river into an incised channel in certain stretches and limits the width of riparian woodland. Some of this adjacent farmland is in the process of being restored to floodplain habitat with the relocation of levees to become setback levees.

The lower American River (below Folsom and Nimbus dams) is fairly low gradient. Most of the lower American River is surrounded by the American River Parkway, which preserves the surrounding riparian zone. The river channel does not migrate to a large degree because it has become deeply incised, leaving tall cliffs and bluffs adjacent to the river.

Multiple water diversion structures in the lower Sacramento River move floodwaters into floodplain bypass areas during high-flow events. These floodplain bypass areas – the Butte basin, Sutter Bypass, and Yolo Bypass – provide broad, inundated floodplain habitat during wet years. Unlike other Sacramento River and Delta habitats, floodplains and floodplain bypasses are seasonally dewatered (as high flows recede). Their predominant communities include grassland, seasonal wetlands, and agricultural vegetation.

Sacramento-San Joaquin River Delta

The Delta comprises an area of approximately 750,000 acres divided into a number of islands by hundreds of miles of waterways. Before reclamation, the Delta was inundated each year by winter and spring runoff, which changed channel geometry in response to flood conditions and tidal influence. Consequently, there were extensive areas of marsh in the Delta.

Nearly all of the Delta's marshland has since been reclaimed by agriculture, peat production, and urban and industrial uses. More than 1,000 miles of levees protect this reclaimed land (CALFED 2000b). However, some small islands remain in a quasinatural state, as do some other areas with aquatic and wetland

communities (e.g., “flooded islands” that were once reclaimed land, but have been abandoned after levee failures). The species composition and ecology of these riparian, marsh, and aquatic plant communities differ from the composition and ecology of communities in the upper and lower Sacramento River portions of the combined primary and extended study areas and are described below.

Along the lower Sacramento River and in the Delta, riparian vegetation is characterized by narrow linear strips of trees and shrubs, in single- to multiple-story canopies. Tree canopies may be continuous or discontinuous, or absent altogether (as in riparian scrubs). These patches of riparian vegetation may be on or at the toe of levees (particularly in the Delta). Riparian communities in this region include cottonwood-willow woodland, Valley oak riparian woodland, riparian scrub, and willow scrub. These communities are described below.

The dynamics of riparian communities along the lower Sacramento River and in the Delta are similar to those described for riparian communities along the upper Sacramento River. However, along the Sacramento River south of Colusa, in the flood bypasses, and in the Delta, the disturbances that remove riparian vegetation, or create newly exposed surfaces where riparian vegetation can establish, differ somewhat from those along the upper Sacramento River. In these downstream areas, disturbances related to meander migration are more limited, and anthropogenic (human-caused) disturbances, such as levee maintenance and trampling, are greater than those upstream. This is because of the close proximity to levees, extensive placement of bank protection, and greater human population.

In addition to the wetland communities described for the upper Sacramento River, the Delta has tidal freshwater and brackish-water emergent marshes that, like nontidal marshes, are dominated by clonal perennial plants. This community occurs on instream islands and along tidally influenced waterways. In addition to the environmental factors affecting nontidal marshes, the species composition of tidal marshes in the Delta is also affected by regional salinity gradients.

The Delta also supports extensive areas of aquatic vegetation. These communities consists of submerged plants generally rooted in the substrate, whose stems may partially extend above the water surface (e.g., during flowering) and floating plants that are generally not rooted in the substrate. The availability of light (which decreases with depth), turbidity, and shade cast by overtopping vegetation can restrict submerged plants to relatively shallow areas. In the Delta (which has turbid waters), most submerged vegetation appears to be restricted to areas less than 5–10 feet deep. The velocity of flows may contribute to this depth restriction.

CVP/SWP Service Areas

Although agricultural and urban land uses have substantially reduced the area and connectivity of natural vegetation, the service areas still contain a large diversity of both lowland and upland plant communities, including many sensitive plant communities (see the *Botanical Resources and Wetlands Technical Report*). The most dramatic difference between historical and existing conditions is the fragmentation of what were once large contiguous blocks of habitat. Significant changes to the natural landscape in the region occurred in the late 1800s and early 1900s with land conversions to agriculture. However, in Southern California, that pattern shifted dramatically compared to the pattern in the Central Valley, as urban growth in the region that started in the 1900s began to convert large areas of agricultural lands and of remaining natural vegetation to developed land uses.

12.1.2 Special-Status Species

Special-status species addressed in this section include plants that are legally protected or are otherwise considered sensitive by Federal, State, or local resource conservation agencies and organizations. These include species that are State listed and/or Federally listed as rare, threatened, or endangered; those considered as candidates or proposed for listing as threatened or endangered; species identified by CDFW as Species of Special Concern or USFS as sensitive, endemic, or needing additional survey or management actions; and plants considered jointly by CDFW and CNPS to be rare, threatened, or endangered; and species afforded protection under local planning documents, including the CALFED Bay-Delta Program's (CALFED) Multi-Species Conservation Strategy (MSCS).

Shasta Lake and Vicinity

Within the Shasta Lake and vicinity portion of the primary study area are a wide variety of vegetative communities and habitat components that support a large diversity of plant species. To aid in determining the potential impacts of the project, a list of potential plant species of concern was developed.

For the purposes of this evaluation, botanical species of concern are plants, lichen, and fungi that fall into any of the following categories:

- Designated as rare or listed as threatened or endangered by the State or Federal government
- Proposed for designation as rare or listing as threatened or endangered by the State or Federal government
- Candidate species for State or Federal listing as threatened or endangered
- Ranked as California Rare Plant Rank (CRPR) 1A, 1B, 2, 3, or 4 (formerly CNPS List 1A, 1B, 2, 3, or 4)

- Considered sensitive or Forest Plan Endemic by the USFS
- Considered a Northwest Forest Plan Survey and Manage (S&M) species by the USFS or U.S. Department of the Interior, Bureau of Land Management (BLM)
- Designated as an MSCS covered species by CALFED (see California Bay-Delta Authority, Section 12.2.4).

Potentially occurring plant species of concern were determined by performing several database searches, reviewing USFWS and CDFW special-status species lists for Shasta County, reviewing other appropriate literature, discussions with resource agency personnel, and professional experience in the region. Additionally, results from the various vegetation habitat mapping efforts, botanical surveys, and wildlife surveys conducted in the area by Reclamation since 2002 were used in developing the list of species of concern.

Table 12-4 summarizes special-status plant species identified as having a potential to occur in the Shasta Lake and vicinity portion of the primary study area. Potentially occurring special-status plant species in the potential Sacramento River downstream restoration sites are summarized in Table 12-5.

Table 12-4. Plant Species of Concern with Potential to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area

Common Name	Scientific Name	Status[1]
Shasta ageratina	*Ageratina shastensis*	CRPR 1B.2, FPE
Sanborn's onion	*Allium sanbornii* var. *sanbornii*	CRPR 4.2
Bent-flowered fiddleneck	*Amsinckia lunaris*	CRPR 1B.2, BLMS
Mallory's manzanita	*Arctostaphylos malloryi*	CRPR 4.3
Shasta County arnica	*Arnica venosa*	CRPR 4.2, FPE
Marbled ginger	*Asarum marmoratum*	CRPR 2B.3
Depauperate milk-vetch	*Astragalus pauperculus*	CRPR 4.3
Moonwort, grape-fern	*Botrychium subgenus Botrychium*	USFS S, S&M
Yellow-twist horsehair	*Bryoria tortuosa*	BLMS
Green bug moss	*Buxbaumia viridis*	USFS S, BLMS, S&M
Callahan's mariposa lily	*Calochortus syntrophus*	CRPR 1B.1
Butte County morning-glory	*Calystegia atriplicifolia ssp. buttensis*	CRPR 4.2
Castle Crags harebell	*Campanula shetleri*	CRPR 1B.3, USFS S, BLM S
Buxbaum's sedge	*Carex buxbaumii*	CRPR 4.2
Bristly sedge	*Carex comosa*	CRPR 2B.1, MSCS r
Shasta clarkia	*Clarkia borealis ssp. arida*	CRPR 1B.1, MSCS m, BLM S
Northern clarkia	*Clarkia borealis ssp. borealis*	CRPR 1B.3, BLM S
Silky cryptantha	*Cryptantha crinita*	CRPR 1B.2, MSCS m, BLM S
California lady's-slipper	*Cypripedium californicum*	CRPR 4.2

Table 12-4. Plant Species of Concern with Potential to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)

Common Name	Scientific Name	Status[1]
Clustered lady's-slipper	*Cypripedium fasciculatum*	CRPR 4.2, USFS S, BLM S, S&M
Mountain lady's-slipper	*Cypripedium montanum*	CRPR 4.2, USFS S, BLM S, S&M
Four-angled spike rush	*Eleocharis quadrangulata*	MSCS m
Shasta limestone monkeyflower	*Erythranthe taylori*	CRPR 1B.1
	Erythronium sp. *nov*.	New species of fawn lilly endemic to Shasta Lake region; occurs in shady, northerly aspect forest habitats and below limestone outcrops; taxonomic treatment in preparation. Considered a special-status species for the purposes of this evaluation.
Butte County fritillary	*Fritillaria eastwoodiae*	CRPR 3.2, USFS S
Dubious pea	*Lathyrus sulphureus* var. *argillaceus*	CRPR 3
Broad-lobed linanthus	*Leptosiphon latisectus*	CRPR 4.3
Cantelow's lewisia	*Lewisia cantelovii*	CRPR 1B.2, USFS S, BLM S
Howell's lewisia	*Lewisia cotyledon* var. *howellii*	CRPR 3.2
Bellinger's meadowfoam	*Limnanthes floccosa* ssp. *bellingeriana*	CRPR 1B.2, MSCS m, BLM S
Awl-leaved navarretia	*Navarretia subuligera*	CRPR 4.3
Shasta snow-wreath	*Neviusia cliftonii*	CRPR 1B.2, USFS S, MSCS m, BLM S
Thread-leaved beardtongue	*Penstemon filiformis*	CRPR 1B.3, MSCS m, BLM S
Narrow-petaled rein orchid	*Piperia leptopetala*	CRPR 4.3
Bidwell's knotweed	*Polygonum bidwelliae*	CRPR 4.3
Eel-grass pondweed	*Potamogeton zosteriformis*	CRPR 2B.2, MSCS m
Pacific fuzzwort	*Ptilidium californicum*	BLM S, S&M
Hoary gooseberry	*Ribes roezlii* var. *amictum*	CRPR 4.3
Bug on a stick	*Schistostega pennata*	S&M
Brownish beaked-rush	*Rhynchospora capitellata*	CRPR 2B.2
Sanford's arrowhead	*Sagittaria sanfordii*	CRPR 1B.2, MSCS m, BLM S
Marsh skullcap	*Scutellaria galericulata*	CRPR 2B.2, MSCS m
Canyon Creek stonecrop	*Sedum obtusatum* ssp. *paradisum*	CRPR 1B.3, USFS S, BLM S
English Peak greenbriar	*Smilax jamesii*	CRPR 1B.3, MSCS m, BLM S

Table 12-4. Plant Species of Concern with Potential to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)

[1] NoteS:

Status Codes

S&M = Survey and Manage Species

CRPR 2 = Plants rare, threatened, or endangered in California but more common elsewhere (includes rare plant ranks 2B.1, 2B.2, and 2B.3)

CRPR 3 = Plants for which more information is need – a review list

CRPR 4 = Plants of limited distribution – a watch list

CRPR Threat Ranks

0.1 = Seriously threatened in California

0.2 = Fairly threatened in California

0.3 = Not very threatened in California

MSCS (Multi Species Conservation Strategy) covered species

R = Recovery. Recover species' populations within the MSCS focus area to levels that ensure the species' long-term survival in nature.

r = Contribute to recovery. Implement some of the actions deemed necessary to recover species' populations within the MSCS focus area.

m = Maintain. Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species (CALFED 2000c).

Key:

BLMS = BLM sensitive

CRPR = California Rare Plant Rank

USFS = U.S. Forest Service

FPE = USFS Forest Plan Endemic Species

USFS S = USFS Sensitive Species

S&M = Survey and Manage Species

MSCS = Multi Species Conservation Strategy

Table 12-5. Plant Species of Concern with Potential to Occur in the Potential Sacramento River Downstream Restoration Sites

Common Name	Scientific Name	Status[1]
Red-flowered bird's-foot trefoil	*Acmispon rubriflorus*	CRPR 1B.1, BLM S
Henderson's bent grass	*Agrostis hendersonii*	CRPR 3.2, MSCS m
Cleveland's milk-vetch	*Astragalus clevelandii*	CRPR 4.3
Jepson's milk-vetch	*Astragalus rattanii var. jepsonianus*	CRPR 4.3, BLM S
Big-scale balsamroot	*Balsamorhiza macrolepis*	CRPR 1B.2, BLM S
Sulphur Creek brodiaea	*Brodiaea matsonii*	CRPR 1B.1
Bristly sedge	*Carex comosa*	CRPR 2B.1, MSCS r
Silky cryptantha	*Cryptantha crinita*	CRPR 1B.2, BLM S, MSCS m
Four-angled spikerush	*Eleocharis quadrangulata*	MSCS m
Boggs Lake hedge-hyssop	*Gratiola heterosepala*	CE, CRPR 1B.2, BLM S, MSCS m
California satintail	*Imperata brevifolia*	CRPR 2B.1
Red Bluff dwarf rush	*Juncus leiospermus var. leiospermus*	CRPR 1B.1, BLM S, MSCS m
Bellinger's meadowfoam	*Limnanthes floccosa ssp. bellingeriana*	CRPR 1B.2, BLM S, MSCS m
Shield-bracted monkeyflower	*Mimulus glaucescens*	CRPR 4.3

Table 12-5. Plant Species of Concern with Potential to Occur in the Potential Sacramento River Downstream Restoration Sites (contd.)

Common Name	Scientific Name	Status[1]
Slender Orcutt grass	*Orcuttia tenuis*	FT, CE, CRPR 1B.1, MSCS m
Ahart's paronychia	*Paronychia ahartii*	CRPR 1B.1, BLM S, MSCS m
Sanford's arrowhead	*Sagittaria sanfordii*	CRPR 1B.2, BLM S, MSCS m
Greene's Tuctoria	*Tuctoria greenei*	FE, CR, CRPR 1B.1, MSCS m

Notes:
[1] Status Codes
CE = California endangered
CR = California rare
FE = Federally endangered
FT = Federally threatened
CRPR (California Rare Plant Rank)
CRPR 1B = Plants rare, threatened, or endangered in California and elsewhere (includes rare plant ranks 1B.1, 1B.2, and 1B.3)
CRPR 2A, 2B = Plants rare, threatened, or endangered in California but more common elsewhere (includes rare plant ranks 2B.1, 2B.2, and 2B.3)
CRPR 3 = Plants for which more information is need – a review list
CRPR 4 = Plants of limited distribution – a watch list
CRPR Threat Ranks
0.1 = Seriously threatened in California
0.2 = Fairly threatened in California
0.3 = Not very threatened in California

BLM (Bureau of Land Management):
S = Sensitive
MSCS (Multi Species Conservation Strategy) covered species
R = Recovery. Recover species' populations within the MSCS focus area to levels that ensure the species' long-term survival in nature.
r = Contribute to recovery. Implement some of the actions deemed necessary to recover species' populations within the MSCS focus area.
m = Maintain. Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species (CALFED 2000c).
Key:
CRPR = California Rare Plant Rank
MSCS = Multi Species Conservation Strategy

The CNDDB was reviewed for records of special-status plant species in or near the Shasta Lake and vicinity portion of the primary study area. The CNDDB is a database consisting of historical observations of special-status plant species, wildlife species, and natural communities. The CNDDB is limited to reported sightings and is not a comprehensive list of special-status species that may occur in a particular area.

A search of the CNPS Electronic Inventory was also conducted. The Electronic Inventory allows users to query the database using a set of variable search criteria. The result of the search is a list of potentially occurring special-status plant species. The criteria used for the query included all CRPR 1A, 1B, 2A, 2B, 3, and 4 plants occurring in Shasta County in closed-cone coniferous forest, chaparral, cismontane woodland, lower montane coniferous forest, marshes and

swamps, pebble plain, valley and foothill grasslands, riparian forest, riparian woodland, and riparian scrub habitats between the elevations of approximately 900 feet and 2,500 feet.

Botanical Surveys Reclamation conducted several botanical surveys for special-status plant species in the Shasta Lake and vicinity portion of the primary study area. Botanical surveys were conducted in between 2002 and 2014. A list of species observed during the surveys is provided as Attachment 2 to the Botanical Resources and Wetlands Technical Report in the Biological Resources Appendix. Detailed survey information is provided as Attachment 6 to the Botanical Resources and Wetlands Technical Report in the Biological Resources Appendix. Baldwin et al. (2012) is used as the standard reference for taxonomic nomenclature and identification.

Botanical surveys were performed during 2002 along the Big Backbone and Squaw Creek arms. In 2003, botanical surveys were conducted along 11 selected riverine reaches: Little Backbone Creek, Sugarloaf Creek, upper Sacramento River, middle Salt Creek, Salt Creek, Nosoni Creek, Dekkas Creek, Campbell Creek, Flat Creek, Ripgut Creek, and Potem Creek. The surveys were conducted in general accordance with the technical methods prescribed in *California Department of Fish and Wildlife Protocols for Surveying and Evaluating Impacts to Special Status Plant Populations and Natural Plant Communities* (California Department of Fish and Game 2009), except that only portions of the project area have been surveyed . In 2004, botanical surveys were conducted at a series of randomly and nonrandomly selected locations. Nonrandomly selected sites were located throughout the Shasta Lake and vicinity portion of the primary study area (not including relocation areas) based on 2002 and 2003 survey results. Sites were selected based on the presence of unique habitat and ecological attributes, such as recently burned areas, unique geologic substrates, late-seral forests, and uncommon plant series. Nonrandomly selected sites varied in size and often included several plant series types. Randomly selected sites were selected throughout the area using plant series polygons developed from previously completed vegetation mapping. Using the geographic information system (GIS), individual vegetation polygons were assigned a unique number, and 100 numbers (i.e., vegetation polygons) were then randomly selected.

Based on previous surveys resulting in discoveries of Shasta snow-wreath (*Neviusia cliftonii*) and Shasta huckleberry (*Vaccinium* sp. *nov*), specific surveys for these species have been conducted since 2009. These surveys were designed to identify potential habitat for and locate populations of these species outside of the proposed project area. Pedestrian surveys were conducted to search the focus areas identified. Using methods described in Lindstrand and Nelson (2006), potential survey areas were identified using soil and geologic information at known sites and choosing areas with those same characteristics. In addition, survey sites were identified using intuitive techniques, such as

selecting areas with vegetative cover types similar to those of known populations and areas near known populations (regardless of vegetative cover).

A genetic study of the Shasta snow-wreath was conducted in 2009 and 2010 to help determine potential project impacts and evaluate potential mitigation measures. The goal of the genetic study was to (1) determine whether all Shasta snow-wreath populations are genetically identical, (2) determine whether there are several homogeneous population clusters, or (3) determine whether some other pattern is present. Twenty-one of the 23 Shasta snow-wreath occurrences known at the time were included in the study. The genetic study determined that the species is characterized by low genetic diversity and high levels of genetic differentiation (National Forest Genetics Laboratory 2010, DeWoody et al. 2012). No strong patterns were found between the Shasta snow-wreath populations and several physical and geographic variables, including soil, geology, population size, and geographic location. Although high levels of genetic differentiation and no strong population patterns are present, the genetic study found three general population clusters, providing insight and basic species information for potential mitigation planning.

A separate genetic study was conducted in 2009, 2010, and 2013 to describe the genetics of Shasta *Vaccinium* (huckleberry). The goal of the study was to determine if the Shasta *Vaccinium* was different genetically from coastal and Sierra Nevada *Vaccinium* populations and, if so, to determine if it warrants recognition as a new taxon. The genetic study determined that the species is genetically distinct from the other *Vaccinium* populations (National Forest Genetics Laboratory 2010, DeWoody et al. 2012b, National Forest Genetics Laboratory 2014). Based on the results of the genetic study combined with distinct morphologic and ecologic characteristics, the Shasta huckleberry appears to be an uncommon and geographically restricted species and warrants recognition as a new taxon. The taxonomic treatment is in preparation.

Between 2010 and 2014, botanical surveys were conducted in all relocation areas, including the dam footprint. The surveys were conducted in general accordance with the *California Department of Fish and Wildlife Protocols for Surveying and Evaluating Impacts to Special Status Plant Populations and Natural Plant Communities* (California Department of Fish and Game 2009).

Eight special-status plant species were found during the survey efforts and/or incidentally during other technical studies: Shasta County arnica (*Arnica venosa*), Northern clarkia (*Clarkia borealis* ssp. *borealis*), Cantelow's lewisia (*Lewisia cantelovii*), Shasta snow-wreath, slender false lupine (*Thermopsis gracilis* var. *gracilis*), Shasta huckleberry, and oval-leaved viburnum (*Viburnum ellipticum*), and Shasta limestone monkeyflower (*Erythranthe taylorii*).

One population of Shasta County arnica was found in ponderosa pine habitat south of Bridge Bay Resort along the Main Body and another near the privately owned cabins on USFS lands in the Salt Creek inlet on the Sacramento Arm.

Additionally, USFS has located a population along the Sacramento Arm north of Slaughterhouse Island during surveys conducted in 2010 (Figure 12-5a and 12-3c).

One population of northern clarkia was found in hardwood-conifer/chaparral habitat near Bailey Cove on the McCloud Arm, and another population was found in hardwood-conifer/chaparral habitat in Sugarloaf Cove west of Beehive Point on the Sacramento Arm. The northern clarkia locations are shown in Figures 12-5c through 12-5d.

One population of Cantelow's lewisia was discovered on a rock outcrop on the right bank of the upper Sacramento River near the Shasta Lake/upper Sacramento River transition zone. Additionally, three populations were found along the Sacramento Arm near Elmore Mountain during surveys conducted in 2010 (Figure 12-5c).

Shasta snow-wreath is currently known from 24 locations, most of which occur at or near the periphery of Shasta Lake. Ten Shasta snow-wreath populations occur in habitats associated with limestone formations, and 13 occur in other habitat types. Most populations are associated with stream drainages or the lower portions of upland slopes. Of these, 13 Shasta snow-wreath populations were discovered during the botanical surveys along the McCloud Arm (south of Shasta Caverns and Keluche Creek), Pit Arm (Brock Creek, Ripgut Creek, Flat Creek, Stein Creek, and west of Stein Creek), and the Main Body (Blue Ridge east, Blue Ridge west, Blue Ridge middle, Cove Creek, south of Cove Creek, and Jones Valley). Locations of Shasta snow-wreath found incidentally and during the surveys are shown in Figures 12-5a through 12-3f.

Slender false lupine populations were discovered in all portions of the primary study area, generally on low-gradient slopes. Locations of slender false lupine found during the surveys and incidentally are shown in Figures 12-5a through 12-5f.

Shasta huckleberry is currently known from 23 occurrences at 13 general locations. Shasta huckleberry occurs at four locations in the project area: (little) Squaw Creek, Shoemaker Gulch, Little Backbone Creek, and Horse Creek near Bully Hill. The Shasta huckleberry populations at these locations represent the lower portions of larger populations of hundreds to over a thousand shrubs that extend further upstream in and around each stream. All locations occur in an area historically known as the Copper Belt of Shasta County and occur in the vicinity of historic copper mining activities. Locations of Shasta huckleberry in the project area found during the surveys are shown in Figures 12-5a through 12-5f. Two oval-leaved viburnum populations were found during the surveys. One population was found in a forested upland slope west of Pine Point Campground along the McCloud Arm and a second in chaparral habitat in Jones Valley along the Pit Arm near the Clikapudi Trail. Locations of oval-leaved viburnum found during the surveys are shown in Figures 12-5d and 12-5f.

Three Shasta limestone monkeyflower occurrences were found in the impoundment area. These occurrences are in the McCloud Arm and include populations downslope from Samwell Cave, at Dekkas Rock, and in the Campbell Creek inlet. The Samwell Cave and Dekkas Rock populations extend upslope and above the impoundment areas, while the population at Campbell Creek occurs entirely within the impoundment area. Nineteen additional Shasta limestone monkeyflower occurrences were found in locations outside the project area. Locations of Shasta limestone monkeyflower found during the surveys are shown in Figures 12-5d and 12-5f.

Reclamation conducted biological resource assessments at each of the six potential Sacramento River downstream habitat restoration areas during 2013. The assessments include botanical surveys for special-status plants and noxious weeds. No special-status plants were found during these surveys. The biological resource assessment results are included as Attachments 12 through 23 to the Botanical Resources and Wetlands Technical Report.

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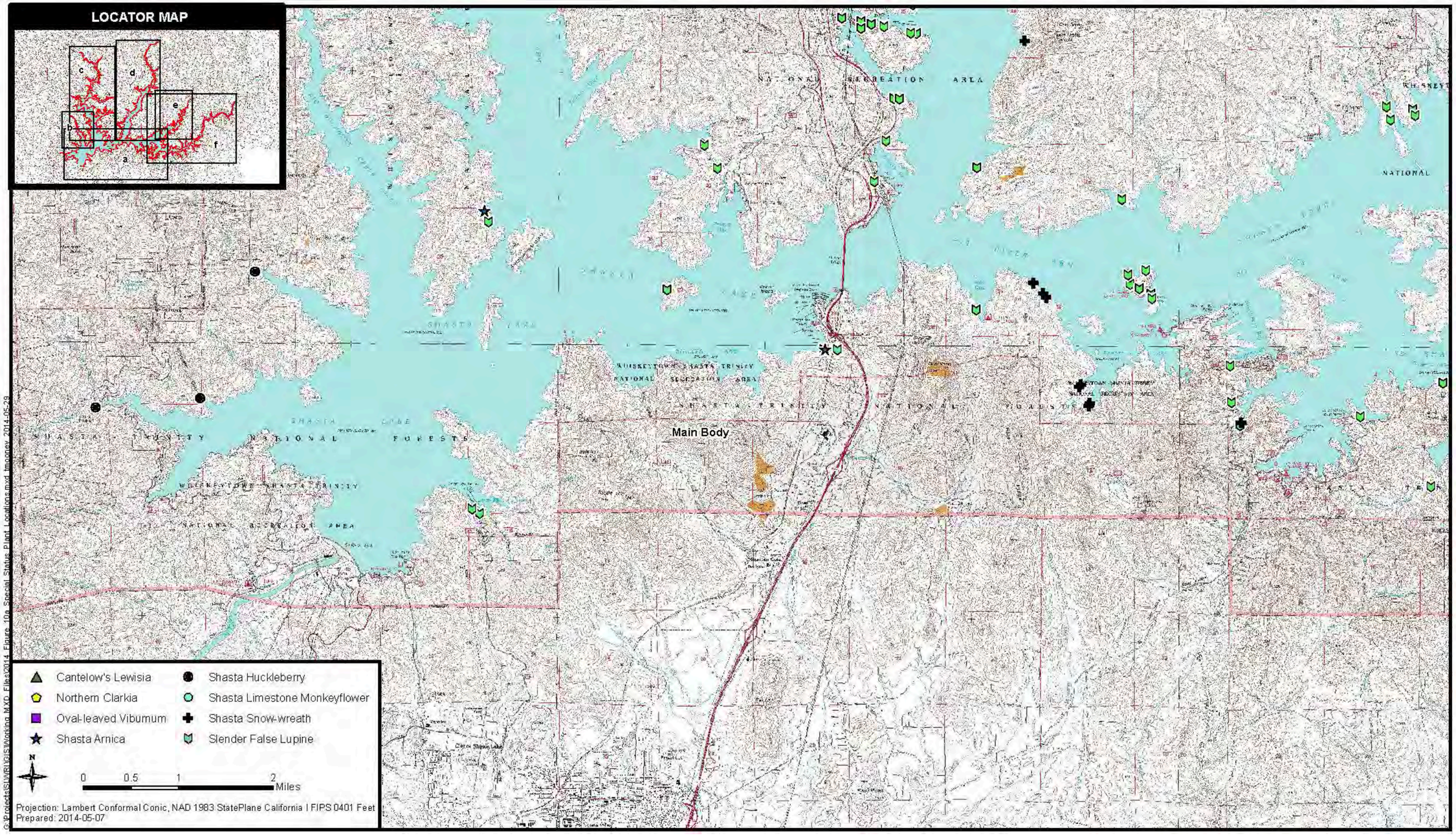

Figure 12-5a. Special-Status Plant Species Occurring in Shasta Lake and Vicinity

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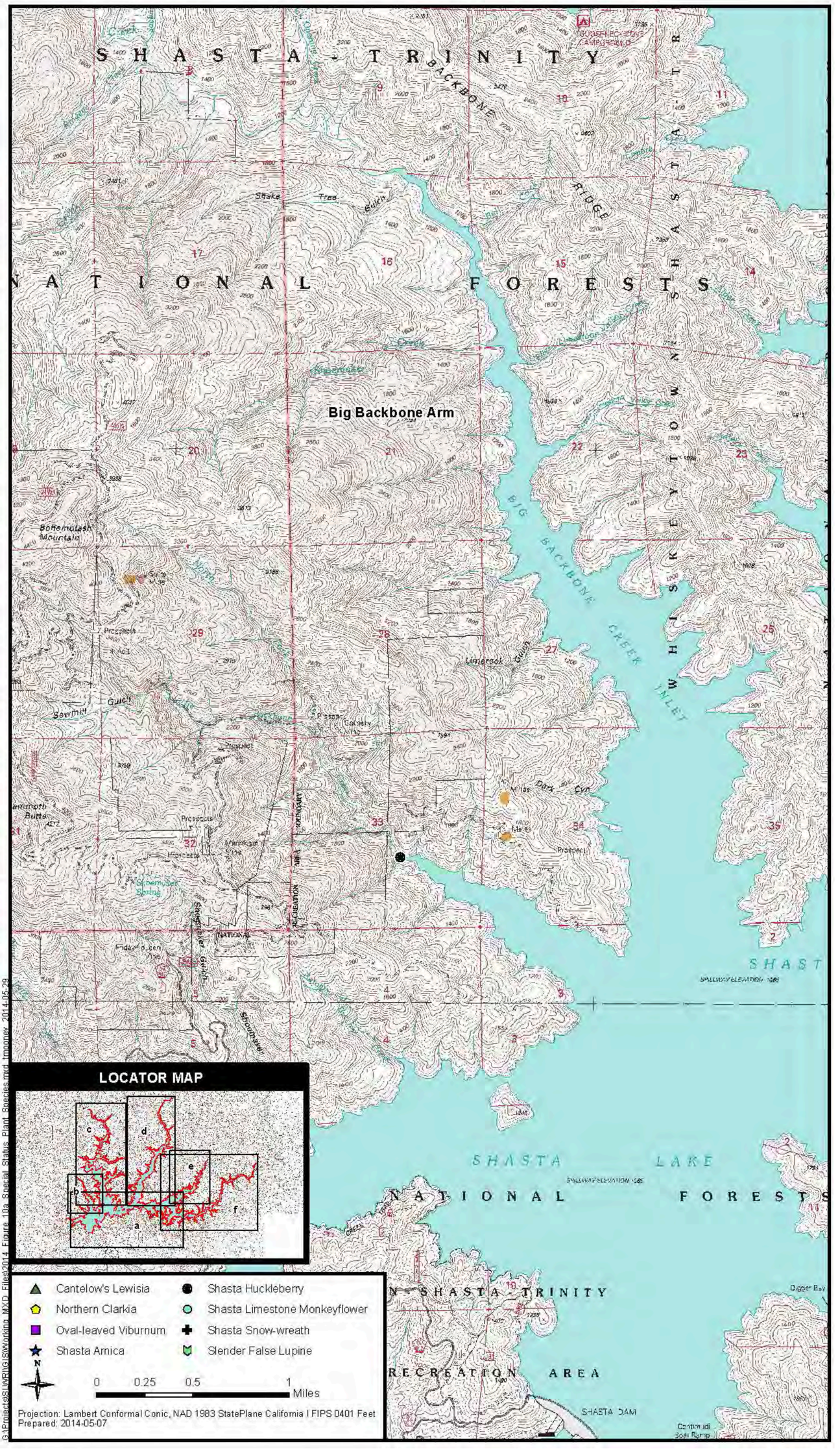
SHASTA - TRINITY
NATIONAL FORESTS
Big Backbone Arm
BIG BACKBONE RIDGE
SHASTA TRINITY
BIG BACKBONE CREEK INLET
SHASTA LAKE
NATIONAL FORESTS
N-SHASTA-TRINITY
RECREATION AREA
SHASTA DAM
Bohemotash Mountain
Limerock Gulch
Shake Tree Gulch
Sawmill Gulch
Dark Cyn
Digger Bay
LOCATOR MAP
a
b
c
d
e
f
Cantelow's Lewisia
Northern Clarkia
Oval-leaved Viburnum
Shasta Arnica
Shasta Huckleberry
Shasta Limestone Monkeyflower
Shasta Snow-wreath
Slender False Lupine
N
0 0.25 0.5 1
Miles
Projection: Lambert Conformal Conic, NAD 1983 StatePlane California I FIPS 0401 Feet
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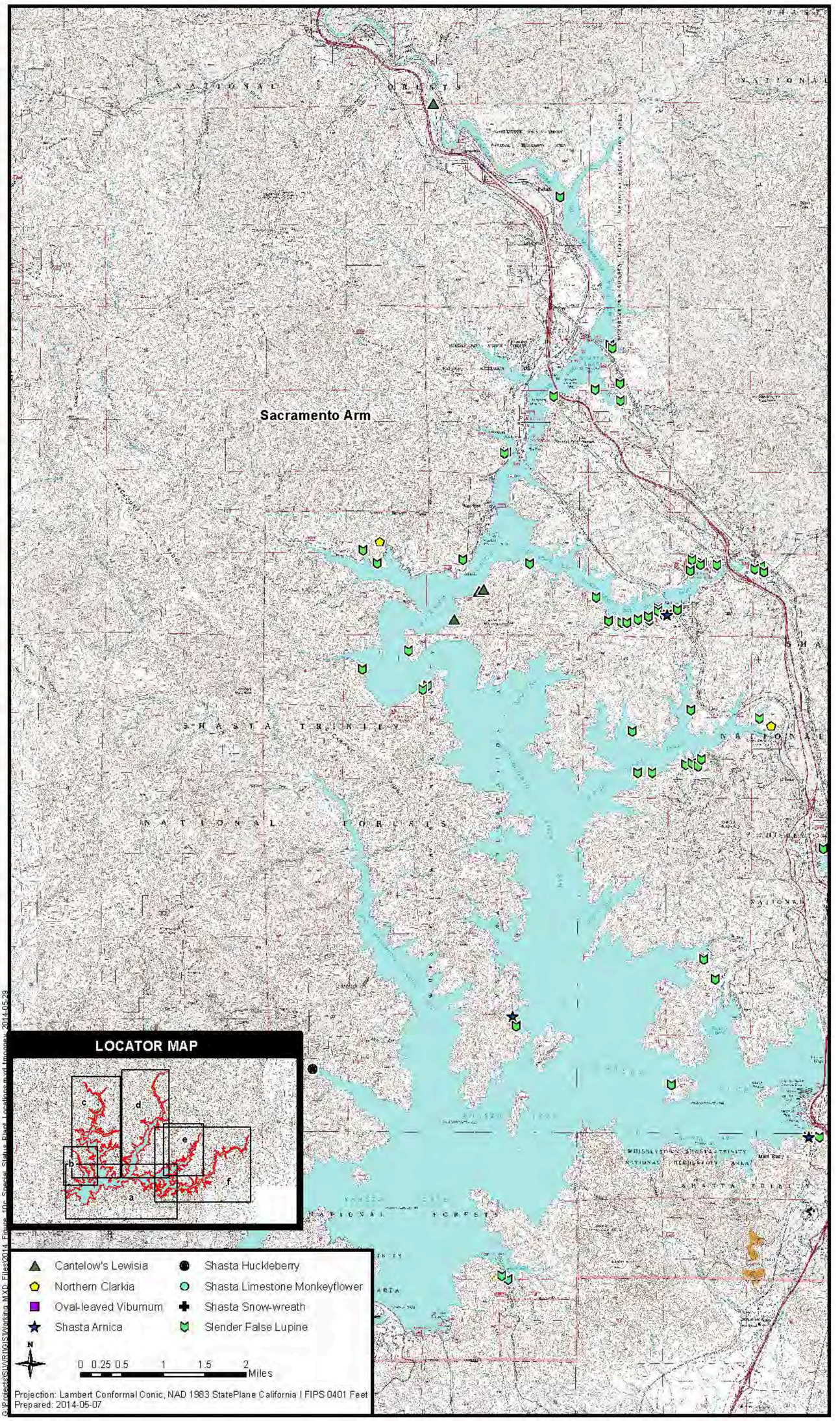
Sacramento Arm
LOCATOR MAP
a
b
c
d
e
f
Cantelow's Lewisia
Northern Clarkia
Oval-leaved Viburnum
Shasta Arnica
Shasta Huckleberry
Shasta Limestone Monkeyflower
Shasta Snow-wreath
Slender False Lupine
N
0 0.25 0.5 1 1.5 2
Miles
Projection: Lambert Conformal Conic, NAD 1983 StatePlane California I FIPS 0401 Feet
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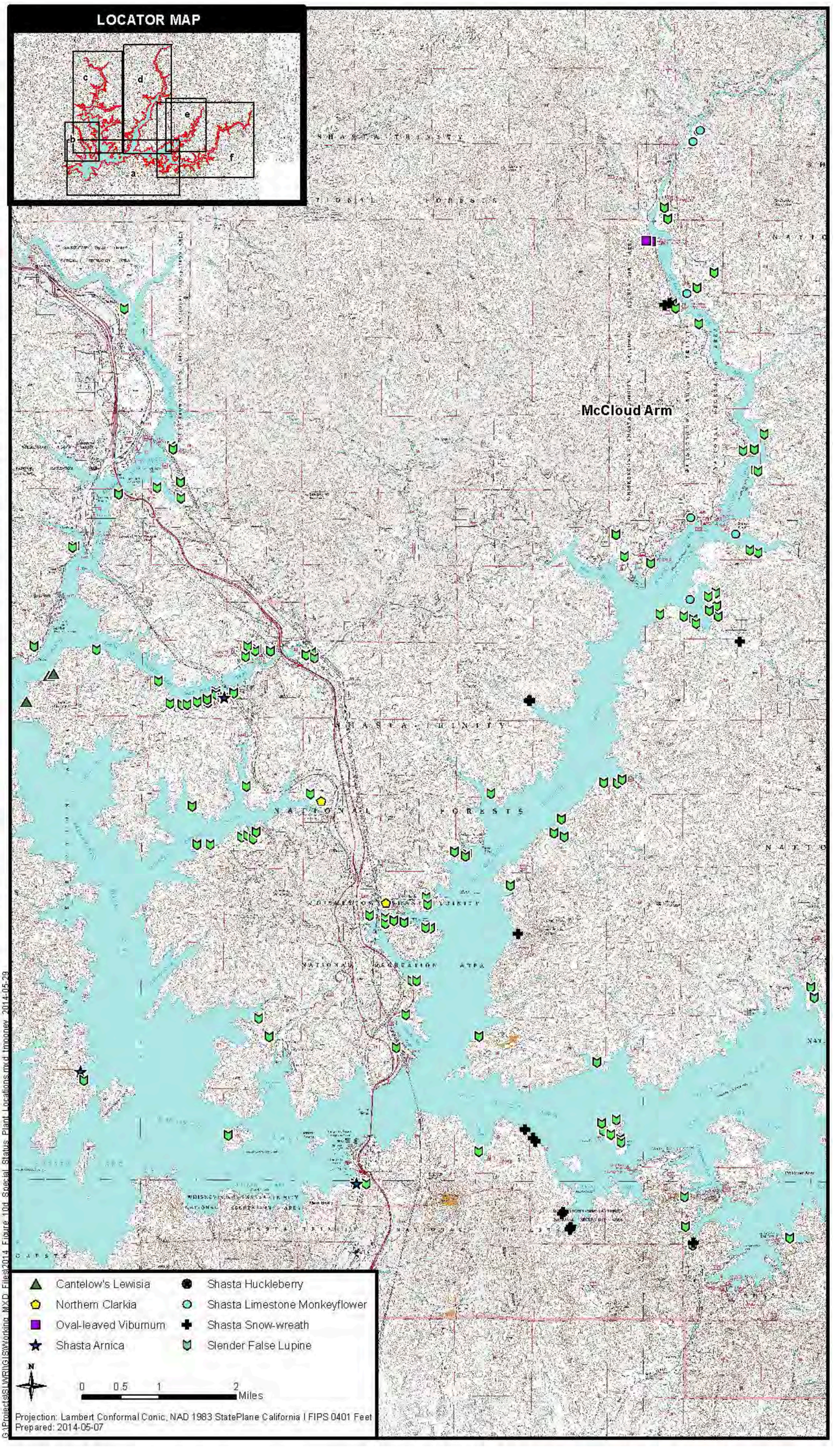
LOCATOR MAP
a
b
c
d
e
f
McCloud Arm
Cantelow's Lewisia
Northern Clarkia
Oval-leaved Viburnum
Shasta Arnica
Shasta Huckleberry
Shasta Limestone Monkeyflower
Shasta Snow-wreath
Slender False Lupine
N
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Miles
Projection: Lambert Conformal Conic, NAD 1983 StatePlane California I FIPS 0401 Feet
Prepared: 2014-05-07
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LOCATOR MAP
a
b
c
d
e
f
SHASTA-TRINITY
NATIONAL FORESTS
Squaw Creek Arm
WHISKEYTOWN - SHASTA - TRINITY
NATIONAL RECREATION AREA
SHASTA LAKE
Cantelow's Lewisia
Northern Clarkia
Oval-leaved Viburnum
Shasta Arnica
Shasta Huckleberry
Shasta Limestone Monkeyflower
Shasta Snow-wreath
Slender False Lupine
N
0 0.25 0.5 1 Miles
Projection: Lambert Conformal Conic, NAD 1983 StatePlane California I FIPS 0401 Feet
Prepared: 2014-05-07
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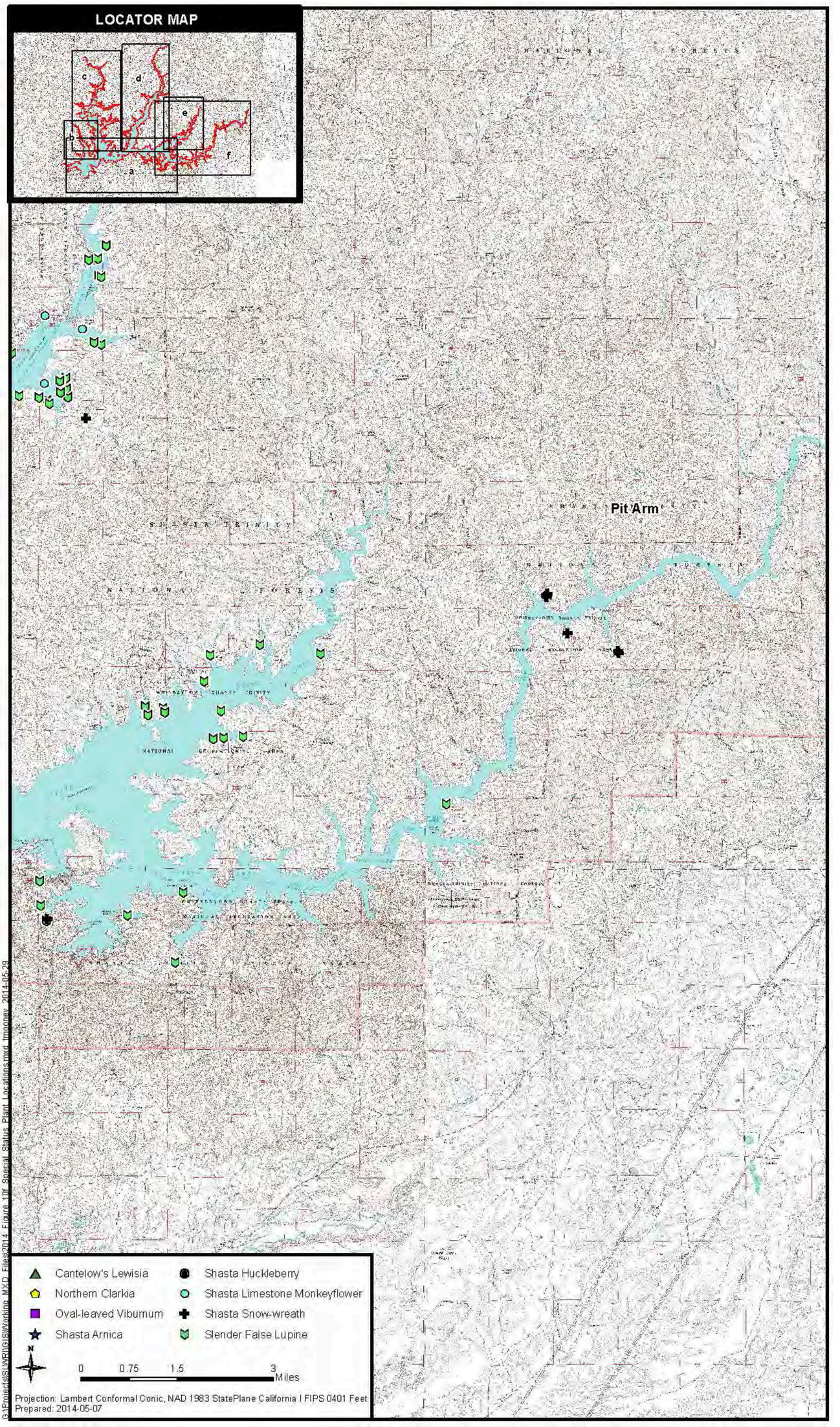
LOCATOR MAP
a
b
c
d
e
f
Pit Arm
Cantelow's Lewisia
Northern Clarkia
Oval-leaved Viburnum
Shasta Arnica
Shasta Huckleberry
Shasta Limestone Monkeyflower
Shasta Snow-wreath
Slender False Lupine
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Miles
Projection: Lambert Conformal Conic, NAD 1983 StatePlane California I FIPS 0401 Feet
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Upper Sacramento River (Shasta Dam to Red Bluff)

Based on review of CNDDB and CNPS database searches, a USFWS list of species that could be potentially affected in this portion of the primary study area, and previously prepared biological reports for the area, 25 special-status plant species were identified as possibly occurring in the primary study area between Shasta Dam and RBPP, and thus their potential to occur in this portion of the study area was evaluated further. These special-status plant species, along with the legal status, habitat, and potential for occurrence of each species, are provided in Table 12-6.

Sixteen of the special-status plant species listed in Table 12-6 have the potential to occur within habitat present along the Sacramento River between Shasta Dam and RBPP. Many of these species, such as Bogg's Lake hedge hyssop (*Gratiola heterosepala*; State endangered, MSCS m, CRPR 1B.2), Ahart's dwarf rush (*Juncus leiospermus* var. *ahartii*; MSCS m, CRPR 1B.2), Ahart's paronychia (*Paronychia ahartii*; MSCS m, CRPR 1B.1), dwarf downingia (*Downingia pusilla*; CRPR 2B.2), Greene's legenere (*Legenere limosa*; MSCS m, CRPR 1B.1), Henderson's bent grass (*Agrostis hendersonii*; MSCS m, CRPR 3.2), Red Bluff dwarf rush (*Juncus leiospermus* var. *leiospermus*; CRPR 1B.2), and slender Orcutt grass (*Orcuttia tenuis*; Federal endangered, state endangered, MSCS m, CRPR 1B.1), typically occur in vernal pools, which are generally not present within the active floodplain of regulated rivers in the extended study area. Other special-status plants, however, could occur in the extended study area in the freshwater marshes, swamps, and riparian woodlands that are found along the river corridor. These species include rose mallow (*Hibiscus lasiocarpus* var. *occidentalis*; MSCS m, CRPR 2B.2) and silky cryptantha (*Cryptantha crinita*; USFS SM, CRPR 1B.2). The remaining five species may occur in annual grassland, chaparral, cismontane woodland, and lower montane coniferous forest vegetation communities along the river corridor, including adobe-lily (*Fritillaria pluriflora*; MSCS m, CRPR 1B.2), Butte County fritillary (*Fritillaria eastwoodiae*; USFS S, CRPR 3.2), dubious pea (*Lathyrus sulphureus* var. *agillaceous*; CRPR 3), mountain lady's slipper (*Cypripedium fasciculatum*; USFS SM, CRPR 4.2), and oval-leaved viburnum (*Viburnum ellipticum*; CRPR 2B.3).

Of the special-status species that could occur along the upper Sacramento River, four are known to occur along the edge of the Sacramento River channel, or along a Sacramento River tributary within 0.2 mile of the river proper, and their establishment and reproduction could potentially be affected by changes in flow regime: silky cryptantha, rose mallow, and Ahart's paronychia (CNDDB 2007, University of California 2011).

Table 12-6. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Pumping Plant

Species	Legal Status[1]					Habitat and Blooming Period	Potential for Occurrence
	USFWS	CDFW	MSCS	USFS	CRPR		
Shasta ageratina *Ageratina shastensis*		–		E	1B.2	Rocky carbonate outcrops in chaparral and lower montane coniferous forest; 1,300–5,900 feet elevation. Blooms June–October.	Could occur near Shasta Dam if suitable outcrops are present. Potential is low because most of the primary study area is below species' known elevation range.
Henderson's bent grass *Agrostis hendersonii*	–	–	m	–	3.2	Mesic sites in valley and foothill grassland, vernal pools; 230–1,000 feet elevation. Blooms April–May.	Could occur along the Sacramento River if suitable vernally mesic habitat is present.
Shasta County arnica *Arnica venosa*	–	–	–	E	4.2	Cismontane woodlands and lower montane coniferous forests, often in disturbed areas and roadcuts; 1,300–4,900 feet elevation. Blooms May–July.	Could occur along the Sacramento River and tributaries within the primary study area. Potential is low because most of the study area is below species' known elevation range.
Sulphur Creek Brodiaea *Brodiaea matsonii*	–	–	–	–	1B.1	Rocky, metamorphic amphibolite schist. Cismontane woodland (streambanks), meadows, and seeps; 640-700 feet elevation. Blooms May–June.	Could occur along the Sacramento River and tributaries within the primary study area.
Silky cryptantha *Cryptantha crinita*	–	–	m	–	1B.2	Gravelly streambeds within cismontane woodland, lower montane coniferous forest, riparian forest, riparian woodland, valley and foothill grassland; 275–4,000 feet elevation. Blooms April–May.	Could occur along the Sacramento River and tributaries within the primary study area.
Clustered lady's slipper *Cypripedium fasciculatum*	–	–	–	SM	4.2	Lower montane coniferous forest, North Coast coniferous forest; often in serpentinite seeps or on streambanks; 300–8,000 feet elevation. Blooms March–July.	Unlikely; no coniferous forest known in the primary study area.

Table 12-6. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Pumping Plant (contd.)

Species	Legal Status[1]					Habitat and Blooming Period	Potential for Occurrence
	USFWS	CDFW	MSCS	USFS	CRPR		
Mountain lady's slipper *Cypripedium montanum*	–	–	–	SM	4.2	Broadleaved upland forest, cismontane woodland, lower montane coniferous forest, North Coast coniferous forest; 500–7,000 feet elevation. Blooms March–July.	Could occur at Shasta Dam or along the Sacramento River and tributaries.
Dwarf downingia *Downingia pusilla*	–	–	–	–	2.2	Mesic sites in valley and foothill grassland, vernal pools. Blooms March–May.	Could occur along the Sacramento River if suitable vernally mesic habitat is present.
Butte County fritillary *Fritillaria eastwoodiae*	–	–	–	S	3.2	Openings and sometime serpentine areas in chaparral, cismontane woodland, and lower montane coniferous forest; 160–4,900 feet elevation. Blooms March–June.	Could occur along the Sacramento River and tributaries within the primary study area.
Adobe-lily *Fritillaria pluriflora*	–	–	m	–	1B.2	Chaparral, cismontane woodland, valley and foothill grassland; often in adobe soils; 200–2,300 feet elevation. Blooms February–April.	Could occur at Shasta Dam and along the Sacramento River.
Bogg's Lake hedge hyssop *Gratiola heterosepala*	–	E	m	–	1B.2	Marshes and swamps, vernal pools; 30–8,000 feet elevation. Blooms April–August.	Could occur along the Sacramento River and tributaries.
Rose mallow *Hibiscus lasiocarpus* var. *occidentalis*	–	–	m	–	1B.2	Freshwater marshes and swamps.	Could occur along the Sacramento River and tributaries.
Ahart's dwarf rush *Juncus leiospermus* var. *ahartii*	–	–	m	–	1B.2	Mesic sites in valley and foothill grassland; 100–300 feet elevation. Blooms March–May.	Could occur along the Sacramento River if suitable vernally mesic habitat is present. Shasta Dam is higher than species' known elevation range.
Red Bluff dwarf rush *Juncus leiospermus* var. *leiospermus*	–	–	–	–	1B.1	Vernally mesic sites in chaparral, cismontane woodland, meadows and seeps, valley and foothill grassland, vernal pools; 100–3,350 feet elevation. Blooms March–May.	Could occur at Shasta Dam or along the Sacramento River if suitable vernally mesic habitat is present.

Table 12-6. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Pumping Plant (contd.)

Species	Legal Status[1]					Habitat and Blooming Period	Potential for Occurrence
	USFWS	CDFW	MSCS	USFS	CRPR		
Dubious pea *Lathyrus sulphureus* var. *argillaceous*	–	–	–	–	3	Cismontane woodland, lower montane coniferous forest, upper montane coniferous forest; 500–1,000 feet elevation. Blooms in April.	Could occur at Shasta Dam and along the Sacramento River.
Greene's legenere *Legenere limosa*	–	–	m	–	1B.1	Vernal pools; 1–3,000 feet elevation. Blooms April–June.	Could occur along Sacramento River if suitable vernal pool habitat is present.
Cantelow's lewisia *Lewisia cantelovii*	–	–	–	S	1B.2	Mesic granitic sites within broadleaved upland forest, chaparral, cismontane woodland, and lower montane coniferous forest; 1,250–4,500 feet. Sometimes in serpentinite seeps. Blooms May–October.	Could occur in the Shasta Dam area. The remainder of the primary study area is below species' known elevation range.
Bellinger's meadowfoam *Limnanthes floccosa* ssp. *bellingeriana*	–	–	m	–	1B.2	Mesic sites in cismontane woodland, meadows and seeps; 950–3,600 feet elevation. Blooms April–June.	Could occur at Shasta Dam. Potential along Sacramento River is low because majority of the primary study area is below species known elevation range.
Shasta snow-wreath *Neviusia cliftonii*	–	–	m	S	1B.2	Carbonate substrates in lower montane coniferous forest and riparian woodland; 1,000–1,600 feet elevation. Blooms May–June.	Could occur in Shasta Dam area. Unlikely to occur along Sacramento River because the primary study area is lower than species known elevation range.
Slender orcutt grass *Orcuttia tenuis*	E	E	m	–	1B.1	Vernal pools; 100–6,000 feet elevation. Blooms May–October.	Could occur along the Sacramento River if suitable vernal pool habitat is present. Federally designated critical habitat for this species occurs east of the Sacramento River, east of Cottonwood (Units 3A and 3B) and northeast of Anderson (Units 2C and 2D).

Table 12-6. Special-Status Plant Species Known or with Potential to Occur in the Primary Study Area, Along the Sacramento River from Shasta Dam to Red Bluff Pumping Plant (contd.)

Species	Legal Status[1]					Habitat and Blooming Period	Potential for Occurrence
	USFWS	CDFW	MSCS	USFS	CRPR		
Ahart's paronychia *Paronychia ahartii*	–	–	m	–	1B.1	Cismontane woodland, valley and foothill grassland, vernal pools; 100–1,700 feet elevation. Blooms March–June.	Could occur at Shasta Dam and along the Sacramento River.
Pacific fuzzwort *Ptilidium californicum*	–	–	–	SM	4.3	An epiphytic on bark at the base of standing mature to old-growth trees or recently fallen logs; rarely on other organic substrates such as decaying logs and stumps, or humus covering boulders; 1,275–5,725 feet elevation.	Could occur along the Sacramento River and tributaries within the primary study area. Potential is low because most of the study area is below species' known elevation range.
Canyon Creek stonecrop *Sedum obtusatum* ssp. *paradisum*	–	–	–	S	1B.3	Granitic, rocky areas in broadleafed upland forest, chaparral, lower montane coniferous forest, subalpine coniferous forest; 980–6,100 feet elevation. Blooms May–June.	Could occur along the Sacramento River and tributaries within the primary study area. Potential is low because most of the study area is below species' known elevation range.
English Peak greenbriar *Smilax jamesii*	–	–	m	-	1B.3	Found along streambanks and lake margins in broadleafed upland forest, lower montane, upper montane, and north coast coniferous forests, and marshes and swamps; 1,600–8,200 feet elevation. Blooms May–July, rarely through August.	Could occur along the Sacramento River and tributaries within the primary study area. Potential is low because most of the study area is below species' known elevation range.
Oval-leaved viburnum *Viburnum ellipticum*	–	–	–	–	2.3	Chaparral, cismontane woodland, lower montane coniferous forest; 800–4,600 feet elevation. Blooms May–June.	Could occur at Shasta Dam and along the Sacramento River.

Sources: CNDDB 2007, CNPS 2011, USFS 2007, USFWS 2011

Note: [1]Legal Status

U.S. Fish and Wildlife Service (USFWS) Federal Listing Categories:
T = Threatened
E = Endangered

U.S. Forest Service (USFS) Listing Categories:
E = Endemic to specific region or National Forest
S = Sensitive
SM = Species considered rare or threatened and recommended for survey and management per Northwest Forest Plan 2002

California Department of Fish and Wildlife (CDFW) State Listing Categories:
R = California Rare
T = California Threatened
E = California Endangered

California Rare Plant Rank (CRPR) Categories:
1B = Plants rare, threatened, or endangered in California and elsewhere
2A, 2B = Plants rare, threatened, or endangered in California but more common elsewhere
3 = Plants for which more information is needed—a review list
4 = Plants of limited distribution—a watch list

Multi-Species Conservation Strategy (MSCS) Listing Categories:
R = recovery r = contribute to recovery m = maintain

Lower Sacramento River and Delta

Most of the special-status plant species listed in Table 12-6 have the potential to occur within the extended study area (lower Sacramento River and Delta and CVP/SWP service areas). Numerous additional special-status plant species could occur in the extended study area. Attachment 4 of the *Botanical Resources and Wetlands Technical Report* contains comprehensive lists of all sensitive plant species in the extended study area that have been reported to the CNDDB, or that otherwise have the potential to occur in the extended study area.

A number of special-status plant species could be affected in the lower Sacramento River and Delta by changes in hydrology (CALFED 2000c). These include species associated with vernal pool, riparian, marsh, and aquatic plant communities; and several other species with restricted distributions on or near channel banks, active floodplains, flood bypasses, and Delta waterways. These assemblages of special-status species are described below.

Species of Vernal Pool Communities In addition to species that are potentially present in the primary study area (Table 12-6), special-status plant species that may be associated with vernal pools along the lower Sacramento River and in the Delta region include alkali milk-vetch (*Astragalus tener* var. *tener*; MSCS r, CRPR 1B.2), brittlescale (*Atriplex depressa*; MSCS m, CRPR 1B.2), Hoover's spurge (*Euphorbia hooveri*; Federal threatened, MSCS m, CRPR 1B.2), Contra Costa goldfields (*Lasthenia conjugens*; Federal endangered, MSCS m, CRPR 1B.1), hairy orcutt grass (*Orcuttia pilosa*; Federal endangered, MSCS m, CRPR 1B.1), slender Orcutt grass (*Orcuttia tenuis*; Federal threatened, MSCS m, CRPR 1B.1), bearded popcornflower (*Plagiobothrys hystriculus*; CRPR 1B.1), Delta woolly-marbles (*Psilocarphus brevissimus* var. *multiflorus*; CRPR 4.2), Crampton's tuctoria (*Tuctoria mucronata*; Federal and State endangered, MSCS r, CRPR 1B.1), and Greene's tuctoria (*Tuctoria greenei*; Federal endangered, MSCS m, CRPR 1B.1). The primary threats affecting most of these species at multiple locations are habitat loss because of development, nonnative species, and incompatible grazing practices. Additional threats affecting some of these species at one or more location include game management practices (e.g., inundation of land for waterfowl during the growing season), off-road vehicle use and trampling, incompatible agricultural practices, and hydrological alterations.

Species of Riparian and Marsh Communities In addition to species considered potentially present in the primary study area (Table 12-6), special-status plant species associated with riparian and marsh communities along the lower Sacramento River or in the Delta region include bristly sedge (*Carex comosa*; MSCS r, CRPR 2B.1), Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*; Federal endangered, MSCS R, CRPR 1B.1), Soft bird's-beak (*Chloropyron molle* ssp. *molle*; Federal endangered, State rare, MSCS R, CRPR 1B.2), Delta button-celery (*Eryngium racemosum*; MSCS r, CRPR 1B.1), Northern California black walnut (*Juglans hindsii*; MSCS r, CRPR 1B.1), Delta

tule pea (*Lathyrus jepsonii* var. *jepsonii*; MSCS r, CRPR 1B.2), Mason's lilaeopsis (*Lilaeopsis masonii*; MSCS R, CRPR 1B.1), Delta mudwort (*Limosella australis*; MSCS r, CRPR 2B.1), Sanford's arrowhead (*Sagittaria sanfordii*; MSCS m, CRPR 1B.2), Marsh skullcap (*Scutellaria galericulata*; MSCS m, CRPR 2B.2), blue skullcap (*Scutellaria lateriflora*; MSCS m, CRPR 2B.2), and Suisun Marsh aster (*Symphyotrichum lentum*; CRPR 1B.2) (CNDDB 2007, CRPR 2011). The primary threats affecting these species are habitat loss, competition from nonnative species, and alterations to hydrology (including trenching and diking). Additional threats include grazing and trampling, installation of riprap, and anthropogenic disturbances (e.g., off-road vehicles; road, utility, and levee maintenance).

Species of Aquatic Communities Eel-grass pondweed (*Potamogeton zosteriformis*; MSCS m, CRPR 2B.2), a submerged aquatic plant of assorted freshwater habitats, is rare in California but more common elsewhere (CNPS 2011). Overall, the distribution, abundance, and threats affecting this species in California are not well known.

CVP/SWP Service Areas

Special-status plants are not likely to occur in a substantial portion of the CVP and SWP service areas because the agricultural and urban land uses tend to preclude suitable habitat for most native species. Although agricultural and developed land uses account for most of the CVP and SWP service areas, a portion of these areas still remains in natural vegetation, Because of the large size of the CVP and SWP service areas, this natural vegetation is distributed over a wide range of climate and soils, and is varied in structure and species composition. Consequently, a large number of special-status plant species has the potential to occur in the natural vegetation that remains within the CVP and SWP service areas (see the *Botanical Resources and Wetlands Technical Report*).

12.1.3 Invasive Species

Shasta Lake and Vicinity and Potential Sacramento River Downstream Restoration Sites

Nonnative plant species introduced to the region are of concern in the Shasta Lake and vicinity portion of the primary study area. When plants that evolved in one region of the globe are moved by humans to another region, a few flourish, crowding out native vegetation and wildlife that feed on the native species. Some invasive plants can even change ecosystem processes such as hydrology, fire regimes, and soil chemistry. These invasive plants have a competitive advantage because they are no longer controlled by their natural predators and can quickly spread. In California, approximately 3 percent of the plant species growing in the wild are considered invasive, but they inhabit a much greater proportion of the landscape (Cal-IPC 2007).

Plant pests are defined by law, regulation, policy, and technical organizations, and are regulated by many different bodies, including the California Department of Food and Agriculture (CDFA), U.S. Department of Agriculture, and the California Invasive Plant Council (Cal-IPC). The CDFA uses an action-oriented pest-rating system. The low rating assigned to a pest by CDFA does not necessarily mean that the pest is not a problem; rather, the rating system is meant to prioritize response by CDFA and county agricultural commissioners. Plants on CDFA's highest priority "A" list are defined as plants "of known economic importance subject to state-county enforced action involving eradication, quarantine regulation, containment, rejection or other holding action." Cal-IPC has developed a list of plant pests specific to California wildlands. The Cal-IPC list is based on information submitted by land managers, botanists, and researchers throughout the state and on published sources. To determine plant pests potentially occurring in the Shasta Lake and vicinity portion of the primary study area, this list was reviewed and local agencies (BLM, USFS, California Department of Transportation, and Shasta County Department of Agriculture) were contacted to gather information about known weed locations (Table 12-7). Additional information about noxious weeds has been compiled by Reclamation from observations made during botanical and other technical studies. Attachment 5 describes each weed source location, the potential mode of spread, and the risk of spread at each of the known sites.

Management actions have been required to prevent the loss of habitat caused by some of the more invasive exotic species that out-compete native vegetation. However, these management actions have been limited and have been confined primarily to areas adjacent to campgrounds and USFS facilities.

Table 12-7. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area

Common Name	Scientific Name	Cal-IPC Rating[1]	CDFA Rating[2]	Habitat
Silver wattle	*Acacia dealbata*	Moderate	None	Mixed woodlands, riparian
Barbed goatgrass	*Aegilops triuncialis*	High	B	Grassland, rangeland, oak woodland
Tree of heaven	*Ailanthus altissima*	Moderate	None	Grassland, oak woodland, riparian
Broomsedge	*Andropogon virginicus*	None	None	Riparian, disturbed areas
Giant reed	*Arundo donax*	High	None	Riparian
Slender wild oats	*Avena barbata*	Moderate	None	Coastal scrub, grassland, oak woodland, forest
Common wild oats	*Avena fatua*	Moderate	None	Coastal scrub, grassland, oak woodland, forest
Black mustard	*Brassica nigra*	Moderate	None	Disturbed areas, fields

Table 12-7. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)

Common Name	Scientific Name	Cal-IPC Rating[1]	CDFA Rating[2]	Habitat
Rattlesnake grass	*Briza maxima*	Limited	None	Grassland
Ripgut brome	*Bromus diandrus*	Moderate	None	Dunes, scrub, grassland, woodland, forest
Soft brome	*Bromus hordeaceus*	Limited	None	Grassland, sage brush, serpentine soils
Red brome	*Bromus madritensis* ssp. *rubens*	High	None	Interior scrub, woodlands, grassland
Cheatgrass	*Bromus tectorum*	High	None	Interior scrub, woodlands, grassland
Lenspod whitetip	*Cardaria chalapensis*	Moderate-ALERT	B	Central Valley wetlands
Italian thistle	*Carduus pycnocephalus*	Moderate	None	Forest, scrub, grasslands, woodlands.
White knapweed	*Centaurea diffusa*	Moderate	A	Great basin scrub, coastal prairie
Spotted knapweed	*Centaurea maculosa*	High	A	Riparian, grassland, wet meadows, forests
Maltese star-thistle	*Centaurea melitensis*	Moderate	None	Disturbed areas, fields
Yellow star-thistle	*Centaurea solstitialis*	High	C	Grassland, woodlands, occasionally riparian
Squarrose knapweed	*Centaurea virgata* var. *squarrosa*	Moderate	A	Scrub, grassland, pinyon-juniper woodland
Rush skeleton weed	*Chondrilla juncea*	Moderate	A	Grassland
Canada thistle	*Cirsium arvense*	Moderate	B	Grassland, riparian areas, forests
Bull thistle	*Cirsium vulgare*	Moderate	None	Riparian areas, marshes, meadows
Poison hemlock	*Conium maculatum*	Moderate	None	Riparian areas
Field bindweed	*Convolvulus arvensis*	Evaluated, not listed	C	Agricultural weed
Pampas grass	*Cortaderia selloana*	High	None	Coastal, riparian
Bermuda grass	*Cynodon dactylon*	Moderate	C	Riparian scrub, common landscape weed
Gypsyflower	*Cynoglossum officinale*	Moderate	None	Disturbed areas
Hedgehog dogtailgrass	*Cynosurus echinatus*	Moderate	None	Grassland, oak woodland, disturbed areas
Scotch broom	*Cystis scoparius*	High	C	Coastal scrub, oak woodland
Orchardgrass	*Dactylis glomerata*	Limited	None	Grassland, disturbed areas

Table 12-7. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)

Common Name	Scientific Name	Cal-IPC Rating[1]	CDFA Rating[2]	Habitat
Fuller's teasel	*Dipsacus sativus*	Moderate	None	Fields, disturbed areas
Barnyardgrass	*Echinochloa crus-galli*	None	None	Wet, disturbed areas. fields
Medusa-head	*Elymus caput-medusae*	High	C	Grassland, scrub, woodland
Longbeak stork's bill	*Erodium botrys*	Evaluated, not listed	None	Many upland habitats
Redstem stork's bill	*Erodium cicutarium*	Limited	None	Many upland habitats
Leafy spurge	*Euphorbia esula*	High-ALERT	A	Forests, woodlands, juniper forests
Tall fescue	*Festuca arundinacea*	Moderate	None	Pasture
Rat-tail fescue	*Festuca myuros*	Moderate	None	Coastal sage scrub, chaparral
Italian ryegrass	*Lolium multiflorum*	Moderate	None	Grassland, oak woodlands, pinyon-juniper woodland
Fig	*Ficus carica*	Moderate	None	Riparian woodland
Fennel	*Foeniculum vulgare*	High	None	Grassland, scrub
French broom	*Genista monspessulana mospessulana*	High	C	Coastal scrub, oak woodland, grassland
Cutleaf geranium	*Geranium dissectum*	Limited	None	Grassland, disturbed areas
English ivy	*Hedera helix*	High	None	Coastal forest, riparian areas
Cutleaf geranium	*Geranium dissectum*	Limited	None	Grassland, disturbed areas
Mediterranean barley, foxtail	*Hordeum marinum, H. murinum*	Moderate	None	Grassland
Common St. John's wort	*Hypericum perforatum*	Moderate	C	Many habitats, disturbed
Rough cat's ear	*Hypochaeris radicata*	Moderate	None	Grassland, woodland
Pale yellow iris	*Iris pseudacorus*	Limited	None	Riparian, fresh emergent wetland
Dyer's woad, Marlahan mustard	*Isatis tinctoria*	Moderate	B	Great basin scrub and grassland
Dalmation toadflax	*Linaria dalmatica*	Moderate	A	Grassland, forest clearings
Italian ryegrass	*Lolium multiflorum*	Moderate	None	Grassland, oak woodlands, pinyon-juniper woodland
Perennial sweetpea	*Lathyrus latifolius*	None	None	Woodland, roadsides

Table 12-7. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)

Common Name	Scientific Name	Cal-IPC Rating[1]	CDFA Rating[2]	Habitat
Water primrose	*Ludwigia peploides*	High	None	Ponds, lakes
Hyssop loosestrife	*Lythrum hyssopifolia*	Limited	None	Marsh, pond
Horehound	*Marrubium vulgare*	Limited	None	Pasture, grassland
Burclover	*Medicago polymorpha*	Limited	None	Grassland, disturbed areas
Parrotfeather	*Myriophyllum aquaticum*	High	None	Ponds, lakes
Oleander	*Nerium oleander*	Evaluated, not listed	None	Riparian areas
Pokeweed	*Phytolacca americana*	None	None	Riparian forest, riparian woodland
Annual rabbitsfoot grass	*Polypogon monspeliensis*	Limited	None	Riparian areas
Wild radish	*Raphanus sativus*	Limited	None	Fields, disturbed areas
Black locust	*Robinia pseudoacacia*	Limited	None	Riparian areas, canyons
Himalayan blackberry	*Rubus armeniacus*	High	None	Riparian areas, marshes, oak woodlands
Cutleaf blackberry	*Rubus laciniatus*	None	None	Riparian areas, marshes, oak woodlands
Common sheep sorrel	*Rumex acetosella*	Moderate	None	Grassland, disturbed areas
Curly dock	*Rumex crispus*	Limited	None	Grassland, vernal pools, meadows, riparian
Bouncingbet	*Saponaria officinalis*	Limited	None	Oak woodland, streambed
Tansy ragwort	*Senecio jacobaea*	Limited	B	Grassland, riparian
Rattlebox	*Sesbania punicea*	High	None	Riparian
Johnsongrass	*Sorghum halepense*	None	C	Disturbed sites, moist places
Spanish broom	*Spartium junceum*	High	None	Coastal scrub, grassland, wetlands, oak woodland, forests
Medusa-head	*Taeniatherum caput-medusae*	High	C	Grassland, scrub, woodland
Spreading hedgeparsley	*Torilis arvensis*	Moderate	None	Grassland, woodland, disturbed areas
Puncturevine	*Tribulus terrestris*	None	C	Dry, disturbed areas
Rose clover	*Trifolium hirtum*	Limited	None	Grassland, woodland
Common mullein	*Verbascum thapsus*	Limited	None	Meadows, riparian, sagebrush, pinyon-juniper woodland
Periwinkle	*Vinca major*	Moderate	None	Riparian, oak woodlands, coastal scrub
Rat-tail fescue	*Vulpia myuros*	Moderate	None	Coastal sage scrub, chaparral

Table 12-7. Nonnative Plant Species Known to Occur in the Shasta Lake and Vicinity Portion of the Primary Study Area (contd.)

Notes:

[1] Cal-IPC Inventory Categories:

High	Severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Widely distributed ecologically.
Moderate	Substantial and apparent ecological impacts on physical processes, plant and animal communities, and vegetation structure. Reproductive biology and other attributes are conducive to moderate to high rates of dispersal, although generally dependent on ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.
Limited	These species are invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic (Cal-IPC 2012).

[2] CDFA Pest Ratings of Noxious Weed Species and Noxious Weed Seed

A – Eradication, containment, rejection, or other holding action at the state-county level.

B – Intensive control or eradication, where feasible, at the county level.

C – Control or eradication as local conditions warrant, at the county level.

Q – Rating as "A" is pending at the state or county level.

Key:

Cal-IPC = California Invasive Plant Council

CDFA = California Department of Food and Agriculture

Upper Sacramento River (Shasta Dam to Red Bluff) and Lower Sacramento River and Delta

A number of nonnative species have been introduced and become abundant in the riparian areas and marshes (fresh emergent wetlands) of the Sacramento Valley and Delta (Hunter et al. 2003). Several of these invasive nonnatives, including red sesbania (*Sesbania punicea*), Himalayan blackberry (*Rubus discolor*), giant reed (*Arundo donax*), and perennial pepperweed (*Lepidium latifolium*), form dense, monotypic stands that preclude the establishment of native species (Bossard, Randall, and Hoshovsky 2000). In general, these species displace native plants, reduce biodiversity, alter river flows, and reduce wildlife habitat values. Table 12-8 lists the most problematic of those species in Sacramento Valley and Delta riparian areas and marshes—invasive species rated by Cal-IPC; many of these species have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure (Cal-IPC 2006).

Table 12-8. Cal-IPC High-Rated Invasive Plants of Sacramento Valley and Delta Riparian and Marsh Habitats

Scientific Name Common Name	Cal-IPC Rating[1]	CDFA Rating[2]	Primary Riparian/ Marsh Habitat(s)	Plant Type
Ailanthus altissima Tree-of-heaven, Chinese sumac	M	C	Marsh, riparian forest/woodland/scrub	Tree
Arundo donax Giant reed	H	B	Riparian forest/scrub	Perennial grass
Bromus diandrus Ripgut brome, great brome	M	–	Riparian scrub	Annual grass
Bromus madritensis ssp. *rubens* Red brome, foxtail chess	H	–	Riparian woodland/scrub	Annual grass
Centaurea melitensis Malta starthistle, tocalote	M	C	Riparian scrub	Annual herb
Centaurea solstitialis Yellow starthistle	H	C	Riparian scrub	Annual herb
Cirsium vulgare Bull thistle	M	C	Marsh	Perennial herb
Conium maculatum Poison hemlock	M	–	Riparian forest	Perennial herb
Cortaderia selloana, Cortaderia jubata Pampasgrass, white pampasgrass, jubatagrass	H	B	Riparian scrub	Perennial grass
Delairea odorata Cape-ivy, German ivy	H	–	Riparian forest	Perennial vine
Dipsacus fullonum Common teasel, wild teasel	M	–	Bog and fen, riparian scrub, marsh	Perennial herb
Egeria densa Brazilian waterweed, egeria	H	C	Lakes, ponds, reservoirs	Perennial aquatic herb
Eucalyptus globules Bluegum, Tasmanian bluegum	M	–	Marsh, riparian forest/woodland	Tree
Ficus carica Edible fig	M	–	Riparian forest, marsh	Shrub/tree
Foeniculum vulgare fennel	H	–	Riparian scrub/woodland	Perennial herb
Geranium dissectum Cutleaf geranium	L	–	Riparian woodland	Annual herb
Hedera helix, Hedera canariensis English ivy and Algerian ivy	H	–	Riparian forest, marsh	Perennial vine/shrub
Hypochaeris glabra Smooth cat's-ear	L	–	Riparian woodland	Annual herb
Hypochaeris radicata Common cat's ear, rough cat's-ear	M	–	Riparian forest/woodland/scrub	Annual herb

Table 12-8. Cal-IPC High-Rated Invasive Plants of Sacramento Valley and Delta Riparian and Marsh Habitats (contd.)

Scientific Name Common Name	Cal-IPC Rating[1]	CDFA Rating[2]	Primary Riparian/ Marsh Habitat(s)	Plant Type
Lepidium latifolium Perennial pepperweed, tall whitetop	H	B	Tidal and nontidal marsh, riparian scrub	Perennial herb
Lolium multiforum, Festuca perennis Italian ryegrass	M	–	Riparian scrub	Annual/biennial grass
Ludwigia peploides Creeping waterprimrose, California waterprimrose	H	–	Rivers, streams, canals	Perennial aquatic herb
Lytrum hyssopifolium Hyssop loosestrife, grass poly	L	–	Marsh	Perennial herb
Lythrum salicaria Purple loosestrife	H	B	Tidal and nontidal marsh	Perennial herb
Mentha pulegium Pennyroyal, European pennyroyal	M	–	Marsh, bog and fen, riparian forest	Perennial herb
Myoporum laetum Ngaio tree, false sandalwood	M	–	Marsh	Shrub/tree
Myriophyllum spicatum Spike watermilfoil	H	C	Lakes, ponds, reservoirs	Perennial aquatic herb
Potamogeton crispus Curly-leaved pondweed, curled pondweed	M	–	Lakes, ponds, reservoirs, rivers, streams, canals	Perennial aquatic herb
Pyracantha angustifolia, P. crenulata, P. coccinea Narrowleaf firethorn, scarlet firethorn	L	–	Riparian woodland	Shrub
Ranunculus repens Creeping buttercup	L	–	Riparian forest/woodland	Perennial herb
Rubus armeniacus (= R. discolor) Himalayan blackberry	H	–	Riparian woodland/forest/scrub, nontidal marsh	Shrub
Rumex acetosella Sheep sorrel	M	–	Riparian scrub	Perennial herb
Rumex crispus Curly dock	L	–	Bog and fen, riparian forest/woodland	Perennial herb
Saponaria officinalis Bouncing-bet, bouncing betty	L	–	Riparian woodland	Perennial herb
Sesbania punicea Red sesbania, scarlet wisteria	H, A	B	Riparian woodland, marsh	Tree
Tamarix chinensis, T. gallica, T. parviflora, T. ramosissima Chinese tamarisk, French tamarisk, small flower tamarisk, salt cedar	H	B	Riparian forest/woodland, marsh	Tree, shrub
Torilis arvensis Hedgeparsley, spreading hedgeparsley	M	–	Riparian woodland	Annual herb

Table 12-8. Cal-IPC High-Rated Invasive Plants of Sacramento Valley and Delta Riparian and Marsh Habitats (contd.)

Scientific Name Common Name	Cal-IPC Rating[1]	CDFA Rating[2]	Primary Riparian/ Marsh Habitat(s)	Plant Type
Verbascum thapsus Common mullein, wooly mullein	L	–	Riparian scrub	Perennial herb

Source: Cal-IPC 2006

Notes:

[1] Cal-IPC Inventory Ratings:

A = Alert – Plant species with the potential to spread explosively; infestations currently small and localized

H = High – species that have severe ecological impacts on physical processes, plant and animal communities, and vegetation structure

M = Moderate –species that have substantial and apparent, but generally not severe, ecological impacts on physical processes, plant and animal communities, and vegetation structure

L = Limited –species that are invasive but their impacts are minor on a statewide level or there was not enough information to justify a higher score

[2] CDFA Weed Ratings:

B = known to be of economic or environmental detriment, and of limited distribution, if present in California

C = known to be of economic or environmental detriment, and usually widespread, if present in California

Key:

Cal-IPC = California Invasive Plant Council

CDFA = California Department of Food and Agriculture

12.1.4 Waters of the United States, Including Wetlands, in Shasta Lake and Vicinity

Reclamation delineated wetlands and other waters of the United States under Federal jurisdiction (jurisdictional waters) in the impoundment area between 2004 and 2010. Jurisdictional waters on public lands in the relocation areas were delineated between 2009 and 2013, and on private lands where access was granted. Supplemental fieldwork is planned for additional private lands in the relocation areas where access has recently been granted. These data will be provided in a wetland delineation report prepared for submittal to the USACE. The wetland delineation report is in preparation and has not been verified by the USACE. All information regarding jurisdictional waters is preliminary.

Jurisdictional waters occur in the impoundment and relocation areas as wetlands and other waters. For wetlands, the impoundment area is defined as the area between 1,070 and 1,090 msl surrounding Shasta Lake. For other waters, the impoundment area includes the lacustrine waters associated with Shasta Lake below 1,070 msl. Wetlands include fresh emergent/riparian wetland, intermittent swale, riparian wetland, seasonal wetland, seep/spring wetland, and vegetated ditch. Other waters include ephemeral, intermittent, and perennial streams, roadside ditches, seep/spring waters, and lacustrine. Because some construction activities associated with the impoundment and relocation areas extend into Shasta Lake below the existing full pool elevation, the surface area of the lake is included in the delineation results. Approximately 46 acres of wetlands and 30,092 acres of other waters occur in the impoundment and relocation areas. Total jurisdictional waters in the impoundment and relocation areas, excluding Shasta Lake at full pool, include approximately 51 acres of wetlands and 103 acres of other waters.

Jurisdictional waters occur in the potential Sacramento River downstream restoration areas as wetlands and other waters. Wetlands include fresh emergent wetlands, pond, riparian wetlands, and riparian/fresh emergent wetland complex. Other waters include ephemeral, intermittent, and perennial streams. Approximately 67 acres of wetlands and 100 acres of other waters occur in the potential Sacramento River downstream restoration areas.

Main Body

The wetland delineation of the impoundment area along the Main Body was conducted from January to April 2010. Jurisdictional waters include seep/spring, riparian, and vegetated ditch wetlands and ephemeral stream, intermittent stream, and perennial stream, seep/spring, and roadside ditch waters. Total acres of jurisdictional waters occurring in the Main Body are summarized in Table 12-9.

Big Backbone Arm

The wetland delineation along the Big Backbone Arm was conducted during November 2006. Jurisdictional waters included seep/spring and riparian wetlands, and ephemeral stream, intermittent stream, and perennial stream waters. Total acres of jurisdictional waters occurring in the Big Backbone Arm are summarized in Table 12-9.

Sacramento Arm

The wetland delineation along the Sacramento Arm was conducted from September through early December 2010 and during March, April, and June 2010. Jurisdictional waters include seep/spring, riparian, seasonal, and riparian/fresh emergent wetlands, and ephemeral stream, intermittent stream, and perennial stream, seep/spring, and roadside ditch waters. Total acres of jurisdictional waters occurring in the Sacramento Arm are summarized in Table 12-9.

McCloud Arm

The wetland delineation along the McCloud Arm was conducted during December 2009 and in April, June, and November 2010. Jurisdictional waters include seep/spring, riparian, and vegetated ditch wetlands and ephemeral stream, intermittent stream, perennial stream, and seep/spring waters. Total acres of jurisdictional waters occurring in the McCloud Arm are summarized in Table 12-9.

Squaw Creek Arm

The wetland delineation along the Squaw Creek Arm was conducted from late August through September 2004. Jurisdictional waters include seep/spring, riparian, and seasonal wet meadow wetlands, and ephemeral stream, intermittent stream, perennial stream, and seep/spring other waters. Total acres of jurisdictional waters occurring in the Squaw Creek Arm are summarized in Table 12-9.

Pit Arm

The wetland delineation along the Pit Arm was conducted from late November 2006 through April 2007. Jurisdictional waters include riparian, seep/spring, seasonal and intermittent swale wetlands, and ephemeral stream, intermittent stream, and perennial stream waters. Total acres of jurisdictional waters occurring in the Pit Arm are summarized in Table 12-9.

Table 12-9. Jurisdictional Waters in the Impoundment Area

Jurisdictional Water Type	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Wetlands							
Fresh emergent/ riparian wetland	0.00	0.00	5.32	0.00	0.00	0.00	5.32
Intermittent swale	0.00	0.00	0.00	0.00	0.00	0.04	0.04
Riparian wetland	1.09	1.73	7.05	8.34	1.49	0.77	20.47
Seasonal wetland	0.00	0.00	0.42	0.00	0.14	0.02	0.58
Seep/spring wetland	0.77	0.23	0.80	0.41	0.16	0.47	2.84
Vegetated ditch	0.13	0.00	0.00	0.02	0.00	0.00	0.15
Total Wetlands	1.99	1.96	13.59	8.77	1.79	1.30	29.40
Other Waters of the United States							
Ephemeral stream	0.28	0.01	0.62	0.28	0.13	0.12	1.44
Intermittent stream	1.42	0.24	2.42	0.91	0.92	2.58	8.49
Perennial stream	1.55	3.00	9.78	20.27	2.39	1.57	38.56
Roadside ditch	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Seep/spring other waters	0.03	0.00	0.001	0.01	0.0001	0.00	0.04
Lacustrine[2]	10,196.88	1,014.12	7,225.14	5,032.68	2,081.60	4,372.80	29,923.22
Total Other Waters	10,200.16	1,017.37	7,237.97	5,054.15	2,085.04	4,377.07	29,971.76
Total Waters of the U.S.	10,200.15	1,019.33	7,251.56	5,062.92	2,086.83	4,378.37	30,001.16

Notes:
[1] Acreage values are approximate
[2] Lacustrine acreage includes area below 1070 msl

Relocation Areas

Wetland delineations at the relocation areas were conducted between January 2010 and September March 2013. Jurisdictional waters include wetlands and other waters. Wetlands include fresh emergent, intermittent swale, riparian, seep/spring, and seasonal wetlands, and vegetated ditches. Other waters present

include ephemeral, intermittent, and perennial streams, seep/spring, and roadside ditches. Total acres of jurisdictional waters occurring in the Relocation Areas are summarized in Table 12-10.

Table 12-10. Jurisdictional Waters in the Relocation Areas

Jurisdictional Water Type	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Wetlands							
Fresh emergent wetland	0.00	N/A	0.07	0.01	0.00	0.00	0.07
Fresh emergent/ riparian wetland	0.00	N/A	0.40	0.00	0.00	0.00	0.40
Intermittent swale	0.00	N/A	0.78	0.00	0.00	0.01	0.78
Riparian wetland	0.15	N/A	3.55	0.39	0.17	0.13	4.39
Seasonal wetland	0.01	N/A	11.30	0.00	0.02	0.00	11.33
Seep/spring wetland	0.03	N/A	0.06	0.12	0.05	0.16	0.42
Vegetated ditch	0.06	N/A	0.002	0.01	0.002	0.00	0.07
Total Wetlands	0.25	N/A	16.16	0.52	0.24	0.29	17.46
Other Waters of the United States							
Ephemeral stream	0.24	N/A	1.16	0.85	0.03	0.09	2.37
Intermittent stream	0.78	N/A	2.96	1.25	0.20	0.33	5.52
Perennial stream	0.00	N/A	0.28	0.54	0.24	0.002	1.06
Non-vegetated ditch	0.04	N/A	0.12	0.00	0.00	0.00	0.16
Roadside ditch	0.00	N/A	0.003	0.00	0.00	0.00	0.003
Seep/spring other waters	0.00	N/A	0.00	0.00	0.03	0.00	0.03
Total Other Waters	1.02	N/A	4.40	2.64	0.50	0.42	8.98
Total Waters of the U.S.	1.31	N/A	20.68	3.16	0.74	0.71	26.60

Note:
[1] Acreage values are approximate.
Key: N/A = Not Applicable

Potential Sacramento River Downstream Restoration Areas

Wetland delineations at the potential Sacramento River downstream restoration areas were conducted between March and November 2013. Jurisdictional waters occur in the potential Sacramento River downstream restoration areas as wetlands and other waters. Wetlands include fresh emergent wetlands, pond,

riparian wetlands, and riparian/fresh emergent wetland complex. Other waters include ephemeral, intermittent, and perennial streams. Approximately 67 acres of wetlands and 100 acres of other waters occur in the potential Sacramento River downstream restoration areas. Total acres of jurisdictional waters occurring in the relocation areas are summarized in Table 12-11.

Table 12-11. Jurisdictional Waters in the Potential Sacramento River Downstream Restoration Areas

Jurisdictional Water Type	Area (Acres[1])					
	Henderson Open Space	Tobiasson Island	Shea Island Complex	Kapusta Island	Anderson River Park	Reading Island
Wetlands						
Fresh emergent wetland	1.16	0.68	1.07	0.15	9.19	5.14
Riparian wetland	1.88	1.58	4.64	10.23	12.09	15.24
Riparian/fresh emergent wetland complex	N/A	N/A	0.05	N/A	3.62	N/A
Total Wetlands	3.04	2.26	5.76	10.38	24.9	17.38
Other Waters of the United States						
Ephemeral stream	0.01	N/A	N/A	N/A	N/A	N/A
Intermittent stream	N/A	N/A	N/A	N/A	0.02	0.02
Perennial stream	1.34	3.12	10.93	8.83	0.68	4.59
Pond	3.51	N/A	N/A	N/A	N/A	N/A
Total Other Waters	4.86	3.12	10.93	8.83	0.70	4.61
Total Waters of the U.S.	7.89	5.38	16.69	19.21	25.59	24.99

Note:
[1] Acreage values are approximate.

Characterization of Wetland Features

Jurisdictional wetlands occurring in the Shasta Lake and vicinity portion of the primary study area include fresh emergent/riparian wetland, intermittent swale, riparian wetland, seasonal wetland, seep/spring wetland, and vegetated ditch.

Fresh emergent/riparian wetlands are uncommon in the Shasta Lake and vicinity portion of the primary study area, occurring only at one location along the Sacramento Arm. This location consists of a former USFS recreation site developed at the confluence of Salt Creek and Shasta Lake, immediately east of I-5. This former recreation site coupled with an undercrossing at I-5 has partially impounded the flows of Salt Creek, resulting in the development of an area characterized by a complex of fresh emergent and riparian wetland

vegetation. Dominant overstory species include Goodding's black willow (OBL[1]), arroyo willow (FACW), red willow (assume FACW), and shining willow (OBL). Fresh emergent species include pennyroyal (*Mentha pulegium*–OBL), willow dock (*Rumex salicifolius*–OBL), and broadleaf cattail (*Typha latifolia*). Wetland hydrology and soils criteria are met through evidence of frequent flooding, including sediment deposits, watermarks, drift lines, and drainage patterns.

Intermittent swales occur along the Big Backbone and Pit arms. These features are characterized as linear, or somewhat linear, drainages that lack evidence of scour and are dominated by wetland plant species resulting from seasonally saturated soils. Typical species occurring in these features include seep monkey flower (*Mimulus guttatus*–OBL), spiny fruit buttercup (*Ranunculus muricatus*–FACW), slender rush (*Juncus tenuis*–FACW), and centaury (*Centaurium venustum*–Not Listed (NL)). Wetland hydrology and soils criteria are met through evidence of long-duration saturation, including saturation in the upper 12 inches, aquic moisture regime, and drainage patterns.

Riparian wetlands are common throughout the Shasta Lake and vicinity portion of the primary study area and generally occur as "stringers," or narrow features found immediately adjacent to intermittent or perennial streams. Typical species found in riparian wetlands include arroyo willow (FACW), Goodding's black willow (OBL), white alder (FACW), Oregon ash (FACW), Indian rhubarb (*Darmera peltata*-NL), mugwort (*Artemisia douglasiana*-FACW), California wild grape (FACW), and Himalayan blackberry (FACW). Wetland hydrology and soils criteria are met through evidence of frequent flooding, including sediment deposits, watermarks, drift lines, and drainage patterns.

Seasonal wetlands occur along the Sacramento, Squaw Creek, and Pit arms. These features are dominated by herbaceous vegetation and are typically adjacent to other wetland features or are depressions that frequently pond. Typical plant species found in these features include slender rush (FACW), sword leaf rush (*Juncus ensifolius*–FACW), seep monkey flower (OBL), yampah (*Perideridia californica*–FACW), annual checker bloom (*Sidalcea calycosa*–OBL), little quaking grass (*Briza minor*–FACW), California oatgrass (*Danthonia californica*–FACW), and spiny fruit buttercup (FACW). Wetland hydrology and soils criteria are met through evidence of long-duration saturation, including saturation in the upper 12 inches, an aquic moisture regime, and drainage patterns.

[1] OBL = Obligate Wetland Plants—Estimated probability of occurring in wetland >99 percent.
FACW = Facultative Wetland Plants—Estimated probability of occurring in wetland >67 percent to 99 percent.
FAC = Facultative Plants—Estimated probability of occurring in wetland 33 percent to 67 percent.
FACU = Facultative Upland Plants—Estimated probability of occurring in wetland 1 percent to <33 percent.
UPL = Obligate Upland Plants—Estimated probability of occurring in wetland <1 percent.
NI = No Indicator—Plants for which insufficient information was available to determine an indicator status.
NL = Not listed—Plants not listed in Reed 1988.

Seep/spring wetlands are found throughout the Shasta Lake and vicinity portion of the primary study area. These features form at locations where groundwater flows meet the ground surface. Hydrophytic vegetation typically colonizes the area where water is provided by the seep/spring. Typical species include white alder (FACW), chain fern (*Woodwardia fimbriata*–FACW), goat's beard (*Aruncus dioicus*–FACW), Indian rhubarb (NL), seep monkey flower (OBL), horsetail (*Equisetum arvense*–FAC), red stem dogwood (*Cornus stolonifera*–FACW), spicebush (NL), and western azalea (FAC). The wetland hydrology and soils criteria are met through evidence of long-duration saturation, including inundation, saturation in the upper 12 inches, watermarks, and drainage patterns.

Vegetated ditches are uncommon in the Shasta Lake and vicinity portion of the primary study area and occur along the Main Body, the McCloud Arm, and in several relocation areas. These features consist of ditches that have been excavated to drain adjacent uplands, parking areas, roads, or railways. These features are generally low gradient and provide hydrologic conditions suitable for colonization by hydrophytic vegetation. Dominant plant species include nutsedge (*Cyperus eragrostis*–FACW), seep monkey flower (OBL), broadleaf cattail, and rush (*Juncus* sp.–assume FACW). Wetland hydrology and soil criteria were met by long-duration inundation and long-duration saturation.

Jurisdictional waters (i.e., other waters) occurring in the Shasta Lake and vicinity portion of the primary study area include ephemeral, intermittent, and perennial streams, roadside ditches, and seep/spring waters.

Ephemeral streams are common throughout the Shasta Lake and vicinity portion of the primary study area. These features are linear drainages characterized by indicators of scour and deposition, minor drift lines, and sediment deposits, but lack a groundwater component that contributes to their flow. The wetland hydrology is provided by sheet flow and these features typically cease flowing soon after storm or runoff events. Ephemeral streams are characterized by poorly defined wetland hydrology indicators, and are typically found in headwater areas with relatively small drainage areas.

Intermittent streams are the most common jurisdictional feature in the Shasta Lake and vicinity portion of the primary study area. Intermittent streams range from small, poorly defined tributaries to larger, well-defined streams that flow into the summer. Like ephemeral streams, intermittent streams flow seasonally, but, in addition to precipitation and sheet flow from adjacent slopes, these features have a groundwater component to their flow regime. Intermittent streams are characterized by the presence of a defined bed and bank, and scour and deposition. Other characteristics, such as algae growth or hydrophytic vegetation in or adjacent to the stream, indicate longer inundation periods. Wetland hydrology and hydric soil criteria are met through evidence of frequent flooding, including water marks, algal matting, drift lines, and sediment deposits.

Perennial streams occur throughout the Shasta Lake and vicinity portion of the primary study area. These features are characterized by perennial flow and often bounded by riparian wetlands. Dominant substrates consist of boulders, bedrock, cobble, sand, and gravel. Wetland hydrology and hydric soil criteria are met through evidence of frequent flooding, including water marks, algal matting, drift lines, and sediment deposits.

Roadside ditches are uncommon in the Shasta Lake and vicinity portion of the primary study area but some are found along the Sacramento Arm. These ditch features occur near roadways and railroad tracks and have been excavated solely to drain uplands. Wetland vegetation is sparse or absent. The wetland boundaries were indicated by sediment and drift deposits.

Seep/spring other waters are uncommon in the Shasta Lake and vicinity portion of the primary study area but some are found along the Main Body, the Sacramento Arm, the McCloud Arm, and the Squaw Creek Arm. These features form at locations where groundwater flows meet the ground surface; however, the features are not dominated by hydrophytic vegetation. The wetland hydrology and soils criteria are met through evidence of long-duration saturation, including inundation, saturation in the upper 12 inches, watermarks, and drainage patterns.

12.2 Regulatory Framework

Biological resources in California are protected and/or regulated by a variety of Federal and State laws and policies. In addition, in many parts of California, there are local or regional habitat and species conservation planning efforts in which a project applicant may participate. Key regulatory and conservation planning issues applicable to the project and alternatives under consideration are discussed below.

12.2.1 Federal

Endangered Species Act

Pursuant to the Federal Endangered Species Act (ESA), USFWS and NMFS have authority over projects that may result in "take" of a Federally listed species. In general, ESA Section 7 prohibits persons (including private parties) from "taking" listed endangered or threatened fish and wildlife species on private property, and from "taking" listed endangered or threatened plant species in areas under Federal jurisdiction or in violation of State law (16 United States Code (USC) 1532, 50 Code of Federal Regulations (CFR) 17.3). Under the ESA, the definition of "take" is to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" as part of an intentional or negligent act or omission. The term "harm" includes acts that result in death or injury to wildlife. Such acts may include significant habitat modification or degradation if it results in death or injury to

wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Section 7(a) of the ESA, as amended, requires Federal agencies to evaluate their actions with respect to any species that is proposed for listing or is listed as endangered or threatened. Section 7(a)(2) requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with USFWS.

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

Clean Water Act

The CWA is the major Federal legislation governing the water quality aspects of the SLWRI. The objective of the act is "to restore and maintain the chemical, physical, and biological integrity of the nation's waters." The CWA establishes the basic structure for regulating discharge of pollutants into the waters of the United States and gives EPA the authority to implement pollution control programs, such as setting wastewater standards for industries. In certain states, such as California, EPA has delegated authority to State agencies.

Section 303 of the CWA requires states to adopt water quality standards for all surface waters of the United States. The three major components of water quality standards are designated users, water quality criteria, and antidegradation policy. Section 303(d) of the CWA requires states and authorized Native American tribes to develop a list of water-quality-impaired segments of waterways. The list includes waters that do not meet water quality standards necessary to support the beneficial uses of a waterway, even after point sources of pollution have had minimum required levels of pollution control technology installed. Only waters impaired by "pollutants" (e.g., clean sediments, nutrients such as nitrogen and phosphorus, pathogens, acids/bases, temperature, metals, cyanide, and synthetic organic chemicals (EPA 2002)), not those impaired by other types of "pollution" (e.g., altered flow, channel modification), are to be included on the list.

Section 303(d) of the CWA also requires states to maintain a list of impaired water bodies so that a total maximum daily load (TMDL) can be established A TMDL is a plan to restore the beneficial uses of a stream or to otherwise correct an impairment. It establishes the allowable pollutant loadings or other quantifiable parameters (e.g., pH, temperature) for a water body and thereby provides the basis for establishing water-quality-based controls. The calculation

for establishing TMDLs for each water body must include a margin of safety to ensure that the water body can be used for the purposes of state designation. Additionally, the calculation also must account for seasonal variation in water quality (EPA 2002). The Central Valley Regional Water Quality Control Board (RWQCB) develops TMDLs for Shasta Lake and its tributaries.

Section 401 of the CWA requires entities to obtain certification from the state or Native American tribes when applying for a Federal license or permit that may result in increased pollutant loads to a water body. The certification is issued only if such increased loads would not cause or contribute to exceedences of water quality standards.

Section 402 created the National Pollutant Discharge Elimination System (NPDES) permit program. This program covers point sources of pollution discharging into a surface water body.

A permit must be obtained from USACE under Section 404 for the discharge of dredged or fill material into "waters of the United States, including wetlands." Waters of the United States include wetlands and lakes, rivers, streams, and their tributaries. Wetlands are defined for regulatory purposes as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support and, under normal circumstances do support, vegetation typically adapted for life in saturated soil conditions.

Rivers and Harbors Act

USACE regulates the construction of structures in, over, or under; excavation of material from; or deposition of material into "navigable waters of the United States" under Section 10 of the Federal Rivers and Harbors Act (33 USC 401 et seq.). Navigable waters of the United States are defined as those waters subject to the ebb and flow of the tide shoreward to the mean high-water mark or those that are currently used, have been used in the past, or may be susceptible to use to transport interstate or foreign commerce.

U.S. Forest Service Sensitive Species

The National Forest Management Act requires USFS to "provide for a diversity of plant and animal communities" (16 USC 1604(g)(3)(B)) as part of its multiple-use mandate. USFS must maintain "viable populations of existing native and desired nonnative species in the planning area" (36 CFR 219.19). The Sensitive Species program is designed to meet this mandate and to demonstrate USFS's commitment to maintaining biodiversity on National Forest System lands. The program is a proactive approach to conserving species to prevent a trend toward listing under the ESA and to ensure the continued existence of viable, well-distributed populations. A "Sensitive Species" is any species of plant or animal that has been recognized by the Regional Forester to need special management to prevent the species from becoming threatened or endangered.

Shasta-Trinity National Forest Land and Resource Management Plan

The Shasta-Trinity National Forest (STNF) Land and Resource Management Plan (LRMP) contains forest goals, standards, and guidelines designed to guide the management of STNF. The following goals, standards, and guidelines related to botanical resource issues associated with the primary study area were excerpted from the STNF LRMP (USFS 1995).

Biological Diversity

Goals (LRMP, p. 4-4) Integrate multiple resource management on a landscape level to provide and maintain diversity and quality of habitats that support viable populations of plants, fish, and wildlife.

Standards and Guidelines (LRMP, p. 4-14)

- **Natural Openings** – Management of natural openings will be determined at the project level consistent with desired future conditions.

- **Snags** – Over time, provide the necessary number of replacement snags to meet density requirements as prescribed for each land allocation and/or management prescription. Live, green culls and trees exhibiting decadence and/or active wildlife use are preferred.

- **Hardwood** – Apply the following standards in existing hardwood types:

  - Manage hardwood types for sustainability.

  - Conversion to conifers will only take place to meet desired future ecosystem conditions.

  - Where hardwoods occur naturally within existing conifer types on suitable timber lands, manage for a desired future condition for hardwoods as identified during ecosystem analysis consistent with management prescription standards and guidelines. Retain groups of hardwoods over single trees.

Threatened, Endangered, and Sensitive Species (Plants and Animals)

Goals (LRMP, p. 4-5)

- Monitor and protect habitat for Federally listed threatened and endangered and candidate species. Assist in recovery efforts for threatened and endangered species. Cooperate with the State to meet objectives for state listed species.

- Manage habitat for sensitive plants and animals in a manner that will prevent any species from becoming a candidate for threatened and endangered status.

Botany (Sensitive and Endemic Plants)

Standards and Guidelines (LRMP, pp. 4-14 through 4-16)

- Map, record, and protect essential habitat for known and newly discovered sensitive and endemic plant species until conservation strategies are developed.

- Analyze the potential effects of all ground-disturbing projects on sensitive and endemic plants and their habitat. Mitigate project effects to avoid a decline in species viability at the Forest level.

- Monitor the effects of management activities on sensitive and endemic plants. If monitoring results show a decline in species viability, alter management strategy.

- Provide reports of sensitive plant populations to the CDFW annually.

- Coordinate sensitive plant inventory and protection efforts with CDFW, USFWS, The Nature Conservancy (TNC), the CNPS, and other concerned agencies, organizations, and adjacent landowners.

- Protect type localities of sensitive and endemic plants for their scientific value.

U.S. Forest Service Survey and Manage

Standards and Guidelines The 1994 Record of Decision (ROD) for Amendments to USFS and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl and Standards and Guidelines for Management for Late-Successional and Old-Growth Related Species in the Range of the Northern Spotted Owl (Northwest Forest Plan (NWFP) ROD amended or was incorporated into BLM and USFS land management plans to require certain actions for rare amphibians, mammals, bryophytes, mollusks, vascular plants, fungi, lichens, and arthropods that occupy late-successional and old-growth forests (USFS and BLM 1994). These rare species were identified in Appendix C of the NWFP ROD collectively as S&M Species. The NWFP ROD also established protection buffers on matrix lands for certain species (i.e., protection buffer species) that were not on the 1994 S&M list and required that those buffers be managed as part of the Late Successional Reserve network. Four survey strategies were developed to guide management of S&M species: (1) manage known sites; (2) survey before ground-disturbing activities; (3) conduct extensive surveys; and (4) conduct general regional surveys.

The NWFP ROD also established overall objectives for managing S&M species populations that were referred to as “persistence objectives.” These objectives were based on the USFS viability provision in the 1982 National Forest System Land and Resource Management Planning Regulation for the National Forest Management Act of 1976. This provision is targeted toward vertebrate species,

but was also applied to nonvertebrate species to the extent practicable, as described in the NWFP ROD. The provision generally states that the USFS shall manage habitat "to maintain viable populations of existing native and desired non-native vertebrate species in the planning area" (36 CFR 219.19). Although the viability standard is part of the USFS planning regulations, the protections for S&M species were also applied to BLM lands in the NWFP ROD with a goal of protecting the long-term health and sustainability of all Federal forests within the range of the northern spotted owl and the species that inhabit them. Because of the uncertainty associated with the continued persistence of species due to natural factors, the NWFP ROD noted that compliance with the planning regulations is not subject to precise numerical interpretations and cannot be fixed at any single threshold; rather, "as in any administrative field, common sense and agency expertise must be applied" (NWFP ROD, p. 44).

In 2001, the *Record of Decision and Standards and Guidelines for Amendments to the Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines* (2001 S&M ROD) (USFS and BLM 2001) modified the management direction provided in the NWFP ROD for S&M and protection buffer species and amended BLM and USFS land management plans in the range of the northern spotted owl accordingly. The list of S&M species was also modified to remove 72 species in all or part of their range because new information indicated they were secure or otherwise did not meet the basic criteria for S&M. Species remaining on the list were assigned to one of six categories using the following criteria: their relative rarity, the ability to reasonably and consistently locate occupied sites during surveys before habitat-disturbing activities, and the level of information known about the species or group of species. The 2001 S&M ROD also removed the direction specific to protection buffer species, excluding these species from S&M Standards and Guidelines requirements. As part of the 2001 Standards and Guidelines, objectives, criteria, and management direction were defined for each category. Specific criteria were also established to add, remove, or change species categories based on new information and as part of the annual species review processes.

In 2004 and again in 2007, the BLM and USFS issued a ROD to eliminate the S&M requirements of the 2001 S&M ROD and to provide protection for species on the S&M lists by managing them under the agencies' special-status species programs. As a result of litigation, the requirements of the 2001 S&M ROD were reinstated. In a subsequent court-mandated settlement agreement (USFS and BLM 2011), the list of S&M species was modified. The settlement agreement also made the following modifications: (1) acknowledged existing exemption categories (2006 Pechman Exemptions), (2) updated the 2001 S&M species list, (3) established a transition period for application of the species list, and (4) established new exemption categories (2011 Exemptions). Agency decisions made after September 30, 2012, are required to use the 2011 S&M list. Some species considered in the S&M program also occur on non-Federal

lands. The requirements of the 1994 NWFP ROD and 2001 S&M ROD as modified under the 2011 Settlement Agreement apply only to lands managed by the BLM and USFS within the range of the northern spotted owl. The 2011 Settlement Agreement was later struck down by the court, and the S&M program has reverted to the 2001 S&M ROD with the 2006 Pechman Exemptions still intact.

Management Guide for the Shasta and Trinity Units of the Whiskeytown-Shasta-Trinity National Recreation Area

A portion of the Shasta Unit of the Whiskeytown-Shasta-Trinity National Recreation Area is included in the Shasta Lake and vicinity portion of the primary study area. The 2014 NRA Management Guide for the Shasta and Trinity Units of the NRA contains management guidance intended to achieve or maintain a desired condition. This guidance takes into account opportunities, management recommendations for specific projects, and mitigation measures needed to achieve specific goals. The following guidance related to strategies for botanical and wetland resource issues associated with the Shasta Lake and vicinity portion of the primary study area were excerpted from the NRA Management Guide (USFS 2014).

- Protect known populations of threatened, endangered and sensitive plant, lichen, and fungi species and their habitats, and implement mitigation measures if necessary to maintain or enhance their continued viability. Conservation strategies for these species will be used as they are developed. Survey for special-status plants, lichens and fungi before ground-disturbing projects.

- Follow the national direction for the use of native plant materials in the revegetation, restoration, and rehabilitation of NFS lands. This includes making native plant materials the first choice in revegetation for restoration and rehabilitation of native ecosystems where timely natural regeneration of the native plant community will not occur.

- Do not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species unless, pursuant to guidelines that it has prescribed, the USFS has determined and made public its determination that the benefits of such actions clearly outweigh the potential harm caused by invasive species; and that all feasible and prudent measures to minimize risk of harm will be taken in conjunction with the actions. An integrated approach for addressing invasive plant problems will be explored since it offers the most thoroughly effective treatment of invasive plants by using a variety of treatment options to eradicate, control, or contain invasive plants where they occur. The combination of treatment methods, including manual, mechanical, biological, controlled grazing, prescribed burning, cultural, and herbicidal methods, will be tailored to fit each site-specific situation and each type of invasive plant. By proposing several methods

for invasive plant control, this approach recognizes that using only one management method is unlikely to be effective in all situations.

- Dead, dying and live defective trees are an important part of a healthy, functioning forest ecosystem. They play many ecological roles in forests such as altering plant succession and providing wildlife habitat. Retention of these types of trees is necessary to meet the needs of snag dependent species and ecosystem health.

U.S. Forest Service Noxious Weed Management Policy 20900

USFS Manual Policy 20900, Noxious Weed Management (USFS 2011), includes the following policy for the management of aquatic and terrestrial invasive species (including vertebrates, invertebrates, plants, and pathogens), based on an integrated pest management approach, throughout the National Forest System:

1. Initiate, coordinate, and sustain actions to prevent, control, and eliminate priority infestations of invasive species in aquatic and terrestrial areas of the National Forest System using an integrated pest management approach, and collaborate with stakeholders to implement cooperative invasive species management activities in accordance with law and policy.

2. When applicable, invasive species management actions and standards should be incorporated into resource management plans at the forest level, and in programmatic environmental planning and assessment documents at the regional or national levels.

3. Determine the vectors, environmental factors, and pathways that favor the establishment and spread of invasive species in aquatic and terrestrial areas of the National Forest System, and design management practices to reduce or mitigate the risk for introduction or spread of invasive species in those areas.

4. Determine the risk of introducing, establishing, or spreading invasive species associated with any proposed action, as an integral component of project planning and analysis, and where necessary provide for alternatives or mitigation measures to reduce or eliminate that risk before project approval.

5. Ensure that all USFS management activities are designed to minimize or eliminate the possibility of establishment or spread of invasive species on the National Forest System, or to adjacent areas. Integrate visitor use strategies with invasive species management activities on aquatic and terrestrial areas of the National Forest System. At no time are invasive species to be promoted or used in site restoration or re-vegetation work, watershed rehabilitation projects, planted for bio-fuels

production, or other management activities on national forests and grasslands.

6. Use contract and permit clauses to require that the activities of contractors and permittees are conducted to prevent and control the introduction, establishment, and spread of aquatic and terrestrial invasive species. For example, where determined to be appropriate, use agreement clauses to require contractors or permittees to meet USFS-approved vehicle and equipment cleaning requirements/standards before using the vehicle or equipment in the National Forest System.

7. Make every effort to prevent the accidental spread of invasive species carried by contaminated vehicles, equipment, personnel, or materials (including plants, wood, plant/wood products, water, soil, rock, sand, gravel, mulch, seeds, grain, hay, straw, or other materials).

    a. Establish and implement standards and requirements for vehicle and equipment cleaning to prevent the accidental spread of aquatic and terrestrial invasive species on the National Forest System or to adjacent areas.

    b. Make every effort to ensure that all materials used on the National Forest System are free of invasive species and/or noxious weeds (including free of reproductive/propagative material such as seeds, roots, stems, flowers, leaves, larva, eggs, veligers, and so forth).

8. Where States have legislative authority to certify materials as weed-free (or invasive-free) and have an active State program to make those State-certified materials available to the public, forest officers shall develop rules restricting the possession, use, and transport of those materials unless proof exists that they have been State-certified as weed-free (or invasive-free), as provided in 36 CFR 261 and Departmental Regulation 1512-1.

9. Monitor all management activities for potential spread or establishment of invasive species in aquatic and terrestrial areas of the National Forest System.

10. Manage invasive species in aquatic and terrestrial areas of the National Forest System using an integrated pest management approach to achieve the goals and objectives identified in Forest LRMPs, and other USFS planning documents, and other plans developed in cooperation with external partners for the management of natural or cultural resources.

11. Integrate invasive species management funding broadly across a variety of National Forest System programs, while associating the funding with the specific aquatic or terrestrial invasive species that is being

prioritized for management, as well as the purpose and need of the project or program objective.

12. Develop and use site-based and species-based risk assessments to prioritize the management of invasive species infestations in aquatic and terrestrial areas of the National Forest System. Where appropriate, use a structured decision making process and adaptive management or similar strategies to help identify and prioritize invasive species management approaches and actions.

13. Comply with the USFS performance accountability system requirements for invasive species management to ensure efficient use of limited resources at all levels of the Agency and to provide information for adapting management actions to meet changing program needs and priorities. When appropriate, use a structured decision-making process to address invasive species management problems in changing conditions, uncertainty, or when information is limited.

14. Establish and maintain a national record keeping database system for the collection and reporting of information related to invasive species infestations and management activities, including invasive species management performance, associated with the National Forest System. Require all information associated with the National Forest System invasive species management (including inventories, surveys, and treatments) to be collected, recorded, and reported consistent with national program protocols, rules, and standards.

15. Where appropriate, integrate invasive species management activities, such as inventory, survey, treatment, prevention, monitoring, and so forth, into the National Forest System management programs. Use inventory and treatment information to help set priorities and select integrated management actions to address new or expanding invasive species infestations in aquatic and terrestrial areas of the National Forest System.

16. Assist and promote cooperative efforts with internal and external partners, including private, State, tribal, and local entities, research organizations, and international groups to collaboratively address priority invasive species issues affecting the National Forest System.

17. Coordinate as needed with USFS Research and Development and State and Private Forestry programs, other agencies included under the National Invasive Species Council, and external partners to identify priority/high-risk invasive species that threaten aquatic and terrestrial areas of the National Forest System. Encourage applied research to

develop techniques and technology to reduce invasive species impacts to the National Forest System.

18. As appropriate, collaborate and coordinate with adjacent landowners and other stakeholders to improve invasive species management effectiveness across the landscape. Encourage cooperative partnerships to address invasive species threats within a broad geographical area.

U.S. Bureau of Land Management Resource Management Plan

BLM manages a number of public lands within the primary study area, including the Chappie-Shasta Off-Highway Vehicle Area west of Shasta Dam. These areas fall under the Northern California BLM district and the resource management plan of the Redding BLM field office. The purpose of BLM's resource management plan is to provide an overall direction for managing and allocating public resources in the planning area. BLM is responsible for administering the following strategies related to resource issues common to the portion of the Redding District lands located in the primary study area (BLM 1992, 1993).

- Provide a regional opportunity for motorized recreation with a focus within the Chappie-Shasta Off-Highway Vehicle Area.
- Enhance non-motorized recreation opportunities within the area via a greenway connecting Redding to Shasta Dam along the Sacramento River.
- Maintain or improve the long-term sustained yield of forest products available from commercial forest lands.
- Improve the long-term condition and protection of deer winter range habitat.
- Maintain special-status species habitat.
- Maintain the existing scenic quality of the areas.
- Maintain opportunities to explore and develop freely available minerals on public lands.

Executive Order 11990: Protection of Wetlands

Executive Order 11990 established the protection of wetlands and riparian systems as the official policy of the Federal government. It requires all Federal agencies to consider wetland protection as an important part of their policies and take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands.

Executive Order 11312: Invasive Species

Executive Order 11312 directs all Federal agencies to prevent and control introductions of invasive nonnative species in a cost-effective and environmentally sound manner to minimize their economic, ecological, and human health impacts. Executive Order 11312 established a national Invasive Species Council made up of Federal agencies and departments and a supporting Invasive Species Advisory Committee composed of State, local, and private entities. The Invasive Species Council and Advisory Committee oversee and facilitate implementation of the Executive Order, including preparation of a National Invasive Species Management Plan.

12.2.2 State

California Endangered Species Act

Under the California Endangered Species Act (CESA), CDFW has the responsibility for maintaining a list of endangered and threatened species (California Fish and Game Code, Section 2070). CDFW also maintains a list of "candidate species," which are species for which CDFW has issued a formal notice that they are under review for addition to the list of endangered or threatened species. Pursuant to the requirements of CESA, an agency reviewing a proposed project within its jurisdiction must determine whether any State-listed endangered or threatened species may be present in the project study area and, if so, whether the proposed project would have a potentially significant impact on any of these species. In addition, CDFW encourages informal consultation on any proposed project that may affect a species that is a candidate for state listing.

Project-related impacts on species listed as endangered or threatened under the CESA would be considered significant. "Take" of protected species incidental to otherwise lawful management activities may be authorized under Section 2081 of the California Fish and Game Code. Under the CESA, "take" is defined as an activity that would directly or indirectly kill an individual of a species, but the definition does not include "harm" or "harass," as the Federal act does. Therefore, the threshold for take may be higher under CESA than under ESA because habitat modification is not necessarily considered take under CESA.

Authorization from CDFW would be in the form of an incidental take permit or as a consistency determination (Section 2080.1(a) of the Fish and Game Code). Section 2080.1(a) of the Fish and Game Code authorizes CDFW to accept a Federal biological opinion as the take authorization for a state-listed species when a species is listed under both the ESA and the CESA.

California Native Plant Protection Act

The Native Plant Protection Act (California Fish and Game Code, Sections 1900–1913) prohibits the taking, possessing, or sale within the state of any plants with a State designation of rare, threatened, or endangered, as defined by

CDFW. The Act's definition of "endangered" and "rare" closely parallel the CESA definitions of "endangered" and "threatened" plant species.

Section 1602 of the California Fish and Game Code—Streambed Alteration

Diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFW, pursuant to Section 1602 of the California Fish and Game Code. The regulatory definition of stream is a body of water that flows at least periodically or intermittently through a bed or channel that has banks and supports wildlife, fish, or other aquatic life. This includes watercourses that have a surface or subsurface flow that supports or has supported riparian vegetation. CDFW's jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife. A CDFW streambed alteration agreement must be obtained for a project that would result in an impact on a river, stream, or lake.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act requires that each of the nine RWQCBs prepare and periodically update basin plans for water quality control. Each basin plan sets forth water quality standards for surface water and groundwater and actions to control nonpoint and point sources of pollution to achieve and maintain these standards. Basin plans offer an opportunity to protect wetlands through the establishment of water quality objectives. The RWQCB's jurisdiction includes Federally protected waters as well as areas that meet the definition of "waters of the state." Waters of the state is defined as any surface water or groundwater, including saline waters, within the boundaries of the state. The RWQCB has the discretion to take jurisdiction over areas not Federally protected under Section 401 provided they meet the definition of waters of the state. Mitigation requiring no net loss of wetlands functions and values of waters of the state is typically required by the RWQCB.

California Department of Fish and Wildlife Species Designations

CDFW maintains an informal list of species called "species of special concern." These are broadly defined as wildlife species that are of concern to CDFW because of population declines and restricted distributions, and/or because they are associated with habitats that are declining in California. These species are inventoried in the CNDDB regardless of their legal status. Impacts on species of special concern may be considered significant.

California Department of Fish and Wildlife/California Native Plant Society Plant California Rare Plant Ranking System

CNPS is a statewide nonprofit organization that seeks to increase understanding of California's native flora and to preserve this rich resource for future generations. CDFW and CNPS assign rare plant ranks through the collaborative efforts of the Rare Plant Status Review Group composed of over 300 botanical experts from government, academia, non-government organizations, and the

private sector and managed jointly by CDFW and CNPS. California native plants meeting the rarity or endangerment criteria are assigned a CRPR. These plants were formerly referred to as CNPS listed species; however, in March 2010, CDFW adopted the name CRPR for the rarity and endangerment categories to eliminate the false impression that these assignments are the exclusive work of CNPS and that CNPS has had undue influence over the regulatory process. CRPR 1 and 2 species generally qualify as endangered, rare, or threatened within the definition of State CEQA Guidelines CCR Section 15380. In general, CRPR 3 and 4 species do not meet the definition of endangered, rare, or threatened pursuant to CEQA Section 15380; however, these species may be evaluated by the lead agency on a case-by-case basis to determine significance criteria under CEQA.

California Department of Fish and Wildlife Special-Status Natural Communities Designations

CDFW maintains a list of plant communities that are native to California. On that list, CDFW identifies special-status natural communities (e.g., sensitive natural communities), which it defines as communities that are of limited distribution statewide or within a county or region, and are often vulnerable to the environmental effects of projects. Occurrences of special-status natural communities are included in the CNDDB; however, no new occurrences have been added to the CNDDB since the mid-1990s, when funding for tracking natural communities was eliminated. These correspond to communities with State rarity ranks of S1–S3: S1 = critically imperiled, S2 = imperiled, and S3 = vulnerable. These communities may or may not contain special-status species or their habitat. Because of their limited distribution in California, most types of wetlands and riparian communities are considered special-status natural communities. Impacts on special-status natural communities may be considered significant.

12.2.3 Local

Shasta, Tehama, Glenn, Sutter, Sacramento, and Yolo counties and the cities of Redding, Colusa, and Sacramento have established codes and policies that address protection of natural resources, including vegetation, sensitive species, and trees, and are applicable to the project.

Shasta County's general plan emphasizes that the maintenance and enhancement of quality fish and wildlife habitat is critical to the recreation and tourism industry, and acknowledges that any adverse and prolonged decline of these resources could result in negative impacts on an otherwise vibrant industry. The general plan identifies efforts to protect and restore these habitats to sustain the long-term viability of the tourism and recreation industry (Shasta County 2004).

The City of Redding's general plan strives to strike a balance between development and conservation by implementing several measures such as creek-corridor protection, sensitive hillside development, habitat protection, and

protection of prominent ridge lines that provide a backdrop to the city (City of Redding 2000).

Tehama County's general plan (Tehama County 2009) update provides an overarching guide to future development and establishes goals, policies, and implementation measures designed to address potential changes in county land use and development. The general plan identifies the importance of retaining agriculture as one of the primary uses of land in Tehama County.

Glenn County's general plan provides a comprehensive plan for growth and development in Glenn County for the next 20 years (2007 to 2027). This plan recognizes that public lands purchased for wildlife preservation generate economic activity as scientists and members of the public come to view and study remnant ecosystems (Glenn County 1993).

The City of Colusa's general plan seeks to promote its natural resources through increased awareness and improved public access (City of Colusa 2007).

Sutter County's general plan contains policies that generally address preservation of natural vegetation, including wetlands. It requires that new development mitigate the loss of Federally protected wetlands to achieve "no net loss," but it does not include any other specific requirements.

Sacramento County's general plan contains policies that promote protection of marsh and riparian areas, including specification of setbacks and "no net loss" of riparian woodland or marsh acreage (Sacramento County 1993). It also addresses the need to conserve vernal pools and ephemeral wetlands to ensure no net loss of vernal pool acreage. Several policies specifically promote protection of native oak trees, and, in some areas of the county, seek to ensure that there is no net loss of canopy area. The general plan for the County of Sacramento is currently under revision.

The City of Sacramento Municipal Code addresses the protection of trees within the city boundaries, including general protection of all trees on city property and specific protection of heritage trees.

Yolo County's general plan aims to provide an active and productive buffer of farmland and open space separating the Bay Area from Sacramento, and integrating green spaces into its communities.

12.2.4 Federal, State, and Local Programs and Projects

California Bay-Delta Authority

The California Bay-Delta Authority (CBDA) was established as a State agency in 2003 to oversee implementation of CALFED for the numerous Federal and State agencies working cooperatively to improve the quality and reliability of California's water supplies while restoring the Bay-Delta ecosystem. The July 2000 CALFED *Final Programmatic EIS/EIR* (CALFED 2000b) analyzed a

range of alternatives to address these needs and included a MSCS to provide a framework for compliance with ESA, CESA, and Natural Community Conservation Planning Act. The August 2000 CALFED Programmatic ROD identified 12 action plans, including Ecosystem Restoration, Watersheds, and Water Supply Reliability, among others (CALFED 2000d). The CALFED Ecosystem Restoration Program has provided a funding source for projects that include those involving acquisition of lands within the Sacramento River Conservation Area, initial baseline monitoring and preliminary restoration planning, and preparation of long-term habitat restoration management and monitoring plans. In 2009, the California Legislature passed sweeping water reform legislation, including the establishment of the Delta Stewardship Council (DSC). The DSC was transferred all the responsibilities, programs, staff and most of the funding from the CBDA, and the CBDA was dissolved. The DSC was also given additional mandates, including the development of a Delta Plan to guide activities and programs of State and local programs in the legal Delta through a consistency determination process.

Resource Conservation Districts

Numerous resource conservation districts (RCD) are within the primary study area. Once known as soil conservation districts, RCDs were established under California law with a primary purpose to implement local conservation measures. Although RCDs are locally governed agencies with locally appointed, independent boards of directors, they often have close ties to county agencies and the National Resources Conservation Service. RCDs are empowered to conserve resources within their districts by implementing projects on public and private lands and to educate landowners and the public about resource conservation. They are often involved in the formation and coordination of watershed working groups and other conservation alliances. In the Shasta Lake and upper Sacramento River vicinity, districts include the Western Shasta County RCD and the Tehama County RCD. To the east are the Fall River and Pit River RCDs, and to the west and north are the Trinity County and Shasta Valley RCDs.

Riparian Habitat Joint Venture

The Riparian Habitat Joint Venture (RHJV) was initiated in 1994 and includes signatories from 18 Federal, State, and private agencies. The RHJV promotes conservation and the restoration of riparian habitat to support native bird populations through three goals:

- Promote an understanding of the issues affecting riparian habitat through data collection and analysis
- Double riparian habitat in California by funding and promoting on-the-ground conservation projects
- Guide land managers and organizations to prioritize conservation actions

RHJV conservation and action plans are documented in the Riparian Bird Conservation Plan (RHJV 2004). The conservation plan targets 14 "indicator" species of riparian-associated birds and provides recommendations for habitat protection, restoration, management, monitoring, and policy. The report notes habitat loss and degradation as one of the most important factors causing the decline of riparian birds in California. The RHJV has participated in monitoring efforts within the Sacramento National Wildlife Refuge Complex and other conservation areas. The RHJV's conservation plan identifies lower Clear Creek as a prime breeding area for yellow warblers and song sparrows, advocating a continuous riparian corridor along lower Clear Creek. Other recommendations of the conservation plan apply to the North Delta Offstream Storage Investigation study area in general.

Sacramento River Conservation Area Program

Senate Bill 1086 called for a management plan for the Sacramento River and its tributaries to protect, restore, and enhance both fisheries and riparian habitat. The Sacramento River Conservation Area Program has an overall goal of preserving remaining riparian habitat and reestablishing a continuous riparian ecosystem along the Sacramento River between Redding and Chico, and reestablishing riparian vegetation along the river from Chico to Verona. The program is to be accomplished through an incentive-based, voluntary river management plan. The Upper Sacramento River Fisheries and Riparian Habitat Management Plan (Resources Agency 1989) identifies specific actions to help restore the Sacramento River fishery and riparian habitat between the Feather River and Keswick Dam. The Sacramento River Conservation Area Forum Handbook (Resources Agency 2003) is a guide to implementing the program. The Keswick Dam-to-Red Bluff portion of the conservation area includes areas within the 100-year floodplain, existing riparian bottomlands, and areas of contiguous valley oak woodland, totaling approximately 22,000 acres. The 1989 fisheries restoration plan recommended several actions specific to the primary study area:

- Fish passage improvements at RBPP (under way; project final EIS/EIR released May 2008)
- Modification of the Spring Creek Tunnel intake for temperature control (completed)
- Spawning gravel replacement program (ongoing)
- Development of side-channel spawning areas, such as those at Turtle Bay in Redding (ongoing)
- Structural modifications to Anderson-Cottonwood Irrigation District Dam to eliminate short-term flow fluctuations (completed)

- Maintaining instream flows through coordinated operation of water facilities (ongoing)
- Improvements at Coleman National Fish Hatchery (partially complete)
- Measures to reduce acute toxicity caused by acid mine drainage and heavy metals (ongoing)
- Various fisheries improvements on Clear Creek (partially complete)
- Flow increases, fish screens, and revised gravel removal practices on Battle Creek (beginning summer 2006)
- Control of gravel mining, improvements of spawning areas, improvements of land management practices in the watershed, and protection and restoration of riparian vegetation along Cottonwood Creek

Sacramento River National Wildlife Refuge

The Sacramento River National Wildlife Refuge (SRNWR) is composed of many units between the cities of Red Bluff and Princeton. The SRNWR along the middle Sacramento River is part of the Sacramento National Wildlife Refuge Complex, consisting of five refuges and three wildlife management areas within the Sacramento Valley. Reaches and subreaches of the river are delineated based generally on transitions in fluvial geomorphic riverine conditions, although county boundaries were considered as well. The middle Sacramento River region between Red Bluff and Colusa includes three units within the Chico Landing Subreach that contain restoration project sites addressed in the Sacramento River–Chico Landing Subreach Habitat Restoration Draft EIR (CBDA 2005). In addition, three areas proposed for restoration in this area occur within the larger SRNWR units that were evaluated in the Environmental Assessment for Proposed Restoration Activities on the Sacramento River National Wildlife Refuge (USFWS 2001; CBDA 2005).

In June 2005, USFWS issued the Sacramento River National Wildlife Refuge Draft Comprehensive Conservation Plan and Environmental Assessment and Finding of No Significant Impact (USFWS 2005) to serve as an integrated management plan for land that it acquires and manages for inclusion in the SRNWR. The SRNWR final comprehensive conservation plan includes goals, objectives, and strategies to guide management of lands within the SRNWR. It also includes assessments of and establishes parameters for “compatible uses,” which are uses that are considered compatible with the primary purposes for which the area was established. Riparian habitat restoration projects are being implemented under cooperative agreements between USFWS and other entities such as TNC in accordance with the SRNWR final comprehensive conservation plan.

Sacramento River Preservation Trust

The Sacramento River Preservation Trust is a private, nonprofit organization active in environmental education and advocacy to preserve the natural environmental values of the Sacramento River. The trust has participated in various conservation and land acquisition projects, including securing lands for the SRNWR. The group is pursuing designation of a portion of the Sacramento River between Redding and Red Bluff as a national conservation area.

Sacramento River Watershed Program

The Sacramento River Watershed Program is an effort to bring stakeholders together to share information and work together to address water quality and other water-related issues within the Sacramento River watershed. The group is funded congressionally through the U.S. Environmental Protection Agency. The program's primary goal is "to ensure that current and potential uses of Sacramento River watershed resources are sustained, restored, and where possible, enhanced while promoting the long-term social and economic vitality of the region." The Sacramento River Watershed Program manages grants for the Sacramento River Toxic Pollutants Control Program; performs extensive water quality monitoring, data collection, and data management for the watershed; and is instrumental in the study and monitoring of toxic pollutants. Although the program does not implement restoration projects, it is a potential partner for coordinating research and monitoring through consensus-based collaborative partnerships and promoting mutual education among the stakeholders of the Sacramento River watershed.

Sacramento Watersheds Action Group

The Sacramento Watersheds Action Group is a nonprofit corporation that secures funding for, designs, and implements projects that provide watershed restoration, streambank and slope stabilization, erosion control, watershed analysis, and road removal. Sacramento Watersheds Action Group has successfully worked with local groups, agencies, and organizations to fund and complete restoration projects on the Sacramento River and tributaries downstream from Keswick Dam. Their projects include development of the Sulphur Creek Watershed Analysis and Action Plan, the Whiskeytown Lake Shoreline Erosion Control Project, the Sulphur Creek Crossing Restoration Project, and the Lower Sulphur Creek Realignment and Riparian Habitat Enhancement Project. Sacramento Watersheds Action Group is a potential local sponsor for watershed restoration actions in the study area.

Shasta Land Trust

The Shasta Land Trust is a regional, nonprofit organization dedicated to conserving open space, wildlife habitat, and agricultural land. The trust works with public agencies and private landowners and is funded primarily through membership dues and donations. It employs various voluntary programs to protect and conserve valuable lands using conservation easements, land donations, and property acquisitions. The trust is a potential local partner for restoration activities in the Shasta Dam-to-Red Bluff area.

The Nature Conservancy

TNC is a private, nonprofit organization involved in environmental restoration and conservation throughout the United States and the world. TNC approaches environmental restoration primarily through strategic land acquisition from willing sellers and obtaining conservation easements. Some of the lands are retained by TNC for active restoration, research, or monitoring activities, while others are turned over to government agencies such as USFWS or CDFW for long-term management. Lower in the Sacramento River basin, TNC has been instrumental in acquiring and restoring lands in the SRNWR and managing several properties along the Sacramento River. It also has pursued conservation easements on various properties at tributary confluences, including Cottonwood and Battle creeks.

The Trust for Public Land

The Trust for Public Land is a national, nonprofit organization involved in preserving lands with natural, historic, cultural, or recreational value, primarily through conservation real estate. The trust's Western Rivers Program has been involved in conservation efforts along the Sacramento River between Redding and Red Bluff (BLM's Sacramento River Bend Management Area), Battle Creek, Paynes Creek, Inks Creek, and Fenwood Ranch in Shasta County. The group promotes public ownership of conservation lands to ensure public access and enjoyment.

12.3 Environmental Consequences and Mitigation Measures

This section describes the methods for environmental evaluation, assumptions, and specific criteria that were used to determine significance for botanical resources and wetlands, and then discusses the effects of the project and proposes mitigation where necessary.

12.3.1 Methods and Assumptions

The following sections describe the methods, processes, procedures, and assumptions used to formulate and conduct the environmental impact analysis. Data for the following analysis were taken from modeling, existing reports on local and site-specific biology, and on-site assessments during field reviews.

CalSim Modeling

The SLWRI 2012 Version CalSim-II model, developed in 2012 for SLWRI, was used to aid in the evaluation of potential impacts of the project alternatives on water-related resources, including riparian habitats along the upper and lower Sacramento River and in the Delta. This computer modeling used historical data on California hydrology to represent the variety of weather and hydrologic patterns, including wet periods and droughts, under which water storage and conveyance facilities would be operated. Two scenarios (base cases) of demands for, and storage and conveyance of, water were used in model runs: 2005 facilities and demands ("existing conditions") and forecasted

2030 demands and reasonably foreseeable projects and facilities ("future conditions"). A model run was conducted for each of these base cases combined with each alternative, so that the effects of the No-Action Alternative and other alternatives could be evaluated relative to both existing and future conditions. CalSim-II is a useful tool for this type of comparative analysis where the model is run twice, once to represent a base condition (no action) and a second time with a specific change (action) to assess the change in the outcome due to the input change.

The hydrologic analysis conducted for this EIS used the SLWRI 2012 Version CalSim-II model to approximate system-wide changes in storage, flow, salinity, and reservoir system reoperation associated with the SLWRI alternatives. The historical flow record of October 1921 to September 2003, adjusted for the influences of land use changes and upstream flow regulation, is used to represent the possible range of water supply conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. CalSim-II uses a mass balance approach to route water through this network. Simulated flows are mean flows for the month; reservoir storage volumes correspond to end-of-month storage. Monthly flow results were also used to simulate mean daily flows. A more detailed description of the SLWRI 2012 Version CalSim-II model, the modeling methodology used to evaluate this project, and key assumptions are provided in the Modeling Appendix. Summaries of the analysis and modeling results are provided in Chapter 6, "Hydrology, Hydraulics, and Water Management."

Maximum vs. Likely Area of Impact in Relocation Areas

The relocation areas identified by Reclamation in the 2013 Draft EIS were based on preliminary information, as planning and related engineering designs were incomplete at that time. Habitat impacts disclosed for the relocation areas in the June 2013 Draft EIS assumed complete impact (i.e., 100 percent loss) within all the relocation areas. Since that time, Reclamation revised the relocation area boundaries by conducting additional planning and design that in many cases reduced the size of the relocation areas. Additionally, Reclamation designed infrastructure and other activities within the revised relocation areas to avoid wetlands and other sensitive resources, and reduce habitat impacts to the extent feasible.

Since final relocation area planning and designs are incomplete, each relocation area contains a "maximum" and "likely" impact area. The maximum area of impact is defined as the maximum area potentially affected by project activities occurring within the relocation areas, while the likely impact area represents Reclamation's best estimate of the actual impact (i.e., "most likely"). For the purposes of this Final EIS, habitat impacts are based on the assumption of complete loss within the likely impact areas. Table 12-12 shows a comparison of the maximum and likely CWHR habitats in the relocation areas.

Table 12-12. Summary of "Maximum" and "Likely" Plant Communities in the Relocation Areas

Plant Communities	Area (Acres)													
	Main Body		Big Backbone Arm		Sacramento Arm		McCloud Arm		Squaw Creek Arm		Pit Arm		Total	
	Max	Likely	Max	Likely	Max	Likely	Max	Likely	Max	Likely	Max	Likely	Max	Likely
Barren[1]	22.32	12.46	0.00		74.17	12.51	29.66	5.40	11.53	0.00	12.77	2.96	150.46	33.32
Birch-leaf mountain-mahogany chaparral	0.00	0.00	0.00		0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.41	0.00
Black willow thicket	0.00	0.00	0.00		0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
Blue oak woodland	0.00	0.00	0.00		0.00	0.00	3.68	0.00	0.00	0.00	0.93	0.00	4.61	0.00
Brewer oak scrub	5.46	2.69	0.00		13.22	0.60	8.40	2.35	0.00	0.00	0.12	0.12	27.20	5.76
Buck brush chaparral	0.00	0.00	0.00		0.77	0.00	1.45	0.03	0.00	0.00	0.04	0.04	2.26	0.06
California annual grassland	4.76	0.40	0.00		20.31	4.95	9.75	0.53	0.84	0.70	0.23	0.01	35.89	6.59
California ash chaparral	0.00	0.00	0.00		0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.68	0.00
California black oak forest	35.03	18.81	0.00		131.78	20.44	77.04	18.70	1.29	0.00	0.04	0.04	245.17	57.99
California buckeye groves[2]	0.00	0.00	0.00		0.00	0.00	1.58	0.003	0.00	0.00	0.00	0.00	1.58	0.003
California yerba santa scrub	0.09	0.02	0.00		0.00	0.00	0.00	0.00	0.00	0.00	2.75	0.74	2.83	0.76
Canyon live oak forest	1.06	0.92	0.00		8.10	1.25	77.26	6.04	4.98	0.24	5.60	5.60	96.99	14.05
Deer brush chaparral	0.18	0.04	0.00		0.00	0.00	0.57	0.00	0.00	0.00	0.40	0.40	1.15	0.43
Ghost pine woodland	105.48	24.52	0.00		41.27	6.81	29.95	1.73	13.48	1.13	11.94	2.38	202.11	36.56
Himalayan blackberry brambles	0.15	0.03	0.00		0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.21	0.03
Interior live oak chaparral	0.00	0.00	0.00		0.60	0.00	0.00	0.00	0.00	0.00	22.70	2.47	23.29	2.47
Interior live oak woodland	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05
Knobcone pine forest	0.11	0.05	0.00		40.64	4.91	9.65	2.23	1.94	0.23	13.96	0.99	66.30	8.42
Lacustrine[1]	0.00	0.00	0.00		0.00	0.00	0.001	0.001	0.00	0.00	0.00	0.00	0.001	0.001

Table 12-12. Summary of "Maximum" and "Likely" Plant Communities in the Relocation Areas (contd.)

Plant Communities	Area (Acres)													
	Main Body		Big Backbone Arm		Sacramento Arm		McCloud Arm		Squaw Creek Arm		Pit Arm		Total	
	Max	Likely	Max	Likely	Max	Likely	Max	Likely	Max	Likely	Max	Likely	Max	Likely
Mixed willow	0.08	0.02	0.00		0.73	0.00	0.00	0.00	0.06	0.00	0.01	0.01	0.87	0.03
Oregon ash groves	0.00	0.00	0.00		0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.33	0.00
Oregon white oak woodland	0.00	0.00	0.00		0.00	0.00	5.72	0.45	0.07	0.00	0.00	0.00	5.72	0.45
Pale spike rush marshes	0.00	0.00	0.00		6.51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.51	0.00
Ponderosa pine–Douglas fir forest	0.00	0.00	0.00		13.06	1.35	106.07	8.25	15.62	1.50	11.80	6.43	146.55	17.54
Ponderosa pine forest	156.56	79.71	0.00		458.50	107.60	347.64	67.35	43.08	16.04	35.97	1.20	1041.75	271.91
Riverine[1]	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sandbar willow thickets	0.00	0.00	0.00		0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.09	0.00
Spicebush thickets	0.00	0.00	0.00		0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.64	0.00
Urban[1]	20.65	15.64	0.00		227.46	217.05	0.48	0.27	0.00	0.00	0.57	0.56	249.16	233.52
Valley oak woodland	0.00	0.00	0.00		1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06	0.00
White alder groves	0.00	0.00	0.00		0.23	0.03	1.90	0.25	0.17	0.04	0.00	0.00	2.31	0.32
White leaf manzanita chaparral	7.28	0.67	0.00		41.41	3.37	14.88	1.91	4.38	1.68	0.00	0.00	67.94	7.64
Total	359.20	155.98	0.00		1,079.84	380.88	727.92	115.50	97.44	21.56	119.83	24.00	2,387.23	697.91

Note:
[1] CWHR Wildlife Habitat Type; no corresponding plant series type include in *A Manual of California Vegetation* (Sawyer and Keeler-Way 1995).

Key:
Max = maximum

Vegetation and Habitat Types

The impact mechanisms of construction-related activities are evaluated in the sections addressing Shasta Lake and its vicinity. Besides construction-related activities, the project could potentially affect vegetation and habitat types through any of the following impact mechanisms:

- Increased inundated width of the river during the active growing season
- Reduced frequency and/or magnitude of peak flows
- Altered geomorphic processes (e.g., meander, channel avulsion) along rivers
- Altered availability of groundwater
- Altered rates of stage decline during seed dispersal or germination establishment

For each vegetation type, environmental effects potentially resulting from each of these impact mechanisms were assessed. This assessment was based on a review of the results of CalSim simulations of mean monthly flows, aerial photographs, background information on the upper Sacramento River and adjacent uplands, and scientific literature on the ecology of each vegetation type. Results of hydraulic modeling of the project's potential effects on peak flows and analyses of the project's potential effects on geomorphic processes along the Sacramento River were not available to support this analysis.

In addition to these impact mechanisms, increased water supplies or increased supply reliability also could reduce a limitation on urban growth and development or on other activities that could affect vegetation in the primary and extended study areas, resulting in potentially significant impacts. The effects of this growth would be analyzed in general plan EIRs and in project-level CEQA compliance documents for the local jurisdictions in which the growth would occur. Mitigation of these impacts would be the responsibility of these local jurisdictions, and not Reclamation. The expected increase in water deliveries relative to the entire CVP and SWP would be small, however, and assuming increased deliveries could be provided to any number of geographic areas within the CVP and SWP service areas (and in part would substitute for ongoing groundwater pumping), the project's impact on urban growth and development that could affect vegetation would be minor.

Similarly, projects potentially affecting streambeds, wetlands, and listed species would require permits from the CDFW, USACE, and USFWS, respectively; impacts on these resources would be avoided, minimized, and/or mitigated during those agency consultations.

Because the extent, location, and timing of induced growth are currently highly uncertain, and in the future the impacts of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects, growth-inducing effects on vegetation and habitat types are not discussed further in this section. However, additional discussion of growth-inducing effects specific to the alternative actions is provided in Chapter 26, "Other Required Disclosures," of this EIS.

For the purposes of the impact analysis for the loss of general habitats in the Shasta Lake and vicinity portion of the primary study area, California Wildlife Habitat Relationship (CWHR) types are used to describe the affected habitats. Table 12-13 provides a crosswalk between MCV and CWHR habitat types.

Special-Status Species

The project could affect special-status plant species through the same impact mechanisms potentially affecting vegetation and habitat types, and also by altering the structure and species composition of vegetative communities, particularly within river corridors.

Potential impacts resulting from these impact mechanisms were assessed for special-status plant species that may occur in the project area. This assessment was based on the potential impacts on vegetation and habitat types for each alternative and on available information about the distribution, ecology, and reproductive biology of each special-status species.

Assumptions

The following assumptions have been made for the purposes of the impact analysis:

- Activity areas (construction areas for infrastructure and relocation areas) would be completely cleared.
- Mechanized equipment would be used for discrete areas where total clearing would occur.
- All trees would be removed along other areas of the lake, including those that could be considered a hazard in coves used by houseboats for moorage; other vegetation would be left.

Trees would be removed using helicopters and barges.

Table 12-13. Comparison Between MCV Vegetation Types and CWHR Habitat Types

MCV Type	CWHR Type
Barren	Barren
Birch-leaf mountain-mahogany chaparral	Mixed chaparral
Black willow thicket	Montane riparian
Blue oak woodland	Blue oak woodland
Brewer oak scrub	Mixed chaparral
Buck brush chaparral	Mixed chaparral
California annual grassland	Annual grassland
California ash chaparral	Mixed chaparral
California black oak forest	Montane hardwood
California buckeye groves	Mixed chaparral
California yerba santa scrub	Mixed chaparral
Canyon live oak forest	Montane hardwood
Deer brush chaparral	Mixed chaparral
Douglas-fir	Douglas-fir
Fremont cottonwood	Montane riparian
Ghost pine woodland	Montane hardwood–conifer, Blue oak–foothill pine
Himalayan blackberry brambles	Montane riparian
Interior live oak chaparral	Mixed chaparral
Interior live oak woodland	Montane hardwood
Knobcone pine forest	Closed-cone pine–cypress
Lacustrine	Lacustrine
Mixed willow	Montane riparian
Oregon ash groves	Montane riparian
Oregon white oak woodland	Montane hardwood
Ponderosa pine–Douglas-fir forest	Montane hardwood–conifer, Klamath mixed conifer
Ponderosa pine forest	Ponderosa pine
Red osier thickets	Montane riparian
Riverine	Riverine
Sandbar willow thickets	Montane riparian
Spicebush thickets	Montane riparian
Valley oak woodland	Montane hardwood
Urban	Urban
White alder groves	Montane riparian
White leaf manzanita chaparral	Mixed chaparral

Key:
CWHR = California Wildlife Habitat Relationship
MCV = A Manual of California Vegetation

12.3.2 Criteria for Determining Significance of Effects

An environmental document prepared to comply with NEPA must consider the context and intensity of the environmental effects that would be caused by, or result from, the proposed action. Under NEPA, the significance of an effect is used solely to determine whether an EIS must be prepared. An environmental document prepared to comply with CEQA must identify the potentially significant environmental effects of a proposed project. A "[s]ignificant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project" (State CEQA Guidelines, Section 15382). CEQA also requires that the environmental document propose feasible measures to avoid or substantially reduce significant environmental effects (State CEQA Guidelines, Section 15126.4(a)).

Vegetation and Habitat Types

The following significance criteria were developed based on guidance provided by the State CEQA Guidelines, and consider the context and intensity of the environmental effects as required under NEPA. Impacts of an alternative on vegetation and habitat types would be significant if project implementation would do any of the following:

- Result in a substantial adverse effect on any riparian vegetation or habitat, oak woodlands or savannas, or other sensitive natural community identified in local or regional plans, policies, regulations, or by CDFW or USFWS
- Conflict with a local policy or ordinance that protects vegetation resources, such as a tree preservation policy or ordinance
- Conflict with or violate the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, State, or Federal habitat conservation plan relating to the protection of plant resources
- Result in the potential for spread of nonnative and invasive plant species

Special-Status Species

Impacts of an alternative on special-status species would be significant if project implementation would do any of the following:

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

- Have the potential to substantially reduce the number or restrict the range of an endangered or threatened plant species or a plant species that is a candidate for State listing or proposed for Federal listing as endangered or threatened

- Have the potential for substantial reductions in the habitat of an endangered or threatened plant species or a plant species that is a candidate for State listing or proposed for Federal listing as endangered or threatened

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

- Have the potential to cause a native plant population to drop below self-sustaining levels

Wetlands

Impacts of an alternative on wetlands would be significant if project implementation would do any of the following:

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

- Conflict with any State or local policies or ordinances protecting wetland and/or riparian resources

- Conflict with or violate the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, State, or Federal habitat conservation plan relating to the protection of wetland resources

Shasta-Trinity National Forest Land and Resource Management Plan

In addition to the above significance criteria, the STNF LRMP (USFS 1995) contains forest goals, standards, and guidelines designed to guide the management of the biological resources within the STNF, located in the Shasta Lake and vicinity portion of the primary study area. To comply with NEPA, this assessment of impacts evaluates the project's compliance with the STNF LRMP forest goals, standards, and guidelines listed in the "Regulatory Framework" section listed above. Mitigation measures are provided (as needed) to move project actions toward compliance with the STNF LRMP.

12.3.3 Topics Eliminated from Further Consideration

No topics related to botanical resources and wetlands that are included in the significance criteria listed above were eliminated from further consideration. All relevant topics are analyzed below.

12.3.4 Direct and Indirect Effects

This section identifies how specific vegetation types could be affected by the project. The project could affect vegetation by doing any of the following:

- Causing construction-related effects at Shasta Dam and around Shasta Lake
- Altering flow regimes downstream from Shasta Lake and downstream from other reservoirs with altered operations
- Increasing water supply reliability that, in turn, could contribute to growth or changes in agricultural land uses in the CVP and SWP service areas

By altering storage and reservoir operations, the project would change flow regimes in downstream waterways. In turn, these alterations to the flow regime could affect vegetation, particularly riparian and wetland vegetation along several waterways.

No-Action Alternative

Under the No-Action Alternative, the Federal Government would take reasonably foreseeable actions, as defined in Chapter 2, "Alternatives," but would take no additional action toward implementing a specific plan to help increase anadromous fish survival in the upper Sacramento River, nor help address the growing water reliability issues in California. Shasta Dam would not be modified, and the CVP would continue operating similar to the existing condition. Changes in regulatory conditions and water supply demands would result in differences in flows on the Sacramento River and at the Delta between existing and future conditions. Possible changes include the following:

- Firm Level 2 Federal refuge deliveries
- SWP deliveries based on full Table A amounts
- Full implementation of the Grassland Bypass Project
- Implementation of salinity management actions similar to the Vernalis Adaptive Management Plan
- Implementation of the South Bay Aqueduct Improvement and Enlargement Project

- Increased San Joaquin River diversions for water users in the Stockton Metropolitan Area after completion of the Delta Water Supply Project
- Increased Sacramento River diversions by Freeport Regional Water Project agencies
- Operation of RBPP with gates out year round
- San Joaquin River Restoration Program Full Restoration Flows

This alternative is used as a basis of comparison for future condition comparisons.

Shasta Lake and Vicinity
Impact Bot-1 (No-Action): Loss of Federally or State Listed Plant Species Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-2 (No-Action): Loss of MSCS Covered Species Species covered by the MSCS would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-3 (No-Action): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species USFS sensitive, BLM sensitive, or CRPR listed species would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-4 (No-Action): Loss of Jurisdictional Waters Waters of the United States would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-5 (No-Action): Loss of General Vegetation Habitats General vegetation habitats would not be lost as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-6 (No-Action): Spread of Noxious and Invasive Weeds Noxious and invasive weeds would not be spread as a result of inundation, vegetation removal, or construction activities. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact Bot-7 (No-Action): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from

Altered Flow Regimes Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities along the upper Sacramento River, and habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants would be small, and beneficial effects are also anticipated to result from other management and restoration actions. Thus, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. As a consequence of these actions, the flow regime of the upper Sacramento River would change between 2005 and 2030. The CalSim-II modeling results that simulate these changes are provided in the *Hydrology, Hydraulics, and Water Management Technical Report*. CalSim-II mean monthly results used to simulate mean daily values also indicate the relative magnitude of changes to the flow regime.

The rates of geomorphic processes strongly affect the extent of different riparian communities, and these rates are strongly related to flow regime. For example, bank erosion and the average rate of meander migration are closely related to the cumulative portion of flow above a threshold volume. On portions of the Sacramento River, this threshold may be around 30,000 cfs (Larsen, Fremier, and Greco 2006; Stillwater Sciences 2007), which is well below the bankfull discharge but well above flows during spring and summer. However, other important thresholds for bank erosion and channel avulsion along the Sacramento River have been estimated within the range from 10,000 to 80,000 cfs (Stillwater Sciences 2007). (For additional discussion of the relationship of geomorphic processes to flow along the Sacramento River, see the *Fisheries and Aquatic Ecosystem Technical Report*.)

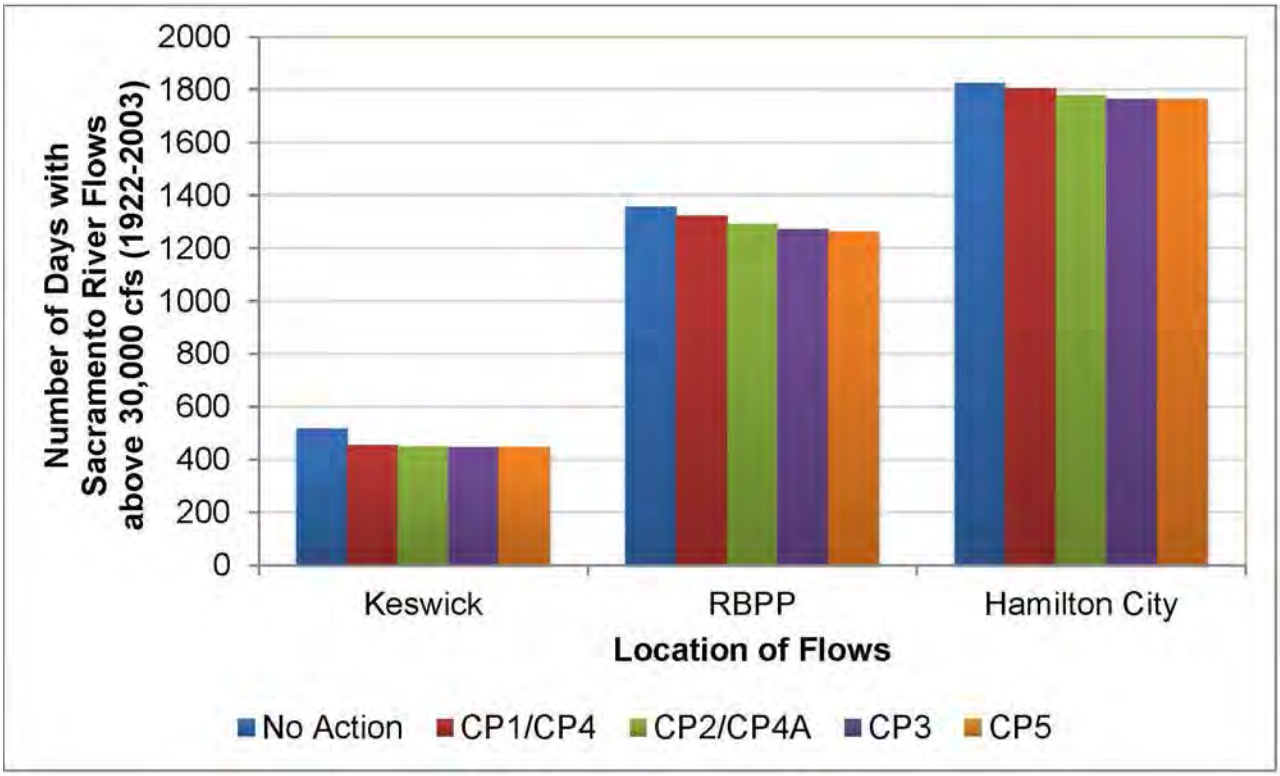
The number of days with Sacramento River flows above 30,000 cfs (1922-2013) are summarized on Figure 12-6. Overall, these modeling results suggest there would be only very small changes in flows greater than 30,000 cfs. Flows of this magnitude strongly affect bank erosion and meander migration, and are related to other geomorphic processes affecting the extent of different riparian communities. These relationships are described in greater detail under CP1.

This change might not be sufficient to cause significant effects on riparian and wetland communities, or on associated special-status species.

In addition to causing small changes in flow regime, the No-Action Alternative would continue to alter the structure and species composition of riparian and wetland vegetation resulting from continued operation of Shasta Dam. Before

the construction of Shasta Dam, river flow and stage would decrease gradually during the period of cottonwood and willow seed dispersal. In many years, this flow pattern would facilitate establishment of these early-successional species along the Sacramento River throughout the primary study area.

Operation of Shasta Dam has increased flow volumes from mid-spring to early summer. Consequently, in most years, operation of the dam precludes or substantially reduces opportunities for establishment of cottonwoods and opportunities for willow establishment. As a result of this (and other alterations to the flow regime of the Sacramento River), the structure and species composition of riparian vegetation has been changing within the primary study area (Fremier 2003, Roberts et al. 2002). The extent of early-successional riparian communities (e.g., cottonwood forest) has been decreasing while the extent of mid-successional communities (e.g., mixed riparian forest) has been increasing. Such changes would continue under the No-Action Alternative for several decades, but would diminish with time.



Key:
cfs = cubic feet per second
RBPP = Red Bluff Pumping Plant

Figure 12-6. Number of Days with Sacramento River Flows above 30,000 cfs (1922-2013)

However, under the No-Action Alternative a number of management and restoration plans and programs would be implemented. These actions are described in Section 12.2, “Regulatory Framework,” of this EIS. These actions

would cause beneficial effects that would likely be of similar magnitude to the anticipated adverse effects of small changes in flow regime and of continued effects from past actions, and thus would largely offset those adverse effects.

For the reasons described above, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Bot-8 (No-Action): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Numerous local and regional plans promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Expected future effects of the No-Action Alternative on riparian communities have largely been considered in the existing plans. The No-Action Alternative would not conflict with approved local or regional plans. This impact would be less than significant.

Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River in the primary study area. These plans, which are discussed in more detail in the "Regulatory Setting" section of this EIS, include the Sacramento River Conservation Area Program, which promotes the conservation and the restoration of riparian habitat. Under the No-Action Alternative, adverse effects would result from the continued consequences of past actions (e.g., construction of Shasta Dam and the introduction of nonnative species) and from the effects of reasonably foreseeable actions. Most adverse effects that are the continued consequences of past actions have been considered in the development of existing local and regional plans. In addition, foreseeable water resources and levee actions are expected to be consistent with local and regional plans, and anticipated adverse effects are likely to be fully mitigated and not conflict with a local or regional plan. Therefore, the No-Action Alternative would not conflict with approved local or regional plans with objectives of riparian habitat protection or watershed management. This impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Bot-9 (No-Action): Disturbance or Removal of Designated Critical Habitat for Special-Status Species Designated critical habitat for vernal pool species in the upper Sacramento River area is not expected to be adversely affected. This impact would be less than significant.

Designated critical habitat for four vernal pool special-status plant species exists in the upper Sacramento River portion of the primary study area: slender orcutt grass, Hoover's spurge, hairy orcutt grass, and Greene's tuctoria. Critical habitat for these species in the primary study area is confined to vernal pool communities (USFWS 2006). Vernal pools are generally not present within the active floodplain. However, if vernal pool habitats for these special-status species are present in the active floodplain of the upper Sacramento River, they could be affected by the small reduction in the frequency and magnitude of

overbank flows. It is not known if this would be an adverse or beneficial effect. Because this effect of the No-Action Alternative is somewhat speculative and not necessarily adverse, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Bot-10 (No-Action): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Although Shasta Dam would not be altered, water storage, conveyance, and deliveries to water districts would likely increase because of reasonably foreseeable projects. However, environmental regulations would continue to provide protection for botanical resources and wetlands, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable projects that would occur with or without enlarging Shasta Dam. Consequently, deliveries to water districts along the upper Sacramento River in the primary study area would likely increase between now and 2030, and this could reduce any limitation on urban growth and development. However, environmental regulations would continue to protect wetlands, riparian habitats, other sensitive botanical communities, and special-status plant species, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Furthermore, CVP water delivered in this area would primarily be for agricultural purposes, and agricultural acreages are not expected to expand. For the reasons described above, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

Lower Sacramento River and Delta

Impact Bot-11 (No-Action): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under the No-Action Alternative. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-12 (No-Action): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under the No-Action Alternative. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-13 (No-Action): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian,

Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under the No-Action Alternative. Therefore, no impact would occur. Mitigation is not required for the No-Action Alternative.

Impact Bot-14 (No-Action): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities along the lower Sacramento River and in the Delta, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants would be small, and beneficial effects are also anticipated to result from management and restoration actions. Thus, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would change because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. As a consequence of these actions, the flow regime of the lower Sacramento River could change between 2005 and 2030. The CalSim-II modeling results that simulate these changes are provided in the *Hydrology, Hydraulics, and Water Management Technical Report*. CalSim-II results temporally downscaled to mean daily values also indicate the relative magnitude of changes to the flow regime. The simulated change in mean daily discharges greater than 30,000 cfs below RBPP and Hamilton City are summarized on Figure 12-6. (These locations are shown on Figure 12-7.) Flows of this magnitude strongly affect bank erosion and meander migration, and are related to other geomorphic processes affecting the extent of different riparian communities. (These relationships are described in greater detail under CP1.) Overall, these modeling results suggest only a very small change in flows greater than 30,000 cfs along the uppermost portion of the lower Sacramento River. This change might not be sufficient to cause significant effects on riparian and wetland communities, or on associated special-status species.

However, besides causing additional, very small changes in flow regime, the No-Action Alternative would continue to alter the structure and species composition of riparian and wetland vegetation along the lower Sacramento River resulting from the continued operation of Shasta Dam. Before the construction of Shasta Dam, flow volume would decrease gradually during the period of cottonwood and willow seed dispersal. In many years, this flow pattern would facilitate establishment of these early- successional species along the Sacramento River throughout the extended study area. As described for the upper Sacramento River above, along the lower Sacramento River, the extent of

early-successional riparian communities would continue decreasing while the extent of mid-successional communities would continue increasing under the No-Action Alternative.

However, under the No-Action Alternative, a number of management and restoration plans and programs carried out by a large number of agencies would be implemented. These actions are described in the “Regulatory Setting” section of this EIS. These actions would cause beneficial effects that would likely be of similar magnitude as the anticipated adverse effects of small changes in flow regime and of continued effects from past actions, and thus would largely offset those adverse effects.

For the reasons described above, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

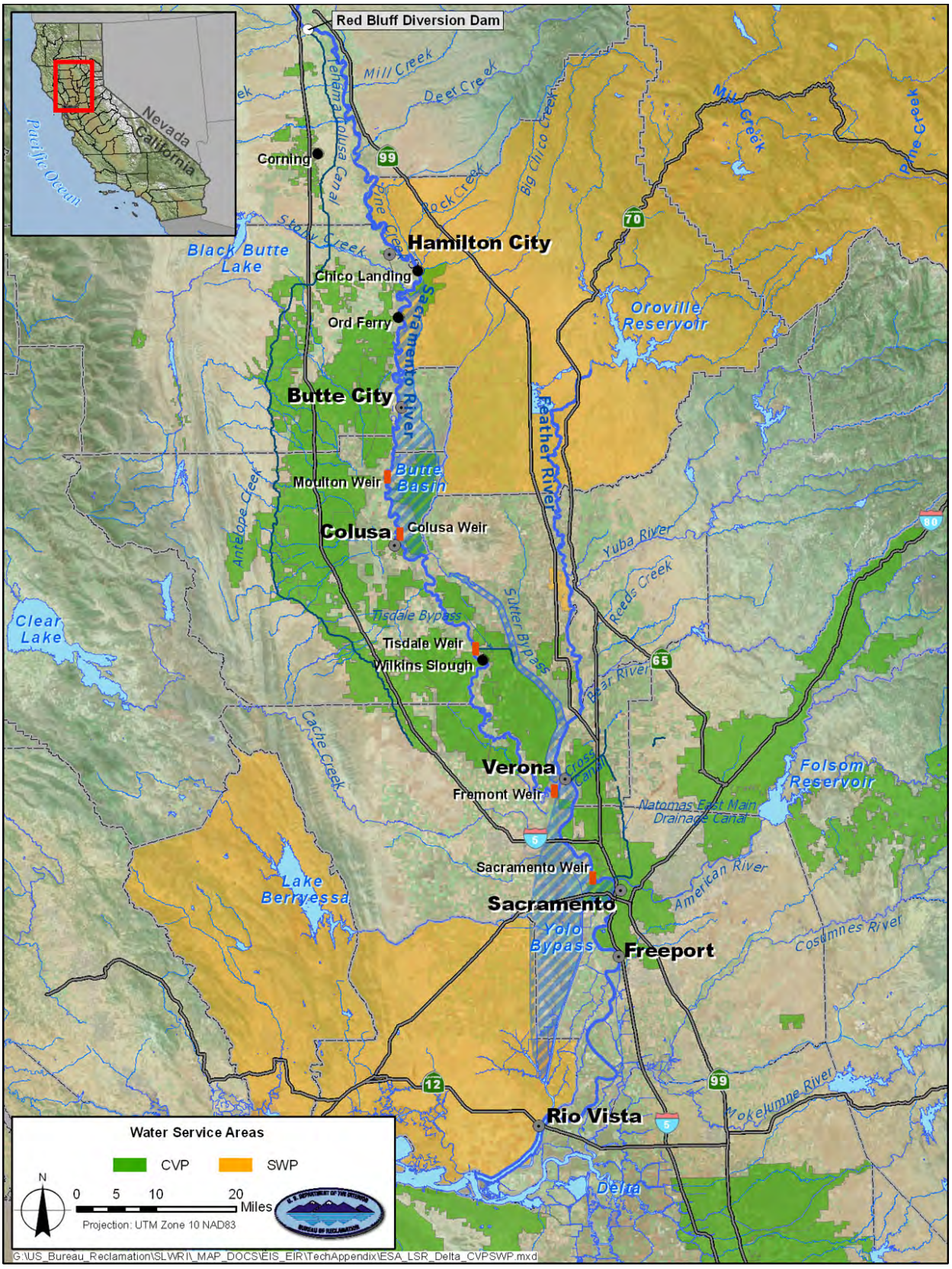


Figure 12-7. Locations Along the Lower Sacramento River

Impact Bot-15 (No-Action): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management along the Lower Sacramento River Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. In the development of regional and local plans, most ongoing adverse effects of past actions were considered, but not all effects of reasonably foreseeable actions. Unmitigated effects from these actions could be sufficient to conflict with these plans. Therefore, the No-Action Alternative could conflict with approved local or regional plans. This impact would be potentially significant.

Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River and in the Delta in the extended study area. These plans, which are discussed in more detail in the "Regulatory Framework" section of this EIS, include the Sacramento River Conservation Area Program and the CALFED Ecosystem Restoration Program, both of which promote the conservation and the restoration of riparian habitat. Under the No-Action Alternative, adverse effects would result from the continued consequences of past actions (e.g., construction of Shasta Dam and the introduction of nonnative species) and from the effects of foreseeable actions. Most adverse effects that are the continued consequences of past actions have been considered in the development of existing local and regional plans. However, the adverse effects of all foreseeable water resource and levee actions were not considered in the development of local and regional plans, and these adverse effects are not likely to be completely avoided or fully mitigated. The unmitigated effects of these actions could be sufficient overall to conflict with a local or regional plan. Therefore, the No-Action Alternative could conflict with approved local or regional plans with objectives of riparian habitat protection or watershed management. This impact would be potentially significant. Mitigation is not required for the No-Action Alternative.

Impact Bot-16 (No-Action): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth along the Lower Sacramento River and in the Delta Although Shasta Dam would not be altered, water storage, conveyance, and deliveries to water districts would likely increase because of reasonably foreseeable actions. However, environmental regulations would continue to provide protection for botanical resources and wetlands, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for site-specific projects. Therefore, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries would likely increase because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. Thus, deliveries to water districts in the extended study area along the lower Sacramento River and in the Delta would likely increase between now and 2030, and this could reduce a limitation on

urban growth and development. However, environmental regulations would continue to protect wetlands, riparian habitats, other sensitive botanical communities, and special-status plant species, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for site-specific projects. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

CVP/SWP Service Areas

Impact Bot-17 (No-Action): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities in the CVP and SWP service areas, and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs would be less than below Shasta Dam along the Sacramento River, and may not be sufficient to alter the distribution of plant communities, or the extent or quality of associated special-status species habitat. Therefore, this impact would be less than significant.

Altered flow regimes associated with the No-Action Alternative could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected by the altered flow regime. Effects on oak communities and upland habitats for special-status plants would be somewhat speculative and may not all be adverse; thus, on oak communities and special-status plants of upland habitats, this impact would be less than significant. Although riparian and wetland communities could be affected, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. Below CVP and SWP reservoirs, these alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities, or the extent or quality of associated special-status species habitat. Therefore, this impact would be less than significant below CVP and SWP reservoirs in the extended study area. Mitigation is not required for the No-Action Alternative.

Impact Bot-18 (No-Action): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas The No-Action Alternative would not have substantial effects on riparian vegetation and habitats, and thus, would not conflict with existing local and regional plans in the CVP and SWP service areas. This impact would be less than significant.

Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of the No-Action

Alternative would not have substantial effects on riparian vegetation and habitats. Therefore, implementation of this alternative would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact in the CVP and SWP service areas would be less than significant. Mitigation is not required for the No-Action Alternative.

Impact Bot-19 (No-Action): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas Although Shasta Dam would not be altered, water storage, conveyance, and deliveries to the CVP and SWP service areas would likely increase because of reasonably foreseeable actions. However, environmental regulations would continue to protect botanical resources and wetlands, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant.

Although Shasta Dam would not be altered under the No-Action Alternative, CVP and SWP water storage, conveyance, and deliveries to the CVP and SWP service areas would likely increase because of several reasonably foreseeable actions that would occur with or without enlarging Shasta Dam. Thus, CVP and SWP deliveries would likely increase between now and 2030, and this could reduce any limitation on growth. However, environmental regulations would continue to protect wetlands, riparian habitats, other sensitive botanical communities, and special-status plant species, and the effects of future growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant. Mitigation is not required for the No-Action Alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

CP1 focuses on increasing water supply reliability and increasing anadromous fish survival. This plan primarily consists of raising Shasta Dam by 6.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 8.5 feet and enlarge the total storage capacity in the reservoir by 256,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years[2] and critical years, when 70,000 acre-feet and 35,000 acre-feet, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP1 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to

[2] Throughout this document, water year types are defined according to the Sacramento Valley Index Water Year Hydrologic Classification unless specified otherwise.

improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Shasta Lake and Vicinity

Impact Bot-1 (CP1): Loss of Federally or State-Listed Plant Species Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No such species are known or expected to occur. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-2 (CP1): Loss of MSCS Covered Species Implementation of the project would result in the loss of MSCS-covered species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant. The only MSCS species known to occur in the project area is Shasta snow-wreath.

Reclamation conducted detailed surveys of all Shasta snow-wreath populations in the vicinity of the project area between March and May 2014 to determine the overall extent of these populations. Surveys were conducted using a total station and survey-grade GPS instruments to obtain accurate population boundaries at each Shasta snow-wreath population. Using the survey information, Reclamation verified whether flooding impacts would occur at each population, and if so, estimates of the amount of loss to each population were calculated using existing topographic information for each dam raise alternative.

Inundation caused by a 6.5-foot dam raise would affect all or portions of nine Shasta snow-wreath populations. These nine populations represent 38 percent of all known Shasta snow-wreath populations and encompass approximately 79 acres. Flooding impacts under CP1 would result in the loss of approximately 1.5 acres, or approximately 2 percent of these nine Shasta snow-wreath populations. The greatest proportional impacts to these populations occur at the Blue Ridge West, Brock Creek, Cove Creek, Keluche Creek, and Shasta Caverns populations. Table 12-14 provides a detailed summary of impacts to Shasta snow-wreath under CP1. Mitigation measures for impacts to Shasta snow-wreath populations are presented in Section 12.3.5, “Mitigation Measures.”

Because complete surveys have not been conducted in the entire impoundment area, other MSCS plant species may be present. In these areas, all or portions of MSCS plant populations could be inundated. This loss of MSCS-covered species and their habitat would be substantial; the impact would be significant. Potential mitigation lands containing comparable habitat and conceptual habitat enhancement projects have been identified adjacent to the project and in the vicinity. Additional discussion of how these lands may be applied as mitigation and at what ratios is provided in Section 12.3.5, “Mitigation Measures.”

Table 12-14. Summary of Impacts to Shasta Snow-wreath Populations Adjacent to Shasta Lake Under CP1

Population	Location	Size (Acres)	CP1 Impact (Acres)	Percent Total Impact to Population	Comments
Blue Ridge (west)	Main Body	1.11	0.470	42%	Lower portion of population would be flooded.
Blue Ridge (east)	Main Body	0.03	0	0%	No impact under CP1.
Brock Creek	Pit River Arm	1.38	0.487	35%	Lower portion of population would be flooded.
Campbell Creek	McCloud River Arm	1.90	0.002	<1%	Small area at the downstream portion of the population would be flooded.
Cove Creek	Main Body	1.87	0.264	14%	Lower portion of population would be flooded.
Ellery Creek	McCloud River Arm	28.65	0.031	<1%	The entire very small disjunct sub-population located near Ellery Creek Campground would be flooded.
Jones Valley	Main Body	0.33	0	0%	No Impact under CP1.
Keluche Creek	McCloud River Arm	0.15	0.085	56%	More than half of the population would be flooded.
Shasta Caverns	McCloud River Arm	0.08	0.018	21%	Lower portion of population would be flooded.
South of Cove Creek	Main Body	1.39	0.143	10%	Lower portion of population would be flooded.
Stein Creek	Pit River Arm	42.15	0.023	<1%	Lower portion of population would be flooded.

Key:
% = percent
< = less than
CP = Comprehensive Plan

Impact Bot-3 (CP1): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species
Implementation of the project would result in the loss of USFS sensitive, BLM sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

For areas where botanical surveys have been conducted, direct impacts have been determined using GIS to ascertain the populations within the impoundment area, relocation areas, and construction footprints.

Based on results of surveys to date, special-status plant species known to occur in the primary study area include Shasta County arnica, northern clarkia, Cantelow's lewisia, Shasta snow-wreath, slender false lupine, Shasta huckleberry, and Shasta limestone monkeyflower.

Direct impacts to Shasta snow-wreath under CP1 are addressed in Impact Bot-2 (CP1). As a USFS sensitive species, the Shasta snow-wreath is recognized by

the USFS to require special management to prevent the species from becoming threatened or endangered. Because the snow-wreath is a Shasta County endemic species, the impacts will result in a decline in populations and habitat and may result in a trend towards listing.

Inundation caused by a 6.5-foot dam raise and activities in the relocation areas could impact all or portions of Shasta County arnica, northern clarkia, Cantelow's lewisia, slender false lupine, Shasta huckleberry, and Shasta limestone monkeyflower populations occurring in the impoundment and relocation areas. Potential populations occurring in the unsurveyed portions of the impoundment area could be flooded and result in a potentially significant impact. Impacts on known populations are provided below.

Inundation of the impoundment area would impact all or portions of the Shasta arnica population south of Bridge Bay Resort on the Main Body of the lake.

Vegetation removal and/or construction activities in the relocation areas would impact all or portions of the northern clarkia populations in Bailey Cove (McCloud Arm).

Inundation of the impoundment area would impact all or portions of the Cantelow's lewisia population on a rock outcrop on the right bank of the Upper Sacramento River riverine reach near the Shasta Lake/upper Sacramento River transition zone. Inundation will also impact populations found along the Sacramento Arm near Elmore Mountain.

Inundation of the impoundment area and vegetation removal in the relocation areas would impact all or portions of 82 slender false lupine populations at scattered locations throughout these areas.

Inundation caused by a 6.5-foot dam raise would impact small portions (approximately 14 shrubs) of four Shasta huckleberry populations located on the Main Body ((little) Squaw Creek, Shoemaker Gulch, Little Backbone Creek) and the Squaw Creek Arm (Horse Creek). These populations extend beyond the project boundary at each location and consist of hundreds to over a thousand shrubs. No Shasta huckleberry population will be completely lost as a result of CP1.Because complete surveys have not been conducted in the entire impoundment area, other USFS sensitive, BLM sensitive, and CRPR species plant species may be present. In these areas, all or portions of USFS sensitive, BLM sensitive, and CRPR species plant populations could be inundated. This would be a potentially significant impact.

Collectively, the loss of USFS sensitive, BLM sensitive, and CRPR species and their habitat would therefore be potentially significant. Mitigation for this impact is described in Section 12.3.5, "Mitigation Measures."

Impact Bot-4 (CP1): Loss of Jurisdictional Waters Implementation of the project will result in the loss of jurisdictional waters caused by flooding the

impoundment area and discharge of fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine habitat). Therefore, this impact would be significant.

Direct impacts would occur by conversion of jurisdictional waters (e.g., wetlands and streams) to lacustrine habitat with implementation of CP1. All features within the impoundment area would be converted to lacustrine habitat. Under CP1, approximately 14 acres of wetlands and 19 acres of other waters would be converted to lacustrine habitat (Table 12-15). This will result in a net loss of approximately 14 acres of wetlands. No net loss of other waters will occur under CP1, as lacustrine waters will replace riverine waters; however, lacustrine and riverine waters provide many different functions and values and are separate aquatic resources. The loss of wetlands and the conversion of approximately 19 acres of riverine waters to lacustrine waters would be a significant impact.

Direct impacts on wetlands and other waters that will be filled as a result of relocation of facilities or dam construction are summarized in Table 12-16.

The impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, “Mitigation Measures.”

Table 12-15. Impacts to Jurisdictional Waters (Acres[1]) in the Impoundment Area (6.5-Foot Dam Raise)

Jurisdictional Water Type	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Wetlands							
Fresh emergent/ riparian wetland	0.00	0.00	5.18	0.00	0.00	0.00	5.18
Intermittent swale	0.00	0.00	0.00	0.00	0.00	0.02	0.02
Riparian wetland	0.41	0.49	3.82	1.87	0.35	0.42	7.36
Seasonal wetland	0.00	0.00	0.25	0.00	0.00	0.02	0.27
Seep/spring wetland	0.43	0.14	0.45	0.24	0.05	0.25	1.56
Vegetated ditch	0.00	0.00	0.00	0.003	0.00	0.00	0.003
Total Wetlands	0.84	0.63	9.70	2.11	0.40	0.71	14.39
Other Waters of the United States							
Ephemeral stream	0.13	0.01	0.29	0.13	0.06	0.05	0.67
Intermittent stream	0.67	0.12	1.12	0.41	0.39	1.21	3.92
Perennial stream	0.82	1.00	5.12	5.77	1.10	0.76	14.57
Roadside ditch	0.00	0.00	0.003	0.00	0.00	0.00	0.003
Seep/spring other waters	0.01	0.00	0.001	0.01	0.00	0.00	0.021
Lacustrine	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Total Other Waters	1.63	1.13	6.54	6.32	1.55	2.02	19.19
Total Waters of the U.S.	2.47	1.74	16.24	8.43	1.95	2.73	33.57

Note:
[1] Acreage values are approximate.

Table 12-16. Impacts to Jurisdictional Waters (Acres[1]) in the Relocation Areas (6.5-Foot Dam Raise)

Jurisdictional Water Type	Relocation Acres						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Wetlands							
Fresh emergent wetland	0.00	N/A	0.02	0.01	0.00	0.00	0.03
Intermittent swale	0.00	N/A	0.00	0.00	0.00	0.001	0.001
Riparian wetland	0.03	N/A	0.20	0.02	0.003	0.13	0.38
Seasonal wetland	0.01	N/A	1.75	0.00	0.0001	0.00	1.76
Seep/spring wetland	0.004	N/A	0.03	0.00	0.006	0.005	0.05
Vegetated ditch	0.05	N/A	0.00	0.004	0.00	0.00	0.05
Total Wetlands	0.094	N/A	2.00	0.03	0.009	0.136	2.27
Other Waters of the United States							
Ephemeral stream	0.06	N/A	0.08	0.12	0.001	0.02	0.281
Intermittent stream	0.26	N/A	0.78	0.09	0.007	0.08	1.22
Perennial stream	0.00	N/A	0.05	0.03	0.04	0.002	0.12
Roadside ditch	0.007	N/A	0.003	0.00	0.00	0.00	0.01
Non-vegetated ditch	0.01	N/A	0.003	0.00	0.00	0.00	0.01
Seep/spring other waters	0.00	N/A	0.00	0.00	0.004	0.00	0.004
Total Other Waters	0.337327	N/A	0.92	0.24	0.05	0.102	1.64
Total Waters of the U.S.	0.43	N/A	2.92	0.27	0.06	0.24	3.92

Note:
[1] Acreage values are approximate.
Key:
N/A = not applicable

Impact Bot-5 (CP1): Loss of General Vegetation Habitats Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Under CP1, 1,227 acres of general vegetation habitat will be directly impacted by the inundation of the impoundment area and 698 acres of general vegetation habitat will be impacted by vegetation removal in the construction footprints of the relocation areas (Table 12-17 and Table 12-18).

This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, “Mitigation Measures.”

Table 12-17. Impacts to CWHR Habitats in the Impoundment Area (6.5-Foot Dam Raise)

Habitat	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Annual grassland	0.07	0.00	0.96	0.37	0.00	0.00	1.40
Barren	1.02	0.00	4.04	0.85	0.00	1.64	7.55
Blue oak–foothill pine	4.96	0.00	0.00	0.00	1.40	4.04	10.40
Blue oak woodland	0.00	0.00	0.00	0.00	0.00	1.32	1.32
Closed-cone pine–cypress	17.75	0.00	6.30	10.78	23.95	188.29	247.07
Douglas-fir	0.00	0.00	0.00	0.01	0.00	0.00	0.01
Mixed chaparral	14.83	6.83	80.01	7.32	5.43	27.73	142.15
Montane hardwood	39.08	18.13	86.75	34.61	9.44	1.28	189.29
Montane hardwood–conifer	34.65	0.50	69.23	66.31	55.70	5.68	232.07
Montane riparian	1.54	2.48	15.92	4.60	0.58	0.80	25.92
Ponderosa pine	108.93	15.36	84.75	81.20	25.06	29.93	345.23
Riverine	0.00	0.35	2.30	3.81	0.59	0.00	7.05
Urban	10.95	0.00	1.37	4.74	0.00	0.75	17.81
Total	233.79	43.65	351.64	214.60	122.14	261.46	1227.27

Note:
[1] Acreage values are approximate.
Key:
CWHR = California Wildlife Habitat Relationship

Table 12-18. Impacts to CWHR Habitats in the Relocation Areas

Habitat	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Annual grassland	0.40	0.00	4.95	0.53	0.70	0.01	6.59
Barren	12.46	0.00	11.97	5.38	0.00	2.96	32.76
Blue oak–foothill pine	0.01	0.00	0.00	0.00	0.00	2.35	2.36
Closed-cone pine–cypress	0.05	0.00	5.65	2.23	0.23	0.94	9.11
Mixed chaparral	3.36	0.00	3.95	4.11	1.70	9.63	22.77
Montane hardwood	19.73	0.00	20.89	21.64	0.24	0.13	66.63
Montane hardwood–conifer	24.69	0.00	19.27	33.48	2.61	6.62	86.66
Montane riparian	0.08	0.00	0.33	0.25	0.04	0.02	0.72
Ponderosa pine	79.56	0.00	96.78	47.58	16.04	0.77	240.74
Urban	15.64	0.00	217.29	0.27	0.00	0.57	233.76
Total	155.98	0.00	381.09	115.47	21.56	23.99	698.10

Note:
[1] Acreage values are approximate.
Key:
CWHR = California Wildlife Habitat Relationship

Impact Bot-6 (CP1): Spread of Noxious and Invasive Weeds Implementation of the project could result in the spread of noxious and invasive weeds as a result of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). Therefore, this impact would be potentially significant.

Noxious and invasive weeds are abundant around Shasta Lake, specifically in the relocation areas. Vectors that would increase as a result of project implementation include weed seed and seed parts brought in on tools, vehicles, and workers' clothing and boots. The extent of the risk would depend on the construction methods used and site-specific actions implemented to complete the project. As access into specific project areas is improved, road construction, temporary roads, and road maintenance would increase the number of vectors in an area. As traffic along new and existing corridors increases, the risk for weed dispersal would increase. Seed mixtures and mulches may be used during erosion control efforts and revegetation of areas. These mixtures and mulches are potential vectors for noxious weed and invasive plant dispersal.

Construction of the dam would result in inundation of shoreline habitat. Depending on the extent of colonization, many populations of noxious weeds could be inundated. However, there would be no increase in vector traffic and no soil disturbance due to inundation. Therefore, the risk of weed spread from the inundation of habitat is low.

However, vegetation removal in areas to be inundated may increase risk of weed spread. Habitat vulnerability and project-associated vectors in inundation zones would be variable, based on the extent of the vegetation removal and the location of the proposed activity. All habitats are vulnerable when canopies are opened and soil is disturbed. Increased traffic and soil disturbance coupled with an adjacent, high-ranking noxious weed may result in a moderate to high risk of weed spread.

Because of the dam expansion, other ground-disturbing projects would be implemented to relocate displaced roads, railways, utilities, homes, and recreation facilities. The potential for disturbance of noxious weeds is highly variable, based on the proposed activity and the abundance of weeds present. Depending on the location of high-ranking noxious weeds, the extent of ground-disturbing activities, and the amount of traffic entering a project site, the risk of noxious weed infestation would vary.

This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact Bot-7 (CP1): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes Altered flow regimes associated with project

implementation under CP1 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

Potential impacts on structure and species composition and loss of sensitive plant communities and special-status plant species resulting from altered flow regimes were determined using the best available information and tools as described in Chapter 2 "CalSim-II" and Chapter 3 "Temporal Downsizing of CalSim-II Flows for Use in Temperature Modeling" of the Engineering Appendix. See Chapter 4 "Geology, Geomorphology, Minerals, and Soils," for additional information on fluvial geomorphology and hydrology, and channel erosion and meander migration.

Potential impacts on flow and stages of the upper Sacramento River from CP1 would be small. On average, in each month, changes in mean monthly flow would be reductions or increases of several percent. Generally, these effects diminish with distance downstream because of the influence of inflows from tributaries and of diversions and flood bypasses.

In average and wet years, river flows would decrease during the November through February period of some years. This would be because of the increased storage space that could be filled in some years, usually following dry or critical water years.

During March through May, changes in mean monthly flows would be small reductions or increases (generally less than 2 percent) typically transitional between small reductions in winter flows and small increases in summer flows. During the June through August period of some years, flow and stage would increase. This increase would be most pronounced during some dry years as more water is released from Shasta Dam for water supply reliability purposes. During March, September, and October, mean monthly flows would generally be increased 1 to 6 percent.

Northern hardpan vernal pools and northern volcanic mudflow vernal pools are not present at Shasta Dam and are generally not present within the active floodplain immediately adjacent to the channel of the upper Sacramento River or its tributaries in the primary study area. Therefore, northern hardpan vernal pools and associated special-status plant species would likely not be affected by the altered flows in the primary study area downstream from Shasta Dam.

The altered flow regime of the upper Sacramento River associated with implementation of CP1 could affect oak communities and upland habitat for special-status plant species by prolonging inundation and changing the

availability of soil moisture. Prolonged inundation during the growing season kills most upland plants. This effect would occur during years when mean monthly stage during March – October is greater than in preceding years. Interannual fluctuations in stage during the growing season already cause upland vegetation to become removed from (or prevent its establishment within) a zone along rivers downstream from Shasta Dam. CP1 could increase the average elevation of this zone slightly (by, on average, increasing stage during the growing season of most years), but it would not increase the zone's elevation range. For some upland vegetation, greater summer flows in some years also could increase summer soil moisture, and reduced intermediate and large flows during winter in some years could reduce spring soil moisture. Because of the important influence of water availability on plant growth and survival, these changes in the availability of moisture could change the structure and species composition of oak communities or affect special-status plants of upland habitats.

These effects, however, are speculative, and may not all prove to be adverse with project implementation and operation. For example, greater summer flows in some years could increase summer soil moisture; in dry years, increased soil moisture could sustain plants that otherwise would be damaged or die. Therefore, the impact on oak communities and on upland habitat for special-status plants resulting from altered flow regimes on the upper Sacramento River within the primary study area would be less than significant.

The flow regime of a river or stream strongly influences the structure and species composition of the riparian and wetland communities associated with it. For this reason, the altered flow regimes resulting from project implementation would affect riparian and wetland vegetation. These effects are described below.

River flows strongly affect the growth and survival of riparian plants. Riparian plants are strongly affected by the timing and duration of inundation; abrasion and burial by water-borne sediment; and by water table fluctuations (Toner and Keddy 1997; Friedman and Auble 1999; Karrenberg, Edwards, and Kollmann 2002; Bagstad, Stromberg, and Lite 2005; Lite and Stromberg 2005; Williams and Cooper 2005). As a result, riparian communities often differ in structure and species composition along gradients of elevation or flooding frequency and intensity (Conard, MacDonald, and Holland 1977; Harris 1987; Toner and Keddy 1997; Bagstad, Stromberg, and Lite 2005; Vaghti and Greco 2007).

River flows not only affect the survival and growth of established riparian vegetation, but also create sites for establishment of early-successional vegetation. The geomorphic processes of channel meander migration, avulsion, and deposition of sediment on floodplains, which result primarily from intermediate and large flows, bury and uproot herbaceous vegetation and uproot or undercut trees and shrubs. These disturbances also create opportunities for early-successional vegetation to establish, including willow and cottonwood

seedlings that grow to form willow scrub and Great Valley cottonwood riparian forest.

Early successional riparian communities change rapidly in structure and species composition (Tu 2000, Fremier 2003, Vaghti and Greco 2007). Over several decades, early-successional vegetation develops into mid- and late-successional vegetation with less willow and cottonwood and a greater abundance of other trees, including box-elder, Oregon ash, black walnut, and valley oak (e.g., Great Valley mixed riparian forest) (Fremier 2003).

Thus, for riparian vegetation, the rates of geomorphic processes strongly affect the extent of different riparian communities, and these rates are strongly related to flow regime. For example, bank erosion and the average rate of meander migration are closely related to the cumulative portion of flow above a threshold volume. On portions of the Sacramento River, this threshold may be around 30,000 cfs (Larsen, Fremier, and Greco 2006; Stillwater Sciences 2007), which is well below the bankfull discharge but well above flows during spring and summer. However, other important thresholds for bank erosion and channel avulsion along the Sacramento River have been estimated within the range from 10,000 to 80,000 cfs (Stillwater Sciences 2007). (For additional discussion of the relationship of geomorphic processes to flow along the Sacramento River, see the *Fisheries and Aquatic Ecosystem Technical Report*.)

Flow regimes during the period of seed dispersal also strongly influence establishment of seedlings of riparian trees and shrubs, particularly willows and cottonwoods. In general, seeds of riparian plants can only successfully germinate and establish on exposed surfaces; prolonged inundation of a surface during the growing season prevents establishment. Willows and cottonwoods have very small, short-lived seed and are shade-intolerant plants; thus, their seeds must disperse to exposed, moist surfaces that are largely free of vegetation. Such surfaces are often created by channel migration, avulsion, and sediment deposition during larger winter and spring flows. They are then exposed by declining flows during the seed dispersal period of willow and cottonwood species. These seed dispersal periods are staggered across spring and summer; for example, March through April for arroyo willow, April through June for cottonwood, and May through August for black willow. Once willow and cottonwood seeds germinate, slowly declining flows are necessary to maintain their roots in contact with saturated soils, which in turn is necessary for establishment. Rapidly declining flows (i.e., those greater than 1 to 1.5 inches per day) result in desiccation and mortality of seedlings (Mahoney and Rood 1998, Stillwater Sciences 2007). Conversely, flows that increase during the growing season kill many seedlings (e.g., by burial, uprooting, or scouring).

Consequently, reductions in the magnitude, duration, and frequency of intermediate and large flows could reduce opportunities for cottonwood and willow species to establish and thus limit the extent of early and mid-

successional riparian communities. The absence of slowly declining spring flows also would reduce cottonwood establishment.

Since its construction, the operation of Shasta Dam has limited the frequency, magnitude, and duration of intermediate and larger flows during fall and winter, and flow volumes have been greater during the growing season. The operation of Shasta Dam also produces increasing flow volumes during the period of cottonwood seed dispersal (rather than flow volume decreasing during this period), largely precluding establishment of cottonwoods (and to a lesser extent willows) throughout much of the riparian zone (Roberts et al. 2002). The combined effect of these changes in flow regime has been a decrease in early- and mid-successional communities along the Sacramento River that is ongoing (Fremier 2003).

CP1 would lead to a further reduction in the magnitude, duration, and frequency of intermediate and large flows, but it would not alter the general annual pattern of flows increasing during the cottonwood seed dispersal period. However, CP1's effects on larger flows could further reduce the frequency or extent of suitable conditions for cottonwoods to establish from seed. Overall, the project would increase the existing, ongoing impacts on riparian vegetation resulting from the operation of Shasta Dam. This could reduce the area of riparian vegetation slightly, and reduce the proportion of riparian vegetation that is in early- and mid-successional stages (e.g., willow- and cottonwood-dominated communities) while increasing the extent of mid-successional communities (e.g., mixed riparian forest). This would be an exacerbation of an ongoing transition (which is described under Impact Bot-7 (No-Action)). These effects would not substantially alter the establishment and spread of invasive plant species. There would, however, be some reduction in the magnitude, duration, and frequency of overbank flows that facilitate the dispersal and establishment of invasive plants, and some reduction in the amount of early successional vegetation that provides suitable habitat for many invasive plant species.

These effects would likely occur along the upper Sacramento River throughout the primary study area. Reductions in the magnitude of intermediate and large flows would likely be sufficient to alter the dynamics and structure of the riparian corridor along the upper Sacramento River, downstream from Shasta Dam, throughout the primary study area. These effects on flows greater than 30,000 cfs downstream from Keswick Dam, RBPP, and Hamilton City are shown on Figure 12-6. As described previously, flows of this magnitude strongly affect bank erosion and meander migration, and are related to other geomorphic processes affecting the extent of different riparian communities. In the primary study area, there would be a small reduction in the number of mean daily flows greater than 30,000 cfs. Downstream from Keswick and the RBPP the number of days with mean flows greater than 30,000 cfs would be reduced by approximately 9 and 2 percent, respectively.

Although the establishment of most wetland plants is less strongly influenced by specific attributes of the flow regime than willows and cottonwoods, flow regime still plays an important role in wetland communities. In general, wetland communities on floodplains are strongly influenced by timing and duration of inundation, scour and deposition of sediment, and fluctuations in water table elevations within and among years (Keddy 2000, Leyer 2005, van Eck et al. 2006). Changes in flow during some years would change the extent of some wetland communities (e.g., seeps, seasonal wetlands) during that year and/or subsequent years, and thus the average extent of those communities. Overall, wetland communities could experience effects similar to those described for riparian communities.

For the reasons outlined above, and because riparian and wetland communities are sensitive natural communities, this impact would be significant.

Ten special-status plant species could occur in riparian or wetland habitats in the primary study area (including mesic upland-associated species; Table 12-6). Of these, within the primary study area and nearby counties (Butte and Glenn), three are known to occur along the edge of the Sacramento River channel, or along a Sacramento River tributary within 0.2 mile of the river proper, and their establishment and reproduction could potentially be affected by changes in flow regime: silky cryptantha (CRPR 1B), rose mallow (CRPR 2B.2), and Ahart's paronychia (CRPR 1B) (CNDDB 2007, University of California 2011). Because altered flow regimes associated with the project could modify habitat for these special-status species, this impact would be significant.

Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-8 (CP1): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management
Numerous local and regional plans promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP1 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

Local and regional plans addressing riparian habitats in the primary study area are discussed in more detail in the "Regulatory Setting" section of this EIS and include the RHJV and the Sacramento River Conservation Area Program, both of which promote the conservation and the restoration of riparian habitat. As described for Impact Bot-7 (CP1), implementation of this alternative could cause substantial adverse effects on riparian and wetland communities by altering the flow regime of the upper Sacramento River and could, therefore, conflict with existing local and regional plans that aim to conserve riparian habitats. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-9 (CP1): Disturbance or Removal of Designated Critical Habitat for Special-Status Species Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP1. This impact would be less than significant.

Critical habitat for four special-status species — slender orcutt grass, Hoover's spurge, hairy orcutt grass, and Greene's tuctoria — exists within the primary study area. Critical habitat for these species in the primary study area is confined to vernal pool communities (USFWS 2006). Vernal pools are generally not present within the active floodplain. However, if vernal pool habitats for these special-status species are present in the active floodplain of the upper Sacramento River, they could be affected by the small reduction in the frequency and magnitude of overbank flows. It is not known if this would be an adverse or beneficial effect. Because this effect of CP1 is somewhat speculative and not necessarily adverse, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-10 (CP1): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Implementing CP1 could increase water supplies for deliveries to water districts in the primary study area along the upper Sacramento River. This increase in water deliveries could reduce any limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

Along the upper Sacramento River, the CVP and SWP service areas contain wetland, riparian, oak, and other sensitive plant communities, and a large number of special-status plant species (Attachment 4). Increased water supplies or increased supply reliability could reduce a limitation on urban growth and development or on other activities that could affect sensitive plant communities or special-status plants in the primary and extended study areas.

The expected increase in water deliveries relative to the entire CVP and SWP service areas would be small (i.e., less than 1 percent), however, and increased deliveries would be provided to a number of geographic areas within the CVP and SWP service areas. Also, a substantial portion of this water would substitute for groundwater pumping, allow for changes in crop type or agricultural irrigation practices, or return idle cropland to production. Consequently, this alternative's effect on growth that could affect vegetation would be minor.

Furthermore, the effects of this growth would be analyzed in general plan EIRs and in project-level CEQA compliance documents for the local jurisdictions in which the growth would occur. Mitigation of these effects would be the

responsibility of these local jurisdictions, and not of Reclamation. Similarly, projects potentially affecting riparian and wetland habitats and listed species would require permits from CDFW, USACE, and USFWS; it is anticipated that effects on these resources would be avoided, minimized, and/or mitigated during those agency consultations.

The extent of induced growth that could affect botanical resources and wetlands would likely be minor, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-11 (CP1): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP1. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-12 (CP1): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP1. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-13 (CP1): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP1. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact Bot-14 (CP1): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River Altered flow regimes associated with project implementation under CP1 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and loss of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be similar to Impact Bot-7 (CP1) for the upper Sacramento River, but alteration of the Sacramento River's flow regime would be attenuated in the lower river by the effects of inflows from tributaries and of diversions and flood bypasses. Measurable effects on riparian and wetland plant communities are unlikely to extend as far downstream as the Delta, in part because releases from Shasta Dam account for a smaller fraction of total flow with increasing distance downstream as tributaries cumulatively add to the Sacramento River's flow.

Nonetheless, significant impacts on riparian and wetland communities, and associated special-status plants, would be caused on the lower Sacramento River, particularly near the upper Sacramento River. South of RBPP, the portion of the Sacramento River's total annual flow that is accounted for by flows greater than 30,000 cfs would still be reduced, and also the frequency of flows greater than 60,000 to 80,000 cfs (i.e., roughly the size of the current 1.5- to 2-year events) would be reduced. Changes in the number of days with mean daily flows greater than 30,000 cfs downstream from RBPP and Hamilton City are summarized on Figure 12-6. (These two locations are shown on Figure 12-7.) As described for Impact Bot-7 (CP1) (and in the *Fisheries and Aquatic Ecosystem Technical Report*), flows above about 30,000 cfs and 1.5- to 2-year events cause substantial changes in riparian ecosystems. These changes indicate that although they would be small, the alterations to the lower Sacramento River's flow regime could be sufficient to cause significant impacts in the Red Bluff-to-Chico Landing reach. This reach is immediately downstream from the primary study area but upstream from the flood bypasses and the Feather and American rivers, which substantially attenuate the effects of flows released from Shasta Dam. This reach is mostly unleveed and has few other constraints to channel movement, river meander, and flooding; consequently, it has an extensive acreage of early-, mid-, and late-successional riparian communities (Resources Agency 2003).

Effects are unlikely to extend to the Delta because the flood bypasses and the Feather and American rivers attenuate the effects of flows released from Shasta Dam. In addition, much of the Sacramento River's length south of Colusa, and almost all Delta sloughs, are leveed (often close to the channel) with extensive reinforcement of channel banks with revetment, restricting channel movement, river meander and flooding. Further; the acreage of early-, mid-, and late-successional riparian communities is much less extensive along the Sacramento River south of Colusa and in the Delta.

Effects of flow alterations are also unlikely to extend to the Delta because the Central Valley's reservoirs and diversions are managed as a single integrated system (consisting of the CVP and SWP). The guidelines for this management, which are described in the CVP Operations Criteria and Plan, have been designed to maintain standards for Delta inflow. CVP and SWP operations must be consistent with the Operations Criteria and Plan to allow coverage by the Operations Criteria and Plan biological opinion. Thus, implementation of CP1 is

not anticipated to alter Sacramento River flows to the Delta sufficiently to alter the dynamics or structure of vegetation in the Delta. Thus, impacts on the Delta portion of the extended study area would be less than significant.

This impact would be significant along the lower Sacramento River and less than significant in the Delta. Mitigation for this impact along the lower Sacramento River is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-15 (CP1): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Along the Lower Sacramento River Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP1 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River and in the Delta. These plans, which are discussed in more detail in the "Regulatory Framework" of this EIS, include the RHJV and the Sacramento River Conservation Area Program, both of which promote the conservation and restoration of riparian habitat. As described for Impact Bot-14 (CP1), implementation of this alternative could cause substantial adverse effects on riparian and wetland communities along a portion of the lower Sacramento River by altering its flow regime, but such effects would not occur in the Delta. Because the project has the potential to result in substantial adverse effects on riparian communities, it could conflict with existing local and regional plans. Therefore, on the lower Sacramento River, this impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-16 (CP1): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Along the Lower Sacramento River and in the Delta Implementation of CP1 could increase water supplies for deliveries to water districts in the extended study area along the lower Sacramento River. This increase in water deliveries could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1) for the upper Sacramento River, but the increased water supplies available along the lower Sacramento River would differ from that along the upper Sacramento River. However, for

the same reasons as Impact Bot-10 (CP1), this impact would also be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CVP/SWP Service Areas

Impact Bot-17 (CP1): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas Altered flow regimes associated with project implementation under CP1 could alter the structure and species composition or cause the loss of sensitive plant communities and habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early successional riparian and wetland communities or of associated habitat for special-status species. Therefore, below CVP and SWP reservoirs in the extended study area, this impact would be less than significant.

Because CVP and SWP reservoirs and diversions are managed as a single integrated system, changing releases from Shasta Dam can result in offsetting releases from other reservoirs (e.g., to meet Delta inflow standards). The effects from CP1 on CVP and SWP reservoir elevations, filling, spilling, and planned releases, and the resulting flows downstream from those reservoirs, would be small and within the range of variability that commonly occurs in these reservoirs and downstream. These alterations may not be sufficient to alter the extent of early successional riparian and wetland communities or of associated habitat for special-status species. Therefore, this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-18 (CP1): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementing CP1 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP1 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, in the CVP and SWP service areas, this impact would be less than significant.

Local and regional plans address and promote the conservation of riparian vegetation and associated habitats in the CVP and SWP service areas. (These plans are discussed in more detail in Section 12.2, “Regulatory Framework.”) However, as described for Impact Bot-17 (CP1), implementation of CP1 would not cause significant impacts on riparian and wetland communities in the CVP and SWP service areas. Therefore, CP1 would not conflict with existing local and regional plans. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-19 (CP1): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas Implementation of CP1 could increase water supplies for deliveries to water districts in the CVP and SWP service areas. This increase in water deliveries could reduce a limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1) for the upper Sacramento River, but the increased water supplies available in the CVP and SWP service areas would differ from that along the upper Sacramento River. However, for the same reasons as Impact Bot-10 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

As with CP1, CP2 focuses on increasing water supply reliability and increasing anadromous fish survival. CP2 primarily consists of raising Shasta Dam by 12.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 14.5 feet and enlarge the total storage capacity in the reservoir by 443,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 120,000 acre-feet and 60,000 acre-feet, respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries. CP2 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

Shasta Lake and Vicinity

Impact Bot-1 (CP2): Loss of Federally or State-Listed Plant Species Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-2 (CP2): Loss of MSCS Covered Species Implementation of the project would result in the loss of MSCS covered species because of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant. Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to but greater than CP1. However, inundation caused by a 12.5-foot raise of Shasta Dam would affect all or

portions of ten Shasta snow-wreath populations. These ten populations represent 42 percent of all known Shasta snow-wreath populations and encompass approximately 79 acres. Flooding impacts under CP2 would result in the loss of approximately 1.8 acres, or approximately 2 percent of these ten Shasta snow-wreath populations. The greatest proportional impacts to these populations occur at the Blue Ridge West, Brock Creek, Cove Creek, Keluche Creek, and Shasta Caverns populations. Table 12-19 provides a detailed summary of impacts to Shasta snow-wreath under CP2. Mitigation measures for impacts to Shasta snow-wreath populations are presented in Section 12.3.5, "Mitigation Measures."

The impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Table 12-19. Summary of Impacts to Shasta Snow-Wreath Populations Adjacent to Shasta Lake Under CP2

Population	Location	Size (Acres)	CP2 Impact (Acres)	Percent Total Impact to Population	Comments
Blue Ridge (west)	Main Body	1.11	0.594	53%	More than half of the population would be flooded.
Blue Ridge (east)	Main Body	0.03	0	0%	No impact under CP2.
Brock Creek	Pit River Arm	1.38	0.545	39%	Lower portion of population would be flooded.
Campbell Creek	McCloud River Arm	1.90	0.002	<1%	Small area at the downstream portion of the population would be flooded.
Cove Creek	Main Body	1.87	0.337	18%	Lower portion of population would be flooded.
Ellery Creek	McCloud River Arm	28.65	0.038	<1%	The entire very small disjunct sub-population located near Ellery Creek Campground would be flooded.
Jones Valley	Main Body	0.33	0.003	1%	Small area at lower portion or population would be flooded.
Keluche Creek	McCloud River Arm	0.15	0.112	73%	Nearly ¾ of the population would be flooded.
Shasta Caverns	McCloud River Arm	0.08	0.026	31%	Lower portion of population would be flooded.
South of Cove Creek	Main Body	1.39	0.149	11%	Lower portion of population would be flooded.
Stein Creek	Pit River Arm	42.15	0.028	<1%	Lower portion of population would be flooded.

Key:
% = percent
< = less than
CP = Comprehensive Plan

Impact Bot-3 (CP2): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species Implementation of the project would result in the loss of USFS sensitive, BLM sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to but greater than CP1. However, inundation caused by a 12.5-foot raise of Shasta Dam could result in the loss of more individual plants or plant populations and their habitat.

Impacts to Shasta County arnica, northern clarkia, Cantelow's lewisia, and Shasta limestone monkeyflower populations resulting from CP2 are similar to those described for CP1; however, CP2 would impact 85 slender false lupine populations. Impacts to Shasta huckleberry resulting from CP2 are the same as those described for CP1. This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-4 (CP2): Loss of Jurisdictional Waters Implementation of the project will result in the loss of jurisdictional waters caused by flooding the impoundment area and discharge of fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine habitat). Therefore, this impact would be significant.

Direct impacts would incur by conversion of jurisdictional waters (e.g., wetlands and streams) to lacustrine habitat with implementation of CP2. All features within the impoundment area would be converted to lacustrine habitat. Under CP2, approximately 19 acres of wetlands and 26 acres of other waters would be converted to lacustrine habitat (Table 12-20). This will result in a net loss of approximately 19 acres of wetlands and loss of approximately 26 acres of riverine waters by conversion to lacustrine waters. The impacts associated with relocation are the same as Impact Bot-4, CP1 as shown on Table 12-16. The impacts to wetlands from relocations would result in the loss of approximately 2.3 acres of wetlands and 1.6 acres of other waters.

Table 12-20. Impacts to Jurisdictional Waters (Acres[1]) in the Impoundment Area (12.5-Foot Dam Raise)

Jurisdictional Water Type	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Wetlands							
Fresh emergent/ riparian wetland	0.00	0.00	5.32	0.00	0.00	0.00	5.32
Intermittent swale	0.00	0.00	0.00	0.00	0.00	0.02	0.02
Riparian wetland	0.75	0.68	5.67	2.84	0.67	0.63	11.24
Seasonal wetland	0.00	0.00	0.29	0.00	0.08	0.02	0.39
Seep/spring wetland	0.58	0.17	0.60	0.21	0.10	0.37	2.03
Vegetated ditch	0.08	0.00	0	0.01	0.00	0.00	0.09
Total Wetlands	1.41	0.85	11.88	3.05	0.85	1.04	19.08
Other Waters of the United States							
Ephemeral stream	0.19	0.01	0.40	0.19	0.09	0.07	0.95
Intermittent stream	1.00	0.15	1.60	0.59	0.61	1.70	5.65
Perennial stream	1.15	1.32	7.46	7.56	1.57	0.94	20.00
Roadside ditch	0.00	0.00	0.004	0.00	0.00	0.00	0.04
Seep/spring other waters	0.02	0.00	0.001	0.01	0.00	0.00	0.03
Total Other Waters	2.36	1.48	9.47	8.35	2.27	2.71	26.64
Total Waters of the U.S.	3.77	2.33	21.35	11.40	3.12	3.75	45.72

Note:
[1] Acreage values are approximate.

The impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-5 (CP2): Loss of General Vegetation Habitats Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Under CP2, a total of 1,725 acres of general vegetation habitats will be directly impacted by the inundation of the impoundment area (Table 12-21).

Table 12-21. Impacts to CWHR Habitats (Acres*) in the Impoundment Area (12.5-Foot Dam Raise)

Habitat	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Annual grassland	0.36	0.00	1.53	0.53	0.00	0.00	2.42
Barren	1.40	0.00	5.58	1.86	0.00	2.56	11.40
Blue oak – foothill pine	7.05	0.00	0.00	0.00	2.46	5.27	14.79
Blue oak woodland	0.00	0.00	0.00	0.00	0.00	1.65	1.65
Closed-cone pine – cypress	24.40	0.00	8.95	14.96	32.72	262.31	343.35
Douglas-fir	0.00	0.00	0.00	0.06	0.00	0.00	0.06
Mixed chaparral	20.58	9.56	112.76	11.02	7.35	40.11	201.40
Montane hardwood	53.30	25.75	120.48	48.59	13.31	1.77	263.20
Montane hardwood – conifer	48.77	0.70	99.06	94.36	78.41	7.73	329.03
Montane riparian	2.72	3.23	20.57	6.12	1.00	1.19	34.83
Ponderosa pine	152.04	21.54	123.71	114.71	35.08	40.92	488.00
Riverine	0.00	0.42	4.02	4.51	0.84	0.00	9.80
Urban	16.65	0.00	1.63	6.42	0.00	1.24	25.94
Total	327.28	61.20	498.30	303.14	171.18	364.75	1725.85

Note:
[1] Acreage values are approximate.

The impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-6 (CP2): Spread of Noxious and Invasive Weeds Implementation of the project could result in the spread of noxious and invasive weeds as a result of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). Therefore, this impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP2 are anticipated to be similar to, but greater than, those described for CP1. This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Bot-7 (CP2): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes Altered flow regimes associated with project implementation under CP2 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. For example, greater summer flows in some years could increase summer soil moisture, especially during some dry and critical years as more water is released

from Shasta Dam for water supply reliability purposes. (Shasta Dam operations historically have increased flow volumes from mid-spring to early summer.) This increased soil moisture in dry years could reduce losses of upland vegetation during drought years. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

This impact would be similar to Impact Bot-7 (CP1). The extent of the impact under CP2 would be greater than that under CP1. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below Keswick Dam and RBPP are summarized on Figure 12-6.) This impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-8 (CP2): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Numerous local and regional plans promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP2 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-8 (CP1), and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-9 (CP2): Disturbance or Removal of Designated Critical Habitat for Special-Status Species Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, critical habitat for vernal pool species is not expected to be adversely affected by CP2 because vernal pools are generally not present within the active floodplain. For this reason, this impact would be less than significant.

This impact would be similar to Impact Bot-9 (CP1). The extent of the impact under CP2 would be greater than that under CP1, CP4, and CP4A, but less than that under CP3 and CP5, which would entail greater alterations of flow regimes. For the same reasons as Impact Bot-9 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-10 (CP2): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Implementation of CP2 could increase water supplies for deliveries to water districts in the primary study area along the upper Sacramento River. This increase in water deliveries could reduce any limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and

mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1). The extent of the impact under CP2 would be greater than that under CP1, CP4, and CP4A, but less than that under CP3 and CP5, which would result in a greater increase in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-11 (CP2): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP2. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-12 (CP2): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP2. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-13 (CP2): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP2. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact Bot-14 (CP2): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River Altered flow regimes associated with project implementation under CP2 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, for riparian and wetland communities and special-status plants, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be similar to Impact Bot-14 (CP1). The extent of the impact under CP2 would be greater than that under CP1, CP4, and CP4A, but less than that under CP3 and CP5, which would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below RBPP and Hamilton City are summarized on Figure 12-6.) Therefore, for riparian and wetland plant communities and associated special-status plant species on the lower Sacramento River, the impact would be significant, but in the Delta, the impact would be less than significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-15 (CP2): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management along the Lower Sacramento River Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP2 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-16 (CP2): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth along the Lower Sacramento River and in the Delta Implementation of CP2 could increase water supplies for deliveries to water districts in the extended study area along the lower Sacramento River. This increase in water deliveries could reduce any limitation on urban growth and development that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-16 (CP1). The extent of the impact under CP2 would be greater than that under CP1, CP4, and CP4A, but less than that under CP3 and CP5, which would result in greater increases in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CVP/SWP Service Areas

Impact Bot-17 (CP2): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas Altered flow regimes associated with project implementation under CP2 could alter the structure and

species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to affect the extent of early-successional riparian and wetland communities or of associated habitats for special-status plant species. Therefore, below CVP and SWP reservoirs in the extended study area, this impact would be less than significant.

This impact would be similar to Impact Bot-17 (CP1). The extent of the impact under CP2 would be greater than that under CP1, CP4, and CP4A, but less than that under CP3 and CP5, which would entail more substantial alterations of flow regimes. Nonetheless, for the same reasons as Impact Bot-17 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-18 (CP2): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP2 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP2 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, in the CVP and SWP service areas, this impact would be less than significant.

This impact would be to the same as Impact Bot-18 (CP1); the impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-19 (CP2): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas Implementation of CP2 could increase water supplies for deliveries to water districts in the CVP and SWP service areas. This increase in water deliveries could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-19 (CP1). The extent of the impact under CP2 would be greater than that under CP1, CP4, and CP4A, but less than that under CP3 and CP5, which would result in greater increases in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

CP3 focuses on increasing agricultural water supply reliability while also increasing anadromous fish survival. This plan primarily consists of raising Shasta Dam by 18.5 feet, which, in combination with spillway modifications, would increase the height of the reservoir's full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. Because CP3 focuses on increasing agricultural water supply reliability, none of the increased storage capacity in Shasta Reservoir would be reserved for increasing M&I deliveries. Operations for water supply, hydropower, and environmental and other regulatory requirements would be similar to existing operations, with the additional storage retained for water supply reliability and to expand the cold-water pool for downstream anadromous fisheries.

Simulations of CP3 did not involve any changes to the modeling logic for deliveries or flow requirements; all rules for water operations were updated to include the new storage, but were not otherwise changed.

The botany and wetland impact analysis previously presented for CP1 assumes maximum vegetation clearing within the relocation areas. Vegetation clearing impacts within the relocation areas under CP3 would be greater than under CP1 and CP2, but would not exceed those acreages of impacts presented under CP1.

Shasta Lake and Vicinity

Impact Bot-1 (CP3): Loss of Federally or State-Listed Plant Species Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-2 (CP3): Loss of MSCS Covered Species Implementation of the project would result in the loss of MSCS covered species because of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant. Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to but greater than CP2. However, inundation caused by an 18.5-foot raise of Shasta Dam would affect all or portions of eleven Shasta snow-wreath populations. These eleven populations represent 46 percent of all known Shasta snow-wreath populations and encompass approximately 79 acres. Flooding impacts under CP2 would result in the loss of approximately 2.6 acres, or approximately 3 percent of these eleven Shasta snow-wreath populations. The greatest proportional impacts to these populations occur at the Blue Ridge West, Brock Creek, Cove Creek, Keluche Creek, and Shasta Caverns populations. Table 12-22 provides a detailed summary of impacts to Shasta snow-wreath under CP3. Mitigation measures for impacts to Shasta snow-wreath populations are presented in Section 12.3.5, "Mitigation Measures."

Table 12-22. Summary of Impacts to Shasta Snow-Wreath Populations Adjacent to Shasta Lake Under CP3

Population	Location	Size (Acres)	CP3 Impact (Acres)	Percent Total Impact to Population	Comments
Blue Ridge (west)	Main Body	1.11	0.750	68%	Lower portion of population would be flooded.
Blue Ridge (east)	Main Body	0.03	0.002	7%	Lower portion of population would be flooded.
Brock Creek	Pit River Arm	1.38	0.634	46%	Nearly half of the population would be flooded.
Campbell Creek	McCloud River Arm	1.90	0.036	2%	Small area at the downstream portion of the population would be flooded.
Cove Creek	Main Body	1.87	0.401	21%	Lower portion of population would be flooded.
Ellery Creek	McCloud River Arm	28.65	0.047	<1%	The entire very small disjunct sub-population located near Ellery Creek Campground would be flooded.
Jones Valley	Main Body	0.33	0.015	4%	Nearly all of both small disjunct sub-populations at the lower portion of the population would be flooded.
Keluche Creek	McCloud River Arm	0.15	0.146	95%	Nearly all of the population would be flooded.
Shasta Caverns	McCloud River Arm	0.08	0.018	21%	Lower portion of population would be flooded.
South of Cove Creek	Main Body	1.39	0.149	11%	Lower portion of population would be flooded.
Stein Creek	Pit River Arm	42.15	0.469	1%	Lower portion of population would be flooded.

Key:
% = percent
< = less than
CP = Comprehensive Plan

Impacts related to dam construction and vegetation clearing or other construction activities within the relocation areas would be similar to but greater than CP2. However, inundation caused by an 18.5-foot raise of Shasta Dam could result in the loss of more individual plants or plant populations, and their habitat.

This impact would be significant. Mitigation for this impact is described in Section 12.3.5, “Mitigation Measures.”

Impact Bot-3 (CP3): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species
Implementation of the project would result in the loss of USFS sensitive, BLM sensitive, or CRPR species because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Impacts related to dam construction and vegetation clearing within the relocation areas would be similar to but greater than CP2. However, inundation caused by an 18.5-foot raise of Shasta Dam could result in the loss of more individual plants.

Impacts to Shasta County arnica and Shasta limestone monkeyflower populations resulting from CP3 are similar to those described for CP2; however, CP3 would impact four Cantelow's lewisia populations, two northern clarkia populations, and 99 slender false lupine populations. Impacts to Shasta huckleberry resulting from CP3 are the same as those described for CP1.This impact would be significant. Mitigation for this impact is described in Section 12.3.5, "Mitigation Measures."

Impact Bot-4 (CP3): Loss of Jurisdictional Waters Implementation of the project will result in the loss of jurisdictional waters caused by flooding the impoundment area and discharge of fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine habitat). Therefore, this impact would be significant.

Direct impacts would incur by conversion of jurisdictional waters (e.g., wetlands and streams) to lacustrine habitat with implementation of CP3. All features within the impoundment area would be converted to lacustrine habitat. Under CP3, approximately 31 acres of wetlands and 49 acres of other waters would be converted to lacustrine habitat (Table 12-23). This will result in a net loss of approximately 31 acres of wetlands and loss of approximately 49 acres of riverine waters by conversion to lacustrine waters. The impacts associated with relocation are the same as Impact Bot-4, CP1 as shown on Table 12-16. The relocation impacts to wetlands would result in the loss of approximately 2.3 acres of wetlands and 1.6 acres of other waters.

The impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Table 12-23. Impacts to Jurisdictional Waters (Acres[1]) in the Impoundment Area (18.5-Foot Dam Raise)

Jurisdictional Water Type	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Wetlands							
Fresh emergent/ riparian wetland	0.00	0.00	5.30	0.00	0.00	0.00	5.30
Intermittent swale	0.00	0.00	0.00	0.00	0.00	0.04	0.04
Riparian wetland	1.09	1.73	7.05	8.33	1.49	0.77	20.46
Seasonal wetland	0.00	0.00	0.42	0.00	0.14	0.02	0.58
Seep/spring wetland	0.77	0.23	0.80	0.41	0.16	0.47	2.84
Vegetated ditch	0.13	0.00	0.00	0.02	0.00	0.00	0.15
Total Wetlands	1.99	1.96	13.57	8.76	1.79	1.30	29.37
Other Waters of the United States							
Ephemeral stream	0.28	0.01	0.62	0.28	0.13	0.12	1.44
Intermittent stream	1.42	0.24	2.42	0.91	0.92	2.58	8.50
Perennial stream	1.55	3.00	9.78	20.27	2.39	1.57	38.56
Roadside ditch	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Seep/spring other waters	0.03	0.00	0.001	0.01	0.00	0.00	0.04
Total Other Waters	3.28	3.25	12.83	21.47	3.44	4.27	48.54
Total	5.27	5.21	26.40	30.23	5.23	5.57	77.91

Note:
[1] Acreage values are approximate

Impact Bot-5 (CP3): Loss of General Vegetation Habitats Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

Under CP3, 2,492 acres of general vegetation habitats will be directly impacted by the inundation of the impoundment area (Table 12-24).

The impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, “Mitigation Measures.”

Table 12-24. Impacts to CWHR Habitats (Acres[1]) in the Impoundment Area (18.5-Foot Dam Raise)

Habitat	Area (Acres[1])						
	Main Body	Big Backbone Arm	Sacramento Arm	McCloud Arm	Squaw Creek Arm	Pit Arm	Total
Annual grassland	0.44	0.00	3.10	0.70	0.00	0.00	4.23
Barren	2.30	0.00	10.60	3.56	0.00	4.13	20.59
Blue oak – foothill pine	10.36	0.00	0.00	0.00	4.29	6.81	21.46
Blue oak woodland	0.00	0.00	0.00	0.00	0.00	1.94	1.94
Closed-cone pine – cypress	32.68	0.00	12.95	20.89	44.72	373.48	484.73
Douglas-fir	0.00	0.00	0.00	0.36	0.00	0.00	0.36
Mixed chaparral	29.19	13.64	161.04	15.14	10.35	59.50	288.87
Montane hardwood	73.49	38.76	171.01	70.36	19.43	2.49	375.56
Montane hardwood – conifer	70.68	0.99	150.42	136.53	111.63	10.55	480.83
Montane riparian	4.16	6.67	26.16	13.91	1.53	1.57	54.00
Ponderosa pine	215.11	30.72	188.21	161.64	49.56	57.50	702.74
Riverine	0.00	0.88	5.24	15.43	1.41	0.00	22.96
Urban	21.95	0.00	1.95	7.96	0.00	1.92	33.80
Total	460.37	91.67	730.68	446.48	242.92	519.89	2492.07

Note:
[1] Acreage values are approximate.
Key:
CWHR = California Wildlife Habitat Relationship

Impact Bot-6 (CP3): Spread of Noxious and Invasive Weeds Implementation of the project could result in the spread of noxious and invasive weeds because of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). Therefore, this impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP3 are anticipated to be similar to, but greater than, those described for CP1. Therefore, this impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Upper Sacramento River (Shasta Dam to Red Bluff)
Impact Bot-7 (CP3): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes Altered flow regimes associated with project implementation under CP3 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

This impact would be similar to Impact Bot-7 (CP1). The extent of the impact would be greater under CP3 than under CP2. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below Keswick Dam and RBPP are summarized on Figure 12-6.) This impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-8 (CP3): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP3 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-8 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-9 (CP3): Disturbance or Removal of Designated Critical Habitat for Special-Status Species Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP3. For this reason, this impact would be less than significant.

This impact would be similar to Impact Bot-9 (CP1). The extent of the impact would be greater than under CP1, CP2, CP4, and CP4A, but less than under CP5, which would entail a greater alteration of flow regimes. However, for the same reasons as Impact Bot-9 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-10 (CP3): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Implementation of CP3 could increase water supplies for deliveries to water districts in the primary study area along the upper Sacramento River. This increase in water deliveries could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1). The extent of the impact would be greater under CP3 than under CP1, CP2, CP4, and CP4A, but less than under CP5, which would result in a greater increase in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-11 (CP3): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP3. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-12 (CP3): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP3. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-13 (CP3): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The proposed gravel augmentation program and riparian, floodplain, and side channel restoration activities would not be implemented under CP3. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Lower Sacramento River and Delta

Impact Bot-14 (CP3): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River Altered flow regimes associated with project implementation under CP3 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and of habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River, but these effects are unlikely to extend to the Delta; thus, for riparian and wetland communities and special-status plants, this impact would be significant on the lower Sacramento River, and less than significant in the Delta.

This impact would be similar to Impact Bot-14 (CP1). The extent of the impact would be greater under CP3 than under CP1, CP2, CP4, and CP4A, but would be less than under CP5, which would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below RBPP and Hamilton City are summarized on Figure 12-6.) This impact would be significant on the lower Sacramento River and less than significant in the Delta. Mitigation for this impact on the lower Sacramento River is proposed in Section 12.3.5, “Mitigation Measures.”

Impact Bot-15 (CP3): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management along the Lower Sacramento River Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River in the extended study area. Because CP3 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-16 (CP3): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth along the Lower Sacramento River and in the Delta Implementation of CP3 could increase water supplies for deliveries to water districts in the extended study area along the lower Sacramento River. This increase in water deliveries could reduce any limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-16 (CP1). The extent of the impact under CP3 would be greater than under CP1, CP2, CP4, and CP4A, but less than that under CP5, which would result in a greater increase in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CVP/SWP Service Areas

Impact Bot-17 (CP3): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas Altered flow regimes associated with project implementation under CP3 could alter the structure and species composition or cause the loss of sensitive plant communities and of habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities or associated habitats for special-status plant species. Therefore, this impact would be less than significant.

This impact would be similar to Impact Bot-17 (CP1). The extent of the impact would be greater under CP3 than under CP1, CP2, CP4, and CP4A, but less than that under CP5, which would entail more substantial alterations of flow

regimes. Nonetheless, for the same reasons as Impact Bot-17 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-18 (CP3): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP3 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP3 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact would be less than significant.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-19 (CP3): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas Implementation of CP3 could increase water supplies for deliveries to water districts in the extended study area in the CVP and SWP service areas. This increase in water deliveries could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-19 (CP1). The extent of the impact under CP3 would be greater than that under CP1, CP2, CP4, and CP4A, but less than that under CP5, which would result in a greater increase in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CP4 and CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

CP4 and CP4A focus on increasing anadromous fish survival while also increasing water supply reliability. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP4 or CP4A would increase the height of the reservoir full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would also be extended to achieve efficient use of the expanded cold-water pool. The additional storage created by the 18.5-foot dam raise would be used to improve the ability to meet temperature objectives and habitat requirements for anadromous fish during drought years and increase water supply reliability. CP4A is identical to CP4 with the exception of Shasta Dam and reservoir operations. CP4 and CP4A have similar reservoir operations in that they each

dedicate a portion of the new storage in Shasta Lake for fisheries purposes; however, the portion of this dedicated storage varies.

For CP4, about 378,000 acre-feet of the increased reservoir storage space would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. Operations for the remaining portion of increased storage (approximately 256,000 acre-feet) would be the same as in CP1, with 70,000 acre-feet and 35,000 acre-feet reserved to specifically focus on increasing M&I deliveries during dry and critical years, respectively.

For CP4A, about 191,000 acre-feet of the increased reservoir storage space would be dedicated to increasing the supply of cold water for anadromous fish survival purposes. For CP4A, operations for the remaining portion of increased storage (approximately 443,000 acre-feet) would be the same as in CP2, with 120,000 acre-feet reserved in dry years and 60,000 acre-feet reserved in critical years to specifically focus on increasing M&I deliveries.

CP4 and CP4A also include augmenting spawning gravel and restoring riparian, floodplain, and side channel habitat in the upper Sacramento River. Gravel placement would occur at one or more sites per year over a 10-year period and would be accomplished by one of three methods: lateral berms, talus cone, or direct placement in river, as appropriate, depending on specific conditions, including geomorphology, of the augmentation site. To the extent available, existing river access points would be used to deliver gravel to the river; however, temporary new access roads would be needed in some cases, mostly adjacent to the river. In addition, riparian, floodplain, and side channel habitat restoration would be constructed at up to six sites identified along the upper Sacramento River: Henderson Open Space, Tobiasson Island, Shea Island Complex, Kapusta Island, Anderson River Park, and Reading Island. These restoration projects could involve some vegetation clearing.

Impacts under CP4 or CP4A associated with vegetation clearing within the relocation areas would be the same under CP3. However, additional vegetation clearing would result under CP4 or CP4A as a result of clearing to access gravel augmentation sites and to construct the identified riparian, floodplain, and side channel restoration projects.

Shasta Lake and Vicinity

Impact Bot-1 (CP4 and CP4A): Loss of Federally or State-Listed Plant Species

Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact would occur for CP4 or CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-2 (CP4 and CP4A): Loss of MSCS Covered Species

Implementation of the project would result in the loss of MSCS covered species

as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be significant for CP4 or CP4A.

This impact would be similar to Impact Bot-2 (CP3). This impact would be significant for CP4 or CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-3 (CP4 and CP4A): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species Implementation of the project would result in the loss of USFS sensitive, BLM sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant for CP4 or CP4A.

This impact would be similar to Impact Bot-3 (CP3) and would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be similar to Impact Bot-3 (CP3) and would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-4 (CP4 and CP4A): Loss of Jurisdictional Waters Implementation of the project would result in the loss of jurisdictional waters because of flooding of the impoundment area and fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine habitat). Therefore, this impact would be significant for CP4 or CP4A.

This impact would be similar to Impact Bot-4 (CP3) and would be significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be similar to Impact Bot-4 (CP3) and would be significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-5 (CP4 and CP4A): Loss of General Vegetation Habitats Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities.

This impact would be similar to Impact Bot-5 (CP3) and would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be similar to Impact Bot-5 (CP3) and would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-6 (CP4 and CP4A): Spread of Noxious and Invasive Weeds Implementation of the project could result in the spread of noxious and invasive weeds as a result of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). This impact would be potentially significant for CP4 or CP4A.

Impacts resulting from the spread of noxious weeds under CP4 are anticipated to be similar to those described for CP3. This impact would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impacts resulting from the spread of noxious weeds under CP4A are anticipated to be similar to those described for CP3. This impact would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Bot-7 (CP4 and CP4A): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes Altered flow regimes associated with project implementation under CP4 or CP4A, could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities, and habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, for riparian and wetland communities and special-status plants, this impact would be significant.

This impact would be the same as Impact Bot-7 (CP1) and would be significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be similar to Impact Bot-7 (CP1), but greater as in Impact Bot-7 (CP2) due to more substantial alterations of flow regimes for CP4A. This impact would be significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-8 (CP4 and CP4A): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP4 or CP4A would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant for CP4 or CP4A.

This impact would be the same as Impact Bot-8 (CP1) and would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be the same as Impact Bot-8 (CP1) and would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-9 (CP4 and CP4A): Disturbance or Removal of Designated Critical Habitat for Special-Status Species Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP4 or CP4A. This impact would be less than significant for CP4 or CP4A.

This impact would be the same as Impact Bot-9 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to Impact Bot-9 (CP1), but greater, as in Impact Bot-9 (CP2) for CP4A. The extent of the impact under CP4A would be greater than that under CP1 and CP4, but less than that under CP3 and CP5, which would entail greater alterations of flow regimes. For the same reasons as Impact Bot-9 (CP2), this impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-10 (CP4 and CP4A): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Implementation of CP4 or CP4A could increase water supplies for deliveries to water districts in the primary study area along the upper Sacramento River. This increase in water deliveries could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant for CP4 or CP4A.

This impact would be the same as Impact Bot-10 (CP1) and would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to Impact Bot-10 (CP1), but greater, as in Impact Bot-10 (CP2). The extent of the impact under CP4A would be greater than that under CP1 and CP4, but less than that under CP3 and CP5, which would result in a greater increase in water deliveries. This impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-11 (CP4 and CP4A): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or

Restoring Riparian, Floodplain, and Side Channel Habitats Implementation of the gravel augmentation program could result in the removal of riparian and wetland vegetation or the degradation of riparian and wetland habitats, including wetlands qualifying as waters of the United States. In addition, actions to restore riparian, floodplain, and side channel habitats would remove riparian vegetation, and could result in discharge of fill material into waters of the United States. This impact would be potentially significant for CP4 or CP4A.

A gravel augmentation program would be implemented under CP4 or CP4A, as described in Chapter 2, "Alternatives." Gravel placement falls under Nationwide Permit (NWP) 27, "Aquatic Habitat Restoration, Establishment, and Enhancement." Activities qualifying for NWPs have been determined by USACE to have no more than minimal adverse effects on the aquatic environment (72 Federal Register 11092). Therefore, the direct placement of gravel into the Sacramento River would not be considered a significant impact on waters of the United States. No vernal pools or other seasonal wetlands are present at any of the proposed augmentation sites. However, gravel augmentation could result in removal of riparian vegetation during construction of access routes to the gravel placement sites. To the extent feasible, existing access roads would be used, but access to some of the proposed placement sites does not currently exist. Clearing and grubbing would be needed to create access to these gravel placement sites, and in some areas, vegetation clearing along banks would be used to allow gravel to fall easily from the banks into the river. These activities could result in removal of riparian vegetation.

In addition, actions would be implemented to restore riparian, floodplain, and side channel habitats by increasing connectivity between the Sacramento River and one or more side channels at the potential downstream Sacramento River restoration sites. As described in Chapter 2, "Alternatives," these actions would involve excavation and grading to modify side channel and adjacent floodplain topography, and subsequent revegetating of disturbed floodplain with native riparian vegetation. This is expected to provide a beneficial effect on floodplain and riparian habitat along these side channels. However, some construction activities associated with restoring river connectivity or removing or rehabilitating existing facilities could result in the long-term removal of riparian vegetation. See Table 12-25 for a summary of the potential impacts to plant communities and see Table 12-26 for potential impacts to jurisdictional waters.

Table 12-25. Summary of Potential Impacts to Plant Communities in the Potential Sacramento River Downstream Restoration Areas

Habitat	Area (Acres[1])					
	Henderson	Tobiasson Island	Shea Island Complex	Kapusta Island	Anderson River Park	Reading Island
N/A Broom patches	N/A	0.570	2.532	0.275	N/A	N/A
Black locust groves	N/A	N/A	N/A	N/A	N/A	N/A
California annual grassland	N/A	1.282	N/A	1.671	0.004	N/A
California yerba santa scrub	N/A	0.001	N/A	N/A	N/A	N/A
Cattail marshes	0.194	N/A	0.185	N/A	N/A	N/A
Foothill pine	N/A	0.718	N/A	0.276	N/A	N/A
Fremont cottonwood forest	1.137	N/A	N/A	0.384	0.223	N/A
Hind's walnut stands	N/A	N/A	N/A	N/A	N/A	N/A
Orchard	N/A	N/A	N/A	N/A	N/A	0.002
Oregon ash groves	N/A	N/A	N/A	N/A	N/A	N/A
Sandbar willow thickets	0.326	0.331	0.294	0.322	0.291	0.149
Shining willow groves	N/A	0.060	0.285	N/A	N/A	N/A
Silver wattle thickets	N/A	N/A	N/A	N/A	N/A	N/A
Soft rush marshes	N/A	N/A	N/A	N/A	N/A	N/A
Valley oak woodland	0.146	0.083	0.239	N/A	0.115	2.552
Wright's buckwheat patches	N/A	N/A	N/A	N/A	N/A	N/A
Water primrose wetlands	0.649	N/A	N/A	N/A	4.251	13.696
White alder groves	N/A	N/A	0.190	N/A	N/A	N/A
White-root beds	N/A	N/A	N/A	0.084	N/A	N/A
Mixed riparian forest	N/A	N/A	N/A	N/A	N/A	5.62
Parrot's feather mats	N/A	N/A	N/A	N/A	1.599	N/A
Reed canarygrass swards	N/A	N/A	N/A	N/A	0.899	N/A
Barren[2]	N/A	N/A	N/A	N/A	N/A	N/A
Riverine[2]	0.100	0.024	N/A	N/A	N/A	0.315

Note:
[1] Acreage values are approximate
[2] CWHR Wildlife Habitat Type; no corresponding plant series type included in A Manual of California Vegetation (Sawyer and Keeler-Wolf 1995).
Key:
N/A = not applicable

Table 12-26. Potential Impacts to Jurisdictional Waters in the Potential Sacramento River Downstream Restoration Areas

Jurisdictional Water Type	Area (Acres[1])					
	Henderson Open Space	Tobiasson Island	Shea Island Complex	Kapusta Island	Anderson River Park	Reading Island
Wetlands						
Fresh emergent wetland	0.160	N/A	0.368	N/A	5.419	7.241
Riparian wetland	0.128	0.101	0.292	0.084	1.857	5.466
Riparian/fresh emergent wetland complex	N/A	N/A	N/A	N/A	1.591	N/A
Other Waters of the United States						
Ephemeral stream	N/A	N/A	N/A	N/A	N/A	N/A
Intermittent stream	N/A	N/A	N/A	N/A	N/A	N/A
Perennial stream	0.163	0.107	2.389	0.048	0.073	6.512
Pond	0.900	N/A	N/A	N/A	N/A	N/A

Note:
[1]Acreage values are approximate.
Key:
N/A = not applicable

Modification of side channels and the side-channel openings connecting them to the Sacramento River would fall under NWP 27, "Aquatic Habitat Restoration, Establishment, and Enhancement." The potential relocation or rehabilitation of the existing power line and poles at the Henderson Open Space and of the existing boat ramp at Reading Island would also qualify for an NWP. Activities qualifying for NWPs have been determined by USACE to have no more than minimal adverse effects on the aquatic environment (72 Federal Register 11092). Although the activities described above would not have a significant impact on waters of the United States, implementation of the gravel augmentation program and riparian, floodplain, and side channel habitat restoration at up to six sites, would have a potentially significant impact on sensitive natural communities for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Although the activities described above would not have a significant impact on waters of the United States, implementation of the gravel augmentation program and riparian, floodplain, and side channel habitat restoration at up to six sites, would have a potentially significant impact on sensitive natural communities for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-12 (CP4 and CP4A): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The gravel augmentation program would involve vegetation removal and gravel placement that could result in the loss of special-status plants if they are present at the gravel placement sites. Similarly, restoring riparian, floodplain, and side channel habitats would

involve excavation, grading, and vegetation clearing that could result in the loss of special-status plants if they are present at the restoration sites. This impact would be potentially significant for CP4 or CP4A.

Special-status plant species could be killed during vegetation clearing and grubbing or gravel placement if they are present at the gravel placement sites or areas that would be cleared for access. Similarly, special-status plants could be killed during vegetation clearing, excavation, and grading if they are present at the riparian, floodplain, and side channel restoration sites or areas disturbed for access.

The impact would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

The impact would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-13 (CP4 and CP4A): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats Implementation of the gravel augmentation program could result in the spread of noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. Similarly, actions to restore riparian, floodplain, and side channel habitats could also spread noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. This impact would be potentially significant for CP4 or CP4A.

Vegetation removal and grubbing at gravel placement sites and access routes could result in increased risk of introduction and spread of noxious and invasive weeds. Riparian, floodplain, and side channel restoration projects also could result in increased risk of introduction and spread of noxious and invasive weeds.

The risk of introducing or spreading noxious weeds would vary depending on the proximity of existing noxious weed infestations, extent of ground-disturbing activities, and the amount of traffic entering a project site. Vectors that would increase as a result of project implementation include weed seed and seed parts brought in on tools, vehicles, and workers' clothing and boots. The number of weed vectors in an area would be increased by vegetation clearing and construction of temporary access routes for gravel placement and would be associated with modifying side channels and adjacent floodplain. As traffic along new and existing corridors increases, the risk for weed dispersal would increase. Seed mixtures and mulches may be used during erosion control efforts and revegetation of disturbed areas. These mixtures and mulches are potential vectors for noxious weed and invasive plant dispersal.

This impact would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Lower Sacramento River and Delta

Impact Bot-14 (CP4 and CP4A): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River The alteration of flow regimes associated with project implementation under CP4 or CP4A could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities and habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. However, adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River. For riparian and wetland plant communities and associated special-status plant species on the lower Sacramento River, the impact would be significant for CP4 or CP4A, but in the Delta, the impact would be less than significant. This impact would be significant for CP4 or CP4A.

This impact would be the same as Impact Bot-14 (CP1) and would be significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be similar to Impact Bot-14 (CP1), but greater, as in Impact Bot-14 (CP2). The extent of the impact under CP4A would be greater than that under CP1 and CP4, but less than that under CP3 and CP5, which would entail more substantial alterations of flow regimes. The relative magnitude of changes to larger flows, which are most important for riparian and wetland vegetation, have been simulated for each alternative below RBPP and Hamilton City and are summarized on Figure 12-6. Therefore, for riparian and wetland plant communities and associated special-status plant species on the lower Sacramento River, the impact would be significant for CP4A, but in the Delta, the impact would be less than significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-15 (CP4 and CP4A): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management along the Lower Sacramento River Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP4 or CP4A would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant for CP4 or CP4A.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant for CP4. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant for CP4A. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-16 (CP4 and CP4A): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth along the Lower Sacramento River and in the Delta Implementation of CP4 or CP4A could increase water supplies for deliveries to water districts in the extended study area along the lower Sacramento River. This increase in water deliveries could reduce any limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supply for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant for CP4 or CP4A.

This impact would be the same as Impact Bot-16 (CP1) and would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to Impact Bot-16 (CP1), but greater as in Impact Bot-16 (CP2). The extent of the impact under CP4A would be greater than that under CP1 and CP4 but less than that under CP3 and CP5, which would result in greater increases in water deliveries. This impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

CVP/SWP Service Areas

Impact Bot-17 (CP4 and CP4A): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas Altered flow regimes associated with implementation of CP4 or CP4A could alter the structure and species composition or cause the loss of sensitive plant communities and habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities or associated habitats for special-status plant species. Therefore, this impact would be less than significant for CP4 or CP4A.

This impact would be the same as Impact Bot-17 (CP1) and would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to Impact Bot-17 (CP1), but greater, as in Impact Bot-17 (CP2). The extent of the impact under CP4A would be greater than that under CP1 and CP4, but less than that under CP3 and CP5, which would entail more substantial alterations of flow regimes. Nonetheless, for the same reasons as Impact Bot-17 (CP1), this impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-18 (CP4 and CP4A): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP4 or CP4A would not cause a significant impact on riparian vegetation and habitats. Therefore, CP4 or CP4A would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact would be less than significant for CP4 or CP4A.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-19 (CP4 and CP4A): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas The implementation of CP4 or CP4A could increase water supplies for deliveries to water districts in the extended study area along the lower Sacramento River. This increase in water deliveries could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant for CP4 or CP4A.

This impact would be the same as Impact Bot-19 (CP1) and would be less than significant for CP4. Mitigation for this impact is not needed, and thus not proposed.

This impact would be similar to Impact Bot-19 (CP1), but greater, as in Impact Bot-19 (CP2) for CP4A. The extent of the impact under CP4A would be greater than that under CP1 and CP4 but less than that under CP3 and CP5, which would result in greater increases in water deliveries. This impact would be less than significant for CP4A. Mitigation for this impact is not needed, and thus not proposed.

CP5 – 18.5-Foot Dam Raise, Combination Plan

CP5 primarily focuses on increasing water supply reliability, anadromous fish survival, Shasta Lake area environmental resources, and recreation opportunities. By raising Shasta Dam 18.5 feet, in combination with spillway modifications, CP5 would increase the height of the reservoir full pool by 20.5 feet and enlarge the total storage capacity in the reservoir by 634,000 acre-feet. The existing TCD would be extended to achieve efficient use of the expanded cold-water pool. Shasta Dam operational guidelines would continue essentially unchanged, except during dry years and critical years, when 150,000 acre-feet and 75,000 acre-feet , respectively, of the increased storage capacity in Shasta Reservoir would be reserved to specifically focus on increasing M&I deliveries.

CP5 would help reduce future water shortages through increasing drought year and average year water supply reliability for agricultural and M&I deliveries. In addition, the increased depth and volume of the cold-water pool in Shasta Reservoir would contribute to improving seasonal water temperatures for anadromous fish in the upper Sacramento River.

At Shasta Lake, CP5 would also include (1) implementing environmental restoration features along the lower reaches of major tributaries, (2) constructing shoreline fish habitat, and (3) constructing either additional or improved recreation features at various locations around Shasta Lake to increase the value of the recreational experience. Formulation of specific environmental restoration features and increased recreation components is included in the Plan Formulation Appendix.

Along the upper Sacramento River, CP5 would also include implementing the same gravel augmentation program and the same riparian, floodplain, and side channel habitat restoration as described for CP4 and CP4A.

Shasta Lake and Vicinity

Impact Bot-1 (CP5): Loss of Federally or State-Listed Plant Species Habitat for Federally or State-listed plant species does not occur at Shasta Lake or in the vicinity. No species are known or expected to occur. Therefore, no impact would occur. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-2 (CP5): Loss of MSCS Covered Species Implementation of the project would result in the loss of MSCS covered species as a result of ground-disturbing construction activities or inundation. Therefore, this impact would be significant.

This impact would be similar to Impact Bot-2 (CP4 and CP4A) and would be significant. Mitigation for this impact is proposed in Section 12.3.5, “Mitigation Measures.”

Impact Bot-3 (CP5): Loss of USFS Sensitive, BLM Sensitive, or CRPR Species Implementation of the project would result in the loss of USFS Sensitive, BLM

Sensitive, or CRPR species as a result of inundation, vegetation removal, or construction activities. Therefore, this impact would be potentially significant.

This impact would be similar to Impact Bot-3 (CP3) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-4 (CP5): Loss of Jurisdictional Waters Implementation of the project would result in the loss of jurisdictional waters because of flooding of the impoundment area and fill associated with the relocation of facilities and dam construction. Flooding caused by implementation of the project would result in the conversion of jurisdictional water types (e.g., wetlands and streams to lacustrine habitat). This impact would be significant.

This impact would be similar to Impact Bot-4 (CP3) and would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-5 (CP5): Loss of General Vegetation Habitats Implementation of the project would result in a loss of general vegetation habitats because of inundation, vegetation removal, or construction activities. This impact would be potentially significant.

This impact would be similar to Impact Bot-5 (CP3) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-6 (CP5): Spread of Noxious and Invasive Weeds Implementation of the project could result in the spread of noxious and invasive weeds because of ground-disturbing activities during construction and an increased number of vectors (means of dispersal). This impact would be potentially significant.

Impacts resulting from the spread of noxious weeds under CP5 are anticipated to be similar to those described for CP3.

This impact would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Upper Sacramento River (Shasta Dam to Red Bluff)

Impact Bot-7 (CP5): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes Altered flow regimes associated with project implementation under CP5 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities and habitat for special-status plant species. Vernal pool plant communities and associated special-status species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial; thus, this impact would be significant.

This impact would be similar to Impact Bot-7 (CP1). The extent of the impact would be greater than under CP1 because CP5 would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below Keswick Dam and RBPP are summarized on Figure 12-6). This impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-8 (CP5): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Numerous local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the upper Sacramento River. Because CP5 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-8 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-9 (CP5): Disturbance or Removal of Designated Critical Habitat for Special-Status Species Designated critical habitat for four vernal pool special-status plant species exists within the primary study area. However, such critical habitat is not expected to be adversely affected by CP5. This impact would be less than significant.

This impact would be similar to Impact Bot-9 (CP1). The extent of the impact would be greater than under CP1 through CP4, because CP5 would entail a greater alteration of flow regimes. However, for the same reasons as Impact Bot-9 (CP1), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-10 (CP5): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth Implementation of CP5 could increase water supplies for deliveries to water districts in the primary study area along the upper Sacramento River. This increase in water deliveries could reduce any limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-10 (CP1). The extent of the impact under CP5 would be greater than that under CP1 through CP4 because it would result in a greater increase in water deliveries. However, this impact would be

less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-11 (CP5): Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats Implementation of the gravel augmentation program could result in the removal of riparian and wetland vegetation or the degradation of riparian and wetland habitats, including wetlands qualifying as waters of the United States. In addition, actions to restore riparian, floodplain, and side channel habitats at the potential downstream Sacramento River restoration sites would remove riparian vegetation, and could result in discharge of fill material into waters of the United States. This impact would be potentially significant.

This impact would be the same as Impact Bot-11 (CP4 and CP4A) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-12 (CP5): Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats The gravel augmentation program would involve vegetation removal and gravel placement that could result in the loss of special-status plants if they are present at the gravel placement sites. Similarly, restoring riparian, floodplain, and side channel habitats would involve excavation, grading, and vegetation clearing that could result in the loss of special-status plants if they are present at the restoration sites. This impact would be potentially significant.

This impact would be the same as Impact Bot-12 (CP4 and CP4A) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Impact Bot-13 (CP5): Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats Implementation of the gravel augmentation program could result in the spread of noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. Similarly, actions to restore riparian, floodplain, and side channel habitats could also spread noxious and invasive weeds as a result of vegetation clearing and grubbing and an increased number of vectors. This impact would be potentially significant.

This impact would be the same as Impact Bot-13 (CP4 and CP4A) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, "Mitigation Measures."

Lower Sacramento River and Delta

Impact Bot-14 (CP5): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River Altered flow regimes associated with project implementation under CP5 could alter the structure and species composition or cause the loss of riparian, wetland, and oak communities and habitat for special-status plant species. Vernal pool plant communities and associated special-status plant species likely would not be affected. Effects on oak communities and upland habitats for special-status plants may not all be adverse. Adverse effects on riparian and wetland communities and associated special-status plants could be substantial on the lower Sacramento River. Thus, this impact would be significant.

This impact would be similar to Impact Bot-14 (CP1). The extent of the impact would be greater under CP5 than under CP1 through CP4, because CP5 would entail more substantial alterations of flow regimes. (The relative magnitude of changes to larger flows (which are most important for riparian and wetland vegetation) simulated for each alternative below RBPP and Hamilton City are summarized on Figure 12-6). This impact would be significant. Mitigation for this impact is proposed in Section 12.3.5, “Mitigation Measures.”

Impact Bot-15 (CP5): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management along the Lower Sacramento River Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along the lower Sacramento River. Because CP5 would adversely affect riparian communities, this alternative could conflict with existing local and regional plans focused on preserving riparian habitats. Therefore, this impact would be potentially significant.

This impact would be the same as Impact Bot-15 (CP1) and would be potentially significant. Mitigation for this impact is proposed in Section 12.3.5, “Mitigation Measures.”

Impact Bot-16 (CP5): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth along the Lower Sacramento River and in the Delta Implementation of CP5 could increase water supplies for deliveries to water districts in the extended study area along the lower Sacramento River. This increase in water deliveries could reduce any limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-16 (CP1). The extent of the impact under CP5 would be greater than that under CP1 through CP4 because it would result in a greater increase in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

CVP/SWP Service Areas

Impact Bot-17 (CP5): Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas Altered flow regimes associated with project implementation under CP5 could alter the structure and species composition or cause the loss of sensitive plant communities and habitat for special-status plant species. However, alteration of flow regimes below CVP and SWP reservoirs in the extended study area would be less than below Shasta Dam along the upper and lower Sacramento River. These alterations may not be sufficient to alter the extent of early-successional riparian and wetland communities or associated habitats for special-status plant species. Therefore, this impact would be less than significant.

This impact would be similar to Impact Bot-17 (CP1). The extent of the impact under CP5 would be greater than that under CP1 through CP4, because it would entail more substantial alterations of flow regimes. Nonetheless, for the same reasons as Impact Bot-17 (CP2), this impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-18 (CP5): Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas Adopted local and regional plans address and promote the conservation of riparian vegetation and associated habitats along rivers below reservoirs in the CVP and SWP service areas. However, implementation of CP5 would not cause a significant impact on riparian vegetation and habitats. Therefore, CP5 would not conflict with existing local and regional plans focused on preserving riparian habitats. Thus, this impact would be less than significant.

This impact would be the same as Impact Bot-18 (CP1) and would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

Impact Bot-19 (CP5): Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in the CVP/SWP Service Areas Implementation of CP5 could increase water supplies for water districts in the CVP and SWP service areas. This increase in water deliveries could reduce a limitation on growth that could affect sensitive plant communities and special-status plant species. However, this increase in water supplies for growth that could affect these resources would be small, and in the future the effects of this growth would be analyzed and mitigated during land use planning and environmental review for specific projects. For these reasons, this impact would be less than significant.

This impact would be similar to Impact Bot-19 (CP1). The extent of the impact under CP5 would be greater than that under CP1 through CP4, because it would result in a greater increase in water deliveries. This impact would be less than significant. Mitigation for this impact is not needed, and thus not proposed.

12.3.5 Mitigation Measures

Table 12-27 presents a summary of mitigation measures for botanical resources and wetlands.

No-Action Alternative

No mitigation measures are required for this alternative.

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Bot-1 (CP1), Bot-9 (CP1) through Bot-13 (CP1), and Bot-16 (CP1) through Bot-19 (CP1). Mitigation is provided below for the remaining impacts of CP1 on botanical resources and wetlands.

Mitigation Measure Bot-2 (CP1): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas

As described in the Preliminary Environmental Commitments and Mitigation Plan Appendix, Reclamation convened an interagency working group to enhance mitigation measures presented in the DEIS. This working group had the benefit of additional information acquired during investigations of nearby private lands available for mitigation and refined analyses of potential project impacts. Using this updated information, the working group developed and refined mitigation measures for botanical and wetland resources, including Shasta snow-wreath. This mitigation measure includes the following components.

Reclamation will facilitate and implement actions necessary to acquire and/or propose land exchanges for Shasta snow-wreath populations on private land for transfer into federal ownership, including roads or other access to those lands. Alternatively, if acquisition and/or land exchange efforts are deemed insufficient, Reclamation will work with cooperating and responsible agencies to establish conservation easements at Shasta snow-wreath populations located on private land, including access to the conservation easements by State and Federal resource agencies to monitor the populations.

Reclamation will select and/or acquire test plot locations for establishment of experimental Shasta snow-wreath populations. At least four currently unoccupied sites with potential Shasta snow-wreath habitat within the STNF boundary will be selected.

Reclamation will develop a program for conservation of genetic material from Shasta snow-wreath sites subject to inundation. This program will include collection of genetic material, including seeds and scions, at all existing Shasta

snow-wreath populations within the inundation area. Appropriate endowment funding for long-term maintenance and storage of at least two public botanical conservatories, one of which will be a California institution affiliated with the Center for Plant Conservation, will be provided.

Table 12-27. Summary of Mitigation Measures for Botanical Resources and Wetlands

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Bot-1: Loss of Federally or State Listed Plant Species	LOS before Mitigation	NI	NI	NI	NI	NI	NI
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	NI	NI	NI	NI	NI	NI
Impact Bot-2: Loss of MSCS Covered Species	LOS before Mitigation	NI	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure Bot-2: Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU
Impact Bot-3: Loss of USFS Sensitive, BLM Sensitive, or CRPR Species	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Bot-3: Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive, and CRPR Plants and Revegetate Affected Areas.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU
Impact Bot-4: Loss of Jurisdictional Waters	LOS before Mitigation	NI	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure Bot-4: Mitigate Loss of Jurisdictional Waters.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU
Impact Bot-5: Loss of General Vegetation Habitats	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Bot-5: Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats.				
	LOS after Mitigation	NI	SU	SU	SU	SU	SU

Table 12-27. Summary of Mitigation Measures for Botanical Resources and Wetlands (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Bot-6: Spread of Noxious and Invasive Weeds	LOS before Mitigation	NI	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Bot-6: Develop and Implement a Weed Management Plan in Conjunction with Stakeholders.				
	LOS after Mitigation	NI	LTS	LTS	LTS	LTS	LTS
Impact Bot-7: Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes	LOS before Mitigation	LTS	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure Bot-7: Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Bot-8: Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management	LOS before Mitigation	LTS	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Bot-8: Implement Mitigation Measure Bot-7: Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Bot-9: Disturbance or Removal of Designated Critical Habitat for Special-Status Species	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Bot-10: Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Table 12-27. Summary of Mitigation Measures for Botanical Resources and Wetlands (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Bot-11: Loss of Sensitive Natural Communities or Habitats Resulting from Implementing the Gravel Augmentation Program or Restoring Riparian, Floodplain, and Side Channel Habitats	LOS before Mitigation	NI	NI	NI	NI	PS	PS
	Mitigation Measure	None required.	None needed; thus, none proposed.			Mitigation Measure Bot-11: Revegetate Disturbed Areas, Consult with CDFW, and Mitigate Loss of Jurisdictional Waters.	
	LOS after Mitigation	NI	NI	NI	NI	LTS	LTS
Impact Bot-12: Loss of Special-Status Plants Resulting from Implementing the Gravel Augmentation Program Restoring Riparian, Floodplain, and Side Channel Habitats	LOS before Mitigation	NI	NI	NI	NI	PS	PS
	Mitigation Measure	None required.	None needed; thus, none proposed.			Mitigation Measure Bot-12: Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations during Construction.	
	LOS after Mitigation	NI	NI	NI	NI	LTS	LTS
Impact Bot-13: Spread of Noxious and Invasive Weeds Resulting from Implementing the Gravel Augmentation Program Restoring Riparian, Floodplain, and Side Channel Habitats	LOS before Mitigation	NI	NI	NI	NI	PS	PS
	Mitigation Measure	None required.	None needed; thus, none proposed.			Mitigation Measure Bot-13: Implement Weed Management Measures and Revegetation.	
	LOS after Mitigation	NI	NI	NI	NI	LTS	LTS

Table 12-27. Summary of Mitigation Measures for Botanical Resources and Wetlands (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Bot-14: Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes on the Lower Sacramento River	LOS before Mitigation	LTS	S	S	S	S	S
	Mitigation Measure	None required.	Mitigation Measure Bot-14: Implement Mitigation Measure Bot-7: Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Bot-15: Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management along the Lower Sacramento River	LOS before Mitigation	PS	PS	PS	PS	PS	PS
	Mitigation Measure	None required.	Mitigation Measure Bot-15: Implement Mitigation Measure Bot-7: Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities.				
	LOS after Mitigation	PS	LTS	LTS	LTS	LTS	LTS
Impact Bot-16: Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth along the Lower Sacramento River and in the Delta	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Bot-17: Altered Structure and Species Composition and Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Altered Flow Regimes in the CVP/SWP Service Areas	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.	None needed; thus, none proposed.				
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Table 12-27. Summary of Mitigation Measures for Botanical Resources and Wetlands (contd.)

Impact		No-Action Alternative	CP1	CP2	CP3	CP4/CP4A	CP5
Impact Bot-18: Conflict with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management in the CVP/SWP Service Areas	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.					
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
Impact Bot-19: Loss of Sensitive Plant Communities and Special-Status Plant Species Resulting from Induced Growth in CVP/SWP Service Areas	LOS before Mitigation	LTS	LTS	LTS	LTS	LTS	LTS
	Mitigation Measure	None required.					
	LOS after Mitigation	LTS	LTS	LTS	LTS	LTS	LTS

Key:
CP = Comprehensive Plan
CVP = Central Valley Project
LOS = level of significance
LTS = less than significant
NA = not applicable
NI = no impact
PS = potentially significant
S = significant
SU = significant and unavoidable
SWP = State Water Project

Reclamation will investigate the feasibility of protecting Shasta snow-wreath populations to be inundated with dikes/berms. Two existing Shasta snow-wreath sites will be chosen for their genetic diversity and and/or extent. Reclamation will then investigate the feasibility of building dike or berm structures designed to eliminate the flooding that would otherwise occur at the new inundation level at these Shasta snow-wreath sites.

Reclamation will develop an active management program for existing Shasta snow-wreath populations. The program, which will be led by Reclamation and include appropriate stakeholders, will provide active management of known Shasta snow-wreath populations outside of the project area on USFS lands to enhance and protect these existing populations. Management activities will include measures to increase fire suppression capacity, use of prescribed fire under rigorous experimental conditions, fencing, integrated weeds management including weed inventory, control (mechanical, chemical, cultural, and biological), abatement, monitoring, and public education. This mitigation measure applies to known and any newly established experimental populations.

Additional studies to determine the biology of Shasta snow-wreath will be conducted by Reclamation. Studies will be undertaken to understand the pollination biology of Shasta snow-wreath and the genetic compatibility of different genotypes and to understand the conditions under which sexual reproduction occurs in this species. Seed germination and scion rooting techniques will be explored to find reliable means of producing material for establishment of experimental populations.

Reclamation will establish an outreach communication program to local land owners and determine if additional Shasta snow-wreath populations occur on private land. Following development, Reclamation will implement the communications program, including applicable subsequent outreach and monitoring.

Reclamation will develop a Shasta Snow-wreath Conservation Agreement. This Conservation Agreement will serve as the overall management document for Shasta snow-wreath and include all responsible State and Federal resource management agencies and appropriate private landowners. At a minimum, the Conservation Agreement will include the following sections:

- Introduction
- Geographic area and entities included in the agreement
- Authority, purpose, objective, and management goal(s) of the Conservation Agreement
- Description, status, distribution, ecology, and population biology of the species

- Known and potential threats to the species
- Current threats of destruction, modification, or curtailment of its habitat or range
- Issues related to overutilization for commercial, recreational, scientific, or educational purposes
- Disease or predation
- Efficacy of existing regulatory mechanisms
- Other natural or manmade factors affecting the species' continued existence
- Conservation or management actions that will be implemented
- Funding of conservation or management actions
- Duration of agreement
- Signatures
- References

The STNF has established monitoring transects in eight Shasta snow-wreath populations, with three years of data for seven populations and two years of data for the eighth population. Reclamation will continue the monitoring efforts at the established populations and expand the effort to additional populations, based on criteria developed by Conservation Agreement participants.

The following mitigation measures will reduce impacts on other MSCS plants, if applicable:

- When feasible in relocation areas, avoid or minimize actions that can result in harm or mortality to individuals or to the viability of populations.
- When feasible, Reclamation will relocate populations of MSCS plants that will be directly affected to suitable habitat within undisturbed portions of the Shasta Lake and vicinity portion of the primary study area.
- When feasible, Reclamation will use seed banking and other *ex situ* (off site) conservation methods for MSCS populations that will be directly affected.

- When feasible, Reclamation will restore/enhance populations of other MSCS plants in the project vicinity.

- A mitigation and monitoring plan will be developed to monitor success of MSCS plant populations that have been relocated or revegetated. The plan will identify suitable sites for mitigation, species to be planted, and numbers and sizes of plantings. It will describe planting techniques, prescribe methods to remove existing noxious weeds, and establish reasonable performance standards and contingency measures. Furthermore, it will establish conservation easements as appropriate. The vegetation restoration plan will be developed in consultation with coordinating and responsible agencies (e.g., USACE, USFWS, and USFS).

- Where appropriate, MSCS covered plant species will be used for revegetation.

Implementation of this mitigation measure would reduce impacts on MSCS plant species; however, because successful relocation, transplanting, and artificial propagation of Shasta snow-wreath are unproven, impacts would remain significant and unavoidable.

Mitigation Measure Bot-3 (CP1): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive, and CRPR Plants and Revegetate Affected Areas As described in the Preliminary Environmental Commitments and Mitigation Plan Appendix, Reclamation convened an interagency working group to enhance mitigation measures presented in the DEIS. This working group had the benefit of additional information from recent investigations of nearby private lands available for mitigation and refined analyses of potential project impacts. Using this updated information, the working group developed and refined mitigation measures for botanical and wetland resources, including include land acquisition, habitat management and enhancement, and other measures.

Mitigation measure Bot-3 consists of a program to acquire nearby private lands with similar habitat attributes and species composition as those impacted by the SLWRI project. Reclamation has identified several willing private landowners and specific parcels for purchase in the project area vicinity. Preliminary investigations of these lands have shown they contain similar and/or additional habitats and special-status species as those impacted by SLWRI. Special-status plant species known to occur on the lands subject to these preliminary investigations include Shasta huckleberry, Shasta arnica, Shasta limestone monkeyflower, Canyon Creek stonecrop, Howell's lewisa, and Shasta eupatory. Additionally, the interagency working group identified other private parcels with similar biological resources in the vicinity of the project area, some of which have owners willing to discuss purchase agreements.

As discussed during the interagency working group meetings, mitigation measure Bot-3 will begin with a 3:1 minimum replacement ratio of acquired lands to impacted lands. The interagency working group also agreed that additional considerations will be made for other replacement ratios (more or less) depending on habitat quality at a particular site. Emphasis will be placed on lands containing high value habitats (e.g., riparian, wetland, limestone, blue oak woodlands) and/or special-status species populations.

This mitigation measure includes the following components intended to reduce impacts on USFS sensitive, BLM sensitive, and CRPR plants:

- When feasible in relocation areas, avoid or minimize actions that can result in harm or mortality to individuals or to the viability of populations.

- When feasible, Reclamation will relocate populations of USFS sensitive, BLM sensitive, and CRPR plants that will be directly affected to suitable habitat within undisturbed portions of the Shasta Lake and vicinity portion of the primary study area.

- When feasible, Reclamation will use seed banking and other *ex situ* (off site) conservation methods for USFS sensitive, BLM sensitive, and CRPR plant populations that will be directly affected.

- When feasible, Reclamation will restore/enhance populations of other USFS sensitive, BLM sensitive, and CRPR plants in the project vicinity.

- Reclamation will develop a mitigation and monitoring plan to monitor success of USFS sensitive, BLM sensitive, and CRPR plant populations that have been relocated or revegetated. The plan will identify suitable sites for mitigation, species to be planted, and numbers and sizes of plantings. It will describe planting techniques, prescribe methods to remove existing noxious weeds, and establish reasonable performance standards and contingency measures. Furthermore, it will establish conservation easements as appropriate. The vegetation restoration plan will be developed in consultation with cooperating and responsible agencies (e.g., USACE, USFWS, USFS).

- To the extent feasible, USFS sensitive, BLM sensitive, and CRPR plant species will be used for revegetation.

Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive, and CRPR plant species; however, because successful relocation and transplantation of these species are unproven, impacts would remain potentially significant and unavoidable.

Mitigation Measure Bot-4 (CP1): Mitigate Loss of Jurisdictional Waters Reclamation will prepare a conceptual wetland mitigation plan following current USACE guidance and requirements. The mitigation plan will incorporate wetland habitats within lands acquired under Bot-3 as appropriate, and may include additional mitigation lands. The wetland mitigation plan will also include measures for wetland habitat creation, restoration, and/or enhancement.

Under CP1, Bot-4 will mitigate for the loss of approximately 14 acres of wetlands and 19 acres of other waters of the U.S. in the inundation area, and approximately 2 acres of wetlands and 2 acres of other waters of the U.S. in the relocation areas. Collectively Bot-4 (CP1) will mitigate for the loss of approximately 16 acres of wetlands and approximately 21 acres of other waters of the U.S.

Until the details of this mitigation measure are developed through the ongoing planning process, Impact Bot-4 (CP1) would remain significant and unavoidable.

Mitigation Measure Bot-5 (CP1): Acquire, Preserve, and Restore Mitigation Lands for Loss of General Vegetation Habitats As described in Bot-3, mitigation lands will be acquired to mitigate for the loss of vegetation habitat. Additionally, opportunities for restoration and enhancement of habitat will be explored and defined. Mitigation measure Bot-5 will begin with a 3:1 minimum replacement ratio of acquired lands to impacted lands. This ratio will be applied to each specific habitat type. Additional considerations will be made for other replacement ratios (more or less) depending on habitat quality at a particular site. Emphasis will be placed on lands containing high-value habitats (e.g., riparian, wetland, limestone, blue oak woodlands) and/or special-status species populations.

Under CP1, Bot-5 will mitigate for the loss of 1,227 acres of habitats in the inundation area and 698 acres in the relocation areas by acquiring a minimum of 5,775 acres of mitigation lands containing comparable habitats.

Until the details of this mitigation measure are developed, Impact Bot-5 (CP1) would remain significant and unavoidable.

Mitigation Measure Bot-6 (CP1): Develop and Implement a Weed Management Plan in Conjunction with Stakeholders Reclamation will develop and implement a weed management plan in conjunction with stakeholders to avoid or minimize the potential for project-related impacts from noxious and invasive plants. This plan will incorporate a combination of inventory, adaptive measures for treatment of existing populations, and measures for controlling spread. The plan will have long-term consideration and be designed as an ongoing program. At a minimum, the plan will include:

- Identification of key established weed populations for removal/treatment.

- Measures to treat source populations, prevent introduction of new infestations during project construction, and ongoing maintenance.

- Provide a mechanism for monitoring and addressing weed populations as the new shoreline develops over time.

- Include objective statements which are achievable and can be readily implemented (e.g., to protect potentially impacted sensitive species, to minimize project impacts, to avoid and control weed spread that affects rare and otherwise desirable species, recreation, fuels/fire implications).

- Consideration for construction-related species, which may be distinctly different from species likely to invade new inundation areas.

Environmental commitments outlined in Chapter 2, "Alternatives," include measures to use native species for revegetation and erosion control in construction areas, including establishment of local source populations for seed/propagule collection; include standard equipment cleaning provisions in all construction contracts; and use only weed-free road fill, gravel, mulches, and erosion control devices.

Implementation of these measures would reduce Impact Bot-6 (CP1) to a less-than-significant level.

Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities Reclamation will implement a riverine ecosystem mitigation and adaptive management plan to mitigate to the extent feasible the identified effects of an altered Sacramento River flow regime on existing riparian and wetland communities, and associated instream, riparian, and wetland habitat values for aquatic and terrestrial special-status species along the Sacramento River from Shasta Dam to Colusa (River Mile 144). The plan is consistent with and will support implementation of the Senate Bill 1086 program, and will be implemented in coordination with USFWS, NMFS, CDFW, and the Sacramento River Conservation Area Forum. The plan will be implemented before or during project construction. The plan is limited to the Sacramento River from Shasta Dam to Colusa (River Mile 144). The plan mitigates to the existing conditions as of 2010 which are considered the baseline conditions.

The goals of the plan, which also serve as performance standards, are to have no net reduction in the average amount of any of the following caused by the project along the Sacramento River from Shasta Dam to Colusa:

- Channel migration in selected areas of natural vegetation dominated by native species
- Overbank inundation of natural vegetation dominated by native species in selected areas
- Regeneration of early-successional riparian vegetation (e.g., cottonwood regeneration) in selected areas

The riverine ecosystem mitigation plan includes a menu of potentially feasible elements:

- Modeling or monitoring at representative locations to quantify direct and indirect impacts resulting from adaptive management of project implementation. A method of quantifying impacts will be used that ensures repeatability. This would include at least one of the following approaches:
  - Conducting aerial surveys to evaluate changes in riparian habitat communities
  - Development and monitoring of up to 15 riparian habitat transects along the Sacramento River at potentially sensitive locations (e.g., downstream from the confluence of tributaries, downstream from diversion structures)

  Monitoring would be conducted for an initial 10-year period, after which the need for continued monitoring would be re-evaluated.
- An evaluation of modifications to the procedures for operating Shasta Dam (e.g., ramping rates) to accomplish any of the following:
  - Reduce or eliminate adverse impacts on ecologically important bankfull and overbank flows (as feasible within existing flood reduction constraints)
  - Reduce or eliminate adverse impacts (e.g., reduction) on meander migration rates
  - Facilitate establishment of cottonwoods and early-successional vegetation at intervals sufficient to sustain cottonwoods and early-successional riparian vegetation along the Sacramento River riparian corridor and floodplain (e.g., at 5- to 15-year intervals)

  - Avoid any increase in flood risk from implementing this mitigation measure. Feasible modifications to operational procedures are those not in conflict with applicable laws, agreements, and regulations, or with the purpose of the project.

- A specific combination of mitigation actions will be implemented to attain the plan's goals. Mitigation actions consist of modifications to dam operation procedures and/or funding of appropriate restoration actions that have been developed by Reclamation, other Federal agencies, State or local governments, or private nonprofits and received applicable Federal and State permits. Appropriate restoration actions include the following:

  - Enhance connectivity of river side channels (e.g., by modifying the elevation of secondary channels, remnant oxbows, or meander scars)

  - Expand the river meander zone at selected locations (e.g., by assisting in funding projects that meet this objective)

  - Increase floodplain connectivity (e.g., by assisting in funding projects that meet this objective)

  - Control and remove nonnative, invasive plant species from riparian areas to shift dominance to native species

  - Create riparian and wetland communities (e.g., through plantings)

  - Increase shaded riverine aquatic habitat (e.g., through plantings)

The following will be considered in implementation of the riverine ecosystem mitigation plan:

- The adaptive management process will evaluate the performance of the restoration actions towards meeting the performance standards and goals.

- The location of restoration actions will be on preserved sites and with funding for management in perpetuity. (Preserved sites will include sites previously preserved by other entities.) A specific restoration plan will be developed for each restoration location and coordinated with resource agencies and local stakeholders.

- Mechanisms by which Reclamation will fund implementation will be determined after project approval for implementation.

At a minimum, mitigation that will be implemented under this plan will include the following:

- Feasible modifications to dam operation procedures identified as reducing adverse impacts on meander migration or ecologically important bankfull and overbank flows, or as facilitating cottonwood establishment, and

- Either of the following elements:

  – Provide actions or funding to increase meander migration, side-channel connectivity, or floodplain connectivity along the Sacramento River, and creation (or conversion of nonnative-dominated to native-dominated) of riparian or wetland communities

or

  – Provide mitigation that has been determined by USFWS, NMFS, and CDFW to be of comparable or greater value and is included in the terms and conditions of permits for impacts on species listed as threatened or endangered by the State or Federal governments

Implementation of this mitigation measure would mitigate the impact of altered flow regimes on instream, riparian, and wetland communities, and thus would reduce Impact Bot-7 (CP1) to a less-than-significant level.

Mitigation Measure Bot-8 (CP1): Implement Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Reclamation will implement Mitigation Measure Bot-7 (CP1) as described above.

As described under Mitigation Measure Bot-7 (CP1), implementing a riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the upper Sacramento River in the primary study area. Consequently, implementation of the previous mitigation measure would reduce Impact Bot-8 (CP1) to a less-than-significant level.

Mitigation Measure Bot-14 (CP1): Implement Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This measure is identical to Mitigation Measure Bot-7 (CP1) as described above. Reclamation will implement a riverine ecosystem mitigation plan.

Implementation of this mitigation measure would reduce Impact Bot-14 (CP1) to a less-than-significant level.

Mitigation Measure Bot-15 (CP1): Implement Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Reclamation will implement Mitigation Measure Bot-7 (CP1) as described above.

As described under Mitigation Measure Bot-7 (CP1), implementing a riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the lower Sacramento River in the extended study area. Consequently, implementing the previous mitigation measure would reduce Impact Bot-15 (CP1) to a less-than-significant level.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability

No mitigation is needed for Impacts Bot-1 (CP2), Bot-9 (CP2) through Bot-13 (CP2), and Bot-16 (CP2) through Bot-19 (CP2). Mitigation is provided below for the remaining impacts of CP2 on botanical resources and wetlands.

Mitigation Measure Bot-2 (CP2): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on Shasta snow-wreath; however, because many of the proposed mitigation measures relocation of this species are unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-3 (CP2): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive and CRPR plant species; however, because relocation of these species is unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-4 (CP2): Mitigate Loss of Jurisdictional Waters This mitigation measure is identical to Mitigation Measure Bot-4 (CP1).

Under CP2, Bot-4 will mitigate for the loss of approximately 19 acres of wetlands and 26 acres of other waters of the U.S. in the inundation area, and approximately 2 acres of wetlands and 2 acres of Other Waters of the U.S. in the relocation areas. Collectively Bot-4 (CP2) will mitigate for the loss of

approximately 21 acres of wetlands and approximately 28 acres of other waters of the U.S.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP2) would remain significant and unavoidable.

Mitigation Measure Bot-5 (CP2): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats This mitigation measure is identical to Mitigation Measure Bot-3 (CP1).

Under CP2, Bot-5 will mitigate for the loss of 1,725 acres of habitats in the inundation area and 698 acres in the relocation areas by acquiring a minimum of 7,269 acres of mitigation lands containing comparable habitats.

Until the details of this mitigation measure are developed, Impact Bot-5 (CP2) would remain significant and unavoidable.

Mitigation Measure Bot-6 (CP2): Develop and Implement a Weed Management Plan in Conjunction with Stakeholders This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this mitigation measure would reduce Impact Bot-6 (CP2) to a less-than-significant level.

Mitigation Measure Bot-7 (CP2): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP1), except that mitigation in the riverine ecosystem mitigation plan will include either of the following elements:

- Increased meander migration, side-channel connectivity, or floodplain connectivity along the Sacramento River, and creation (or conversion from nonnative-dominated to native-dominated) of riparian or wetland communities

or

- Mitigation that has been determined by USFWS, NMFS, and CDFW to be of comparable or greater value and is included in the terms and conditions of permits for impacts on species listed as threatened or endangered by the State or Federal government

Implementation of this mitigation measure would reduce Impact Bot-7 (CP2) to a less-than-significant level.

Mitigation Measure Bot-8 (CP2): Implement Mitigation Measure Bot-7 (CP2): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional

Plans with Objectives of Riparian Habitat Protection or Watershed Management Reclamation will implement Mitigation Measure Bot-7 (CP2) as described above.

Implementing this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the upper Sacramento River in the primary study area. Implementation of this mitigation measure would reduce Impact Bot-8 (CP2) to a less-than-significant level.

Mitigation Measure Bot-14 (CP2): Implement Mitigation Measure Bot-7 (CP2): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP2). Reclamation will implement a riverine ecosystem mitigation plan.

Implementation of this mitigation measure would reduce Impact Bot-14 (CP2) to a less-than-significant level.

Mitigation Measure Bot-15 (CP2): Implement Mitigation Measure Bot-7 (CP2): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Reclamation will implement Mitigation Measure Bot-7 (CP2) as described above.

Implementing this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the lower Sacramento River in the extended study area. Implementation of this mitigation measure would reduce Impact Bot-15 (CP2) to a less-than-significant level.

CP3 – 18.5-Foot Dam Raise, Agricultural Water Supply Reliability and Anadromous Fish Survival

No mitigation is needed for Impacts Bot-1 (CP3), Bot-9 (CP3) through Bot-13 (CP3), and Bot-16 (CP3) through Bot-19 (CP3). Mitigation is provided below for the remaining impacts of CP3 on botanical resources and wetlands.

Mitigation Measure Bot-2 (CP3): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on Shasta snow-wreath; however, because many of the proposed mitigation measures for relocation of this species are unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-3 (CP3): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive and CRPR plant species; however, because relocation of these species is unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-4 (CP3): Mitigate Loss of Jurisdictional Waters This mitigation measure is identical to Mitigation Measure Bot-4 (CP1).

Under CP3, Bot-4 will mitigate for the loss of approximately 29 acres of wetlands and 48 acres of other waters of the U.S. in the inundation area, and approximately 2 acres of wetlands and 2 acres of Other Waters of the U.S. in the relocation areas. Collectively Bot-4 (CP3) will mitigate for the loss of approximately 31 acres of wetlands and approximately 50 acres of Other Waters of the U.S.

Until the details of this mitigation measure are developed, Impact Bot-4 (CP3) would remain significant and unavoidable.

Mitigation Measure Bot-5 (CP3): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats This mitigation measure is identical to Mitigation Measure Bot-3 (CP1).

Under CP3, Bot-5 will mitigate for the loss of 2,492 acres of habitats in the inundation area and 698 acres in the relocation areas by acquiring a minimum 9,570 acres of mitigation lands containing comparable habitats.

Until the details of this mitigation measure are developed, Impact Bot-5 (CP3) would remain significant and unavoidable.

Mitigation Measure Bot-6 (CP3): Develop and Implement a Weed Management Plan in Conjunction with Stakeholders This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this mitigation measure would reduce Impact Bot-6 (CP3) to a less-than-significant level.

Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP1), except that mitigation in the riverine ecosystem mitigation plan will include either of the following elements:

- Increased meander migration, side-channel connectivity, or floodplain connectivity along the Sacramento River, and creation (or conversion

from nonnative-dominated to native-dominated) of riparian or wetland communities

or

- Mitigation that has been determined by USFWS, NMFS, and CDFW to be of comparable or greater value and is included in the terms and conditions of permits for impacts on species listed as threatened or endangered by the State or Federal government.

Implementation of this mitigation measure would reduce Impact Bot-7 (CP3) to a less-than-significant level.

Mitigation Measure Bot-8 (CP3): Implement Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Reclamation will implement Mitigation Measure Bot-7 (CP3) as described above.

The implementation of this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the upper Sacramento River in the primary study area. Implementation of this mitigation measure would reduce Impact Bot-8 (CP3) to a less-than-significant level.

Mitigation Measure Bot-14 (CP3): Implement Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Reclamation will implement a riverine ecosystem mitigation plan.

Implementation of this mitigation measure would reduce Impact Bot-14 (CP3) to a less-than-significant level.

Mitigation Measure Bot-15 (CP3): Implement Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management Reclamation will implement Mitigation Measure Bot-7 (CP3) as described above.

The implementation of this riverine ecosystem mitigation plan would reduce conflicts with approved local and regional plans that address and promote the conservation of riparian vegetation communities along the lower Sacramento River in the extended study area. Implementation of this mitigation measure would reduce Impact Bot-15 (CP3) to a less-than-significant level.

CP4 and CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability

No mitigation is needed for Impacts Bot-1 (CP4 and CP4A), Bot-9 (CP4 and CP4A), Bot-10 (CP4 and CP4A), and Bot-16 (CP4 and CP4A) through Bot-19 (CP4 and CP4A). Mitigation is provided below for the remaining impacts of CP4 or CP4A on botanical resources and wetlands.

Mitigation Measure Bot-2 (CP4 and CP4A): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on Shasta snow-wreath; however, because many of the proposed mitigation measures for relocation of this species are unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-3 (CP4 and CP4A): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-3 (CP1).

Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive, and CRPR plant species; however, because relocation of these species is unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-4 (CP4 and CP4A): Mitigate Loss of Jurisdictional Waters This mitigation measure is identical to Mitigation Measure Bot-4 (CP1).

Until the details of this mitigation measure are developed, Impact Bot-4 (CP4 and CP4A) would remain significant and unavoidable.

Mitigation Measure Bot-5 (CP4 and CP4A): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats This mitigation measure is identical to Mitigation Measure Bot-3 (CP1).

Until the details of this mitigation measure are developed, Impact Bot-5 (CP4 and CP4A) would remain significant and unavoidable.

Mitigation Measure Bot-6 (CP4 and CP4A): Develop and Implement a Weed Management Plan in Conjunction with Stakeholders This mitigation measure is identical to Mitigation Measure Bot-6 (CP1).

Implementation of this mitigation measure would reduce Impact Bot-6 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-7 (CP4 and CP4A): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and

Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP1).

Implementation of this mitigation measure would reduce Impact Bot-7 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-8 (CP4 and CP4A): Implement Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management This mitigation measure is identical to Mitigation Measure Bot-7 (CP1).

Implementation of this mitigation measure would reduce Impact Bot-8 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-11 (CP4 and CP4A): Revegetate Disturbed Areas, Consult with CDFW, and Mitigate Loss of Jurisdictional Waters
Reclamation will implement the following measures to reduce and compensate for loss of sensitive natural communities:

- Before removing any vegetation at the augmentation sites and access areas, a survey will be conducted to map and classify the natural communities present in these areas, including wetland communities.

- Augmentation access will be designed to avoid disturbing wetland plant communities to the extent feasible. Removal of mature riparian vegetation and other sensitive vegetation will be minimized to the extent possible while still allowing access to gravel augmentation sites.

- CDFW will be consulted with to determine if a Section 1602 streambed alteration agreement will be required for the gravel augmentation activities affecting the bed and bank of the Sacramento River and side channels.

- Staging and gravel and equipment storage will be confined to developed or disturbed areas to the extent feasible.

- A revegetation plan will be prepared to restore native vegetation in all areas cleared to implement the gravel augmentation program immediately following completion of the gravel augmentation activities at each augmentation site. The revegetation plan will include performance standards and success criteria to ensure that mitigation habitat would be successfully maintained and result in no net loss of sensitive natural communities, including riparian vegetation.

- All conditions of the streambed alteration agreement will be implemented to the satisfaction of CDFW, subject to limitations on its authority set forth in Fish and Game Code Section 1600 et seq.

In addition, Reclamation will implement the following measures to reduce and compensate for potential loss of sensitive natural communities from the riparian, floodplain, and side channel restoration actions:

- A survey will be conducted before removing any vegetation at the augmentation sites and access areas to map and classify the natural communities present in restoration and potential construction areas at restoration sites.

- CDFW will be consulted with to determine if a Section 1602 streambed alteration agreement will be required for the restoration and construction activities at each restoration site affecting the bed and bank of the Sacramento River and side channel.

- Relocated and/or rehabilitated facilities (e.g., power poles) will be designed to avoid disturbing sensitive plant communities to the extent feasible.

- A 100-foot no disturbance buffer will be established around sensitive plant communities that are to be avoided during construction. Removal of mature riparian vegetation and other sensitive vegetation will be minimized to the extent possible.

- Staging, equipment storage, and construction access will be designed to avoid disturbing vegetation to the extent feasible.

- Native riparian and other sensitive vegetation, if any, removed from restoration sites will be replaced on a no-net-loss basis. Riparian vegetation will be replaced through planting and establishment of comparable native riparian vegetation on-site. Other sensitive plant communities may be replaced through restoration of comparable native vegetation at other sites if necessary.

- Planting mix, composition, and density will be determined by a more detailed site analysis, but could include native cottonwood, willow, box elder, valley oak, western sycamore, elderberry, and a variety of understory brush species. Temporary irrigation will be provided on an as-needed basis, where feasible.

- All conditions of the streambed alteration agreement will be implemented to the satisfaction of CDFW, subject to limitations on its authority set forth in Fish and Game Code Section 1600 et seq.

Reclamation will prepare and implement a wetland mitigation plan following current USACE guidance and requirements. The wetland mitigation plan will include measures for wetland habitat creation, restoration, and/or enhancement.

Implementation of this mitigation measure would reduce Impact Bot-11 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-12 (CP4 and CP4A): Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations during Construction Reclamation will implement the following measures to avoid impacts on special-status plants resulting from the gravel augmentation program:

- Botanists will be hired to conduct protocol-level special-status plant surveys before commencing any construction activities that could disturb vegetation.

- All special-status plants identified within 250 feet of the proposed augmentation sites will be mapped and identified for avoidance. Access routes and gravel placement will be designed to avoid impacts on special-status plants.

- Fencing will be installed a minimum of 100 feet from special-status plants, and no project activity will be permitted within the area occupied by special-status plants or the 100-foot buffer area around these plants.

- Insecticides, herbicides, fertilizers, or other chemicals that might harm special-status plants will not be used within 100 feet of the plants. Roadways and disturbed areas within 100 feet of special-status plants will be watered at least twice a day and as needed to minimize dust emissions.

In addition, Reclamation will implement the following measures to avoid impacts on special-status plants resulting from the riparian, floodplain, and side channel restoration actions:

- Qualified botanists will be hired to conduct protocol-level special-status plant surveys before commencing any construction activities that could disturb vegetation.

- All special-status plants identified within 250 feet of the proposed augmentation sites will be mapped and avoided to the extent feasible. Protective fencing will be installed around special-status plant locations and a 100-foot buffer zone during construction activities.

- Insecticides, herbicides, fertilizers, or other chemicals that might harm special-status plants will not be used within 100 feet of special-status plants. Roadways and disturbed areas within 100 feet of special-status plants will be watered at least twice a day and as needed to minimize dust emissions.

Implementation of this mitigation measure would reduce Impact Bot-12 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-13 (CP4 and CP4A): Implement Weed Management Measures and Revegetation Reclamation will implement the following measures to reduce the risk of introducing and spreading noxious weeds or invasive plant species during gravel augmentation and riparian, floodplain, and side channel restoration:

- Before conducting gravel augmentation activities, invasive plant and noxious weed infestations will be identified and mapped within the augmentation sites, including vegetation clearing sites.

- Noxious weeds will be removed at the onset of construction and disposed of properly. If noxious weeds are not removed at the onset of construction, they will be fenced and avoided during construction.

- Any clothing, footwear, and equipment used during construction will be ensured free of soil, seeds, vegetative matter or other debris or potential seed-bearing material before entering the project sites or before moving from infested sites to uninfested sites.

- Mitigation Measure Bot-11 (CP4 and CP4A) will be implemented to restore native vegetation in all areas disturbed by gravel placement and construction of access routes immediately following completion of the gravel augmentation activities at each augmentation site.

- Only weed-free gravel, fill soil, mulch, seed mixes, and straw materials will be used during construction; best management practices will be implemented; and postconstruction revegetation will be conducted. Certified weed-free material will be used if available.

Implementation of this mitigation measure would reduce Impact Bot-13 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-14 (CP4 and CP4A): Implement Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP1).

Implementation of this mitigation measure would reduce Impact Bot-14 (CP4 and CP4A) to a less-than-significant level.

Mitigation Measure Bot-15 (CP4 and CP4A): Implement Mitigation Measure Bot-7 (CP1): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management This mitigation measure is identical to Mitigation Measure Bot-7 (CP1). Implementation of this mitigation measure would reduce Impact Bot-15 (CP4 and CP4A) to a less-than-significant level.

CP5 – 18.5-Foot Dam Raise, Combination Plan

No mitigation is needed for Impacts Bot-1 (CP5), Bot-9 (CP5), Bot-10 (CP5), and Bot-16 (CP5) through Bot-19 (CP5). Mitigation is provided below for the remaining impacts of CP5 on botanical resources and wetlands.

Mitigation Measure Bot-2 (CP5): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate MSCS Plants; and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-2 (CP1). Implementation of this mitigation measure would reduce impacts on Shasta snow-wreath; however, because many of the proposed mitigation measures for relocation of this species are unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-3 (CP5): Acquire and Preserve Mitigation Lands; Avoid Populations; Relocate USFS Sensitive, BLM Sensitive and CRPR Plants and Revegetate Affected Areas This mitigation measure is identical to Mitigation Measure Bot-3 (CP1). Implementation of this mitigation measure would reduce impacts on USFS sensitive, BLM sensitive, and CRPR plant species; however, because relocation of these species is unproven, the impact would remain significant and unavoidable.

Mitigation Measure Bot-4 (CP5): Mitigate Loss of Jurisdictional Waters This mitigation measure is identical to Mitigation Measure Bot-4 (CP1).

Until the details of this mitigation measure are developed, Impact Bot-4 (CP5) is considered significant and unavoidable.

Mitigation Measure Bot-5 (CP5): Acquire and Preserve Mitigation Lands for Loss of General Vegetation Habitats This mitigation measure is identical to Mitigation Measure Bot-3 (CP1).

Until the details of this mitigation measure are developed, Impact Bot-5 (CP5) would remain significant and unavoidable.

Mitigation Measure Bot-6 (CP5): Develop and Implement a Weed Management Plan in Conjunction with Stakeholders This mitigation measure is identical to Mitigation Measure Bot-6 (CP1). Implementation of this

mitigation measure would reduce Impact Bot-6 (CP5) to a less-than-significant level.

Mitigation Measure Bot-7 (CP5): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-7 (CP5) to a less-than-significant level.

Mitigation Measure Bot-8 (CP5): Implement Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed Management This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-8 (CP5) to a less-than-significant level.

Mitigation Measure Bot-11 (CP5): Revegetate Disturbed Areas, Consult with CDFW, and Mitigate Loss of Jurisdictional Waters This mitigation measure is identical to Mitigation Measure Bot-11 (CP4 and CP4A). Implementation of this mitigation measure would reduce Impact Bot-11 (CP5) to a less-than-significant level.

Mitigation Measure Bot-12 (CP5): Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations during Construction This mitigation measure is identical to Mitigation Measure Bot-12 (CP4 and CP4A). Implementation of this mitigation measure would reduce Impact Bot-12 (CP5) to a less-than-significant level.

Mitigation Measure Bot-13 (CP5): Implement Weed Management Measures and Revegetation This mitigation measure is identical to Mitigation Measure Bot-13 (CP4 and CP4A). Implementation of this mitigation measure would reduce Impact Bot-13 (CP5) to a less-than-significant level.

Mitigation Measure Bot-14 (CP5): Implement Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Avoid and Compensate for the Impact of Altered Flow Regimes on Riparian and Wetland Communities This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-14 (CP5) to a less-than-significant level.

Mitigation Measure Bot-15 (CP5): Implement Mitigation Measure Bot-7 (CP3): Implement a Riverine Ecosystem Mitigation and Adaptive Management Plan to Reduce Conflicts with Approved Local or Regional Plans with Objectives of Riparian Habitat Protection or Watershed

Management This mitigation measure is identical to Mitigation Measure Bot-7 (CP3). Implementation of this mitigation measure would reduce Impact Bot-15 (CP5) to a less-than-significant level.

12.3.6 Cumulative Effects

Chapter 3, "Considerations for Describing the Affected Environment and Environmental Consequences," discusses overall cumulative impacts methodology related to the action alternatives, including the relationship to the CALFED Bay-Delta Program Programmatic EIS/EIR cumulative impacts analysis, qualitative and quantitative assessment, past and future actions in the study area, and significance criteria. Table 3-1, "Present and Reasonably Foreseeable Future Actions Included in the Analysis of Cumulative Impacts, by Resource Area," in Chapter 3, lists the present and reasonably foreseeable future projects considered quantitatively and qualitatively within the cumulative impacts analysis. This cumulative impacts analysis accounts for potential project impacts combined with the impacts of existing facilities, conditions, land uses, and reasonably foreseeable actions expected to occur in the study area on a qualitative and quantitative level.

The action alternatives would not combine with any of the quantitatively assessed projects listed in Table 3-1 to have a cumulatively considerable impact on botanical resources in the primary study area. Impacts on botanical resources in the extended study area from these projects would not combine with the impacts from any of the action alternatives as the geographic scope of the impacts do not overlap.

The following analysis relates to the cumulative impacts of the qualitatively assessed projects listed in Table 3-1 when considered with the impacts of the action alternatives. Projects listed in Table 3-1 that could contribute to a cumulative impact on botanical resources in the primary and extended study area include, but are not limited to, Sacramento River Basin Salmonid Rearing Habitat Improvements, Bay-Delta Conservation Plan, Sacramento River Conservation Area Forum Program, Butte Regional Conservation Plan, Fremont Landing Conservation Bank, Antlers Bridge Replacement, Moody Flats Quarry, and Mountain Gate at Shasta Mixed-Use Plan.

A large number of past actions have occurred in the primary and extended study areas. These past actions have substantially degraded botanical resources and wetlands within the study areas. This degradation is indicated by the number of species that have been listed as threatened or endangered under the CESA and Federal ESA, and by the large portion of all native plant species that are now assigned a CRPR, listed by CDFW and CNPS. Consequently, there is an existing significant cumulative impact on botanical resources.

Past actions have caused these effects by converting habitat to developed or agricultural land uses, altering biotic interactions or physical processes, and

damaging or causing mortality from human activities (e.g., vegetation removal during road, levee, or utility maintenance).

Most botanical resources and wetlands in the study areas have been adversely affected by most of the mechanisms described above (i.e., conversion of habitat to developed or agricultural land uses, the spread of invasive species, alteration of physical processes, and human disturbance). Overall, these botanical resources and wetlands have been substantially degraded by past actions, and past actions are continuing to affect them. In particular, the geographic range and abundance (and thus the effects) of many nonnative, invasive plant species that were introduced into the study areas in the past are still rapidly increasing.

The construction of Shasta Dam and the subsequent flooding of the area now known as Shasta Lake affected botanical and wildlife resources endemic to the region. For example, based on existing population locations, Shasta snow-wreath populations may have connected at the confluence of the Pit, Squaw, McCloud, and Sacramento rivers before inundation. The creation of Shasta Lake fragmented the habitat and populations of this species. As a result, these populations are more vulnerable to extirpation.

The effects of climate change on operations at Shasta Lake could potentially affect botanical resources both at the lake and downstream. As described in the Climate Change Modeling Appendix, climate change could result in higher reservoir releases in the future because of an increase in winter and early-spring inflow into the lake from high-intensity storm events. The change in reservoir releases could be necessary to manage for flood events resulting from these potentially larger storms. The potential increase in releases from the reservoir could lead to long-term changes in flooding frequency and acreages and distribution of vegetation.

Shasta Lake and Vicinity

As described in Section 12.3, without mitigation, CP1 through CP5 could cause potentially significant effects on botanical and wetland resources in the primary and extended study areas. These effects could be caused by project construction activities; increased elevations of the water surface of Shasta Lake; and alteration of the flow regime of the Sacramento River and associated geomorphic processes, and thus of riparian vegetation. Although causing similar effects, CP1 through CP5 differ in the magnitude of their effects. At Shasta Lake and its vicinity, these potential adverse effects would be similar for all alternatives, but differ with the height of the dam raise: the effects of CP2 and CP4A would be greater than CP1, but less than CP3 through CP5 (which would be identical). Along the upper Sacramento River and in the extended study area, potential adverse effects would be the result of altered flow regimes and would differ with both the height of the dam raise and operation of the dam: the effects of CP2 and CP4A would be greater than CP1 and CP4 (which would be identical), but less than CP3 and CP5 (which also would have identical effects).

At Shasta Lake and vicinity, CP1 through CP5 would cause the loss of MSCS Covered Species, USFS sensitive, BLM sensitive, or CRPR Species, Jurisdictional Waters, and general habitats, and could cause the spread of noxious and invasive weeds. The mitigation measures described in Section 12.3.6 would reduce impacts on botanical and wetland resources. However, the adverse effects of CP1 through CP5 caused by construction activities and inundation would not be eliminated, with the exception of noxious and invasive weed impacts (Impact Bot-6). Because the overall effect of past actions on botanical resources and wetlands has been cumulatively significant, and the likely additional effects of reasonably foreseeable future actions on these at Shasta Lake and in its vicinity, the adverse effects under CP1 through CP5 (except Impact Bot-6) would potentially be cumulatively considerable and these effects would be potentially cumulatively significant. Because mitigation measures to control the spread of weeds would effectively address the project's impact from that mechanism, however, CP1 through CP5 would not make a cumulatively considerable incremental contribution to an overall significant cumulative impact on plants and wetlands from noxious and invasive weeds.

Upper Sacramento River and Extended Study Area

Along the Sacramento River and other rivers downstream from CVP and SWP reservoirs, substantial past alterations to geomorphic processes, vegetation, and associated habitats have resulted in an overall significant and substantial effect on these resources. For example, as a result of past actions, wetland and riparian vegetation occupies less than 10 percent of its historical extent in the Central Valley (DWR 2012). Therefore, additional adverse effects that are considered to have cumulatively considerable incremental contributions would increase the existing significant cumulative impact. This adverse effect would be the result of the continued consequences of past actions (e.g., construction of Shasta Dam and introduction of nonnative species), and of present and foreseeable water resource and levee actions whose adverse effects may not be fully mitigated.

Most adverse effects that are the continued consequences of past actions have been considered in the development of existing local and regional plans. Consequently, with respect to local and regional plans, an overall significant cumulative effect does not already exist. However, the adverse effects of all present and reasonably foreseeable water resources and levee actions are not likely to be avoided or fully mitigated. The unmitigated impact of these actions could be sufficiently considerable to result in a significant cumulative impact overall.

Habitat loss along the upper Sacramento River and in the extended study area already has resulted in an overall effect on sensitive communities and special-status plants that is significant and substantial. (This is the primary reason that a large number of plant species along the upper Sacramento River and in the extended study area have been listed as threatened or endangered by the State or Federal governments, or have been assigned a CRPR by CDFW and CNPS.)

CP1 – 6.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability As described in Chapter 2, "Alternatives," without mitigation, by altering the flow regime and associated geomorphic processes on the Sacramento River, CP1 could affect sensitive plant communities and special-status species (Impact Bot-7 (CP1) and Bot-14 (CP1)) and could potentially affect regional or local plans with objectives of riparian habitat protection or watershed management (Impact Bot-8 (CP1) and Bot-15 (CP1)). These effects could occur on the upper Sacramento River and portions of the lower Sacramento River. Because substantial past alterations to geomorphic processes, vegetation, and associated habitats along the Sacramento River have resulted in an overall significant cumulative effect on these resources, additional incremental adverse effects would likely be cumulatively considerable. However, with the implementation of Mitigation Measure Bot-7 (CP1), adverse effects from CP1 on botanical resources and wetlands along the Sacramento River would be fully mitigated. Thus, CP1 would not result in a cumulatively considerable incremental impact on these resources, and the potential to affect regional or local plans would also be eliminated. Therefore, the impacts of CP1 would not make a cumulatively considerable incremental contribution to a significant cumulative impact.

By altering the flow regimes below CVP and SWP reservoirs in the extended study area, CP1 could possibly cause similar effects on these rivers as along the Sacramento River. (These effects were identified as Impacts Bot-17 (CP1) and Bot-18 (CP1).) However, the alteration of these flow regimes would be less extensive than along the Sacramento River. Even without mitigation, the effects of CP1 on these rivers might not be sufficient to alter the extent or species composition of sensitive communities or to alter the habitats of special-status plant species. In addition, Mitigation Measure Aqua-15 (CP1), "Maintain Flows in the Feather River, American River, and Trinity River Consistent with Existing Regulatory and Operational Requirements and Agreements," would reduce these effects to a level that is unlikely to alter the extent or species composition of sensitive communities or to alter the extent or quality of habitat for special-status plant species. Therefore, the impacts of CP1 would not make a cumulatively considerable incremental contribution to a significant cumulative impact.

By altering flow regimes on the upper Sacramento River, CP1 also could affect designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP1)). However, vernal pool plant communities and associated special-status species likely would not be affected by any of the alternatives. Therefore, the project would not make a cumulatively considerable incremental contribution to a significant cumulative impact on critical habitat for special-status species of vernal pool habitats.

Along the upper Sacramento River and in the extended study area, CP1 could induce growth that results in the loss of sensitive plant communities and special-status plant species (Impacts Bot-10 (CP1), Bot-16 (CP1), and Bot-19

(CP1)). Habitat loss has resulted in an overall significant cumulative effect on sensitive communities and special-status plants that is substantial. (It is the primary reason that a large number of plant species along the upper Sacramento River and in the extended study area have been listed as threatened or endangered by the State or Federal governments, or have been assigned a CRPR by CDFW and CNPS.) CP1 could induce growth-related effects because it would increase water supplies for deliveries to water districts, and this could reduce a limitation on growth. For example, most CVP water supports agricultural purposes, and agricultural acreages are not expected to increase substantially over time.

However, some increment of the CVP water could be used for municipal and industrial contractors, such as Contra Costa Water District or Santa Clara Valley Water District, as would SWP water. In this case, some growth-related effects could occur from development and have an incremental effect on botanical resources and wetlands. Present and foreseeable future projects are also likely to add to this habitat loss. Although the future effects of any growth-related effects induced by CP1 would be analyzed and mitigated during land use planning and environmental review for site-specific development projects, it is unlikely that all effects would be avoided or fully mitigated. Therefore, CP1 would make a small incremental, but cumulatively considerable, contribution to an existing significant cumulative impact. This would be a cumulatively significant and unavoidable impact.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP1 could contribute to potentially significant impacts of climate change on habitat acreages and distribution. Although the mitigation measures listed above would be implemented to reduce project-related impacts of CP1, CP1 would still make a cumulatively considerable incremental contribution to a significant cumulative impact on botanical resources and wetlands. This would be a cumulatively significant and unavoidable impact.

CP2 – 12.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply Reliability The cumulative effects of CP2 would be similar to those of CP1, but greater in magnitude (because CP2 would entail more substantial alterations of flow regimes). Although greater in magnitude than the effects of CP1, the effects of CP2 on sensitive plant communities and special-status species along the upper Sacramento River and in the extended study area (Impacts Bot-7 (CP2), Bot-14 (CP2), and Bot-17 (CP2)), and potential effects on regional or local plans with objectives of riparian habitat protection or watershed management (Impacts Bot-8 (CP2), Bot-15 (CP2), and Bot-18 (CP2)) would not make a cumulatively considerable incremental contribution to a significant cumulative impact, for the same reasons given for CP1.

Similarly, although greater in magnitude than the effects of CP1, the impact of CP2 on designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP2)) would not be a cumulatively considerable incremental contribution to a significant cumulative impact for the same reasons given for CP1.

Also similar to CP1, along the upper Sacramento River and in the extended study area, CP2 could cause growth-related effects that result in the loss of sensitive plant communities and special-status plant species (Impacts Bot-10 (CP2), Bot-16 (CP2), and Bot-19 (CP2)). However, the potential for CP2 to cause growth-related effects would be greater than for CP1. For the same reasons given for CP1, CP2 would make a small incremental, but cumulatively considerable, contribution to an existing significant cumulative impact. This would be a cumulatively significant and unavoidable impact.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP2 could contribute to potentially significant impacts of climate change on habitat acreages and distribution. Although mitigation measures listed above would be implemented to reduce project-related impacts of CP2, CP2 would still make a cumulatively considerable incremental contribution to a significant cumulative impact on botanical resources and wetlands. This would be a cumulatively significant and unavoidable impact.

CP3 – 18.5-Foot Dam Raise, Anadromous Fish Survival and Water Supply
The cumulative effects of CP3 would be similar to those of CP1 and CP2, but greater in magnitude. Although greater in magnitude than the effects of CP1 or CP2 (because CP3 would entail more substantial alterations of flow regimes), the effects of CP3 on sensitive plant communities and special-status species along the upper Sacramento River and in the extended study area (Impacts Bot-7 (CP3), Bot-14 (CP3), and Bot-17 (CP3)), and potential effects on regional or local plans with objectives of riparian habitat protection or watershed management (Impacts Bot-8 (CP3), Bot-15 (CP3), and Bot-18 (CP3)) would not make a cumulatively considerable incremental contribution to a significant cumulative impact, for the same reasons given for CP1.

Similarly, although greater in magnitude than the effects of CP1 or CP2, the effects of CP3 on designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP3)) would not make a cumulatively considerable incremental contribution to a significant cumulative impact, for the same reasons given for CP1.

Also similar to CP1 and CP2, along the upper Sacramento River and in the extended study area, CP3 could cause growth-related effects that result in the loss of sensitive plant communities and special-status plant species (Impacts

Bot-10 (CP3), Bot-16 (CP3), and Bot-19 (CP3)). However, because CP3 would not reserve any storage capacity to specifically focus on increasing M&I deliveries, the potential for CP3 to cause growth-related effects would be less than for CP1 or CP2. For the same reasons given for CP1, CP3 would make a small incremental, but cumulatively considerable, contribution to an existing significant cumulative impact. This would be a cumulatively significant and unavoidable impact.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP3 could contribute to potentially significant impacts of climate change on habitat acreages and distribution. Although mitigation measures listed above would be implemented to reduce project-related impacts of CP3, CP3 would still make a cumulatively considerable incremental contribution to a significant cumulative impact on botanical resources and wetlands. This would be a cumulatively significant and unavoidable impact.

CP4 and CP4A – 18.5-Foot Dam Raise, Anadromous Fish Focus with Water Supply Reliability The cumulative effects of CP4 would be the same as CP1, and the effects of CP4A would be the same as CP2, except that CP4 and CP4A would also result in effects from the gravel augmentation program, and riparian, floodplain, and side channel restoration in the primary study area.

However, the gravel augmentation program, and riparian, floodplain, and side channel restoration actions would not make a cumulatively considerable incremental contribution to a significant cumulative impact on botanical resources and wetlands. These additional actions would not cause growth-related effects or effects on vernal pool habitats, but could affect sensitive plant communities, special-status species, and invasive plants. To sensitive communities, the overall, long-term effect of the gravel augmentation program and riparian, floodplain, and side channel restoration actions would be beneficial, and Mitigation Measure Bot-11 (CP4 and CP4A), Revegetate Disturbed Areas; Consult with CDFW, would substantially reduce the effects of any localized, short-term vegetation removal during their implementation. Without additional mitigation, however, these actions could adversely affect special-status species and facilitate the spread of invasive plants. Implementing mitigation measures Bot-12 (CP4 and CP4A), Conduct Preconstruction Surveys for Special-Status Plants and Avoid Special-Status Plant Populations during Construction, and Bot-13 (CP4 and CP4A), Implement Weed Management Measures and Revegetation, would avoid effects on special-status plants and effectively prevent facilitation of the spread of invasive plants.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high-flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation

and special-status species that would occur with implementation of CP4 or CP4A could contribute to potentially significant impacts of climate change on habitat acreages and distribution. However, the gravel augmentation program and the riparian, floodplain, and side channel restoration actions would not make a cumulatively considerable incremental contribution to a significant cumulative impact on botanical resources and wetlands. The overall, long-term effect of the gravel augmentation program and riparian, floodplain, and side channel restoration actions would be beneficial. Further, the mitigation measures described immediately above would be implemented and avoid effects on special-status plants and effectively prevent facilitation of the spread of invasive plants, including during climate change and an expected increase in high-flow events.

Consequently, the gravel augmentation and riparian, floodplain, and side channel restoration actions would not make a cumulatively considerable incremental contribution to a potentially significant cumulative impact on botanical resources and wetlands.

CP5 – 18.5-Foot Dam Raise, Combination Plan The cumulative effects of CP5 would be similar to those of CP1, CP2, CP3, CP4, and CP4A, but greater in magnitude. Although greater in magnitude than the effects of CP1 through CP4 (because CP5 would entail more substantial alterations of flow regimes), the effects of CP5 on sensitive plant communities and special-status species along the upper Sacramento River and in the extended study area (Impacts Bot-7 (CP5), Bot-14 (CP5), and Bot-17 (CP5)), and potential effects on regional or local plans with objectives of riparian habitat protection or watershed management (Impacts Bot-8 (CP5), Bot-15 (CP5), and Bot-18 (CP5)) would not make a cumulatively considerable incremental contribution to a significant cumulative impact, for the same reasons given for CP1.

Similarly, although greater in magnitude than the effects of CP1 through CP4, the effects of CP5 on designated critical habitat for special-status species of vernal pool habitats (Impact Bot-9 (CP5)) would not make a cumulatively considerable incremental contribution to a significant cumulative impact, for the same reasons given for CP1.

CP5 includes the same gravel augmentation program and riparian, floodplain, and side channel restoration actions included in CP4 and CP4A. For the same reasons given for CP4 and CP4A, the effects of the gravel augmentation program and the restoration actions on sensitive communities, special-status species, and spread of invasive plants would not make a cumulatively considerable incremental contribution to a significant cumulative impact.

Similar to CP1 through CP4, along the upper Sacramento River and in the extended study area, CP5 could cause growth-related effects that result in the loss of sensitive plant communities and special-status plant species (Impacts Bot-10 (CP5), Bot-16 (CP5), and Bot-19 (CP5)). However, the potential for

CP5 to cause growth-related effects would be greater than for CP1 through CP4, because it would result in a greater increase in average annual water deliveries. For the same reasons given for CP1, CP5 would make a small incremental, but cumulatively considerable, contribution to an existing significant cumulative impact. This would be a cumulatively significant and unavoidable impact.

As stated previously, effects of climate change on operations at Shasta Lake could include a higher frequency of high flow events, potentially resulting in changes to downstream vegetation. Potentially significant effects on vegetation and special-status species that would occur with implementation of CP5 could contribute to potentially significant impacts of climate change on habitat acreages and distribution. Although mitigation measures listed above would be implemented to reduce project-related impacts of CP5, CP5 would still make a cumulatively considerable incremental contribution to a significant cumulative impact on botanical resources and wetlands.