6.2 Vegetation and Wildlife

Terrestrial vegetation and wildlife would benefit from each of the CALFED Bay-Delta Program elements. An increase in target habitat supporting plant and wildlife species, including special-status species, is expected as a result of the Ecosystem Restoration Program.

6.2 Vegetation and Wildlife

6.2.1 SUMMARY

The Bay-Delta and other regions in the CALFED Bay-Delta Program (Program) study area contain some of the most varied natural terrestrial habitats and highest biodiversity anywhere in North America. In addition to biological importance, populations of plant and wildlife species are of great importance to the state's economy with respect to commercial and recreational interests. Many of these resources have been severely reduced or degraded by human settlement, population growth, and economic development since the mid-nineteenth century; but they remain a prominent part of California's natural landscape. Populations of diverse plant and animal species are the most healthy and therefore most valuable when the ecological processes that create and maintain habitat are functioning properly. The Program seeks to restore value by improving ecological functions in order to support sustainable plant and wildlife populations.

In addition to biological importance, populations of plant and wildlife species in the Program study area are of great importance to the state's economy with respect to commercial and recreational interests.

Preferred Program Alternative. Terrestrial vegetation and wildlife would benefit from many of the Program elements. The Ecosystem Restoration Program would result in net increases in area for target habitat supporting plant and wildlife species, including special-status species. Measures would protect natural habitats from future activities and would reconstruct the historical pattern of habitats in the Program regions. The Water Quality Program could reduce loading of organic and inorganic constituents, thus reducing bioaccumulation of those compounds in the food web. The Water Use Efficiency and Water Transfer Programs could result in increased quantity or quality of wetland and riparian habitats if water saved or transferred is allocated to restoration of habitat. Watershed restoration projects could improve habitat for target populations (including special-status species), increase habitat diversity, and improve water quality and flow conditions in streams and reservoirs and decrease erosion— thus benefitting vegetation and wildlife in downstream locations. Structural watershed improvements (for example, removing roadways and improving channels) could increase habitat area for natural vegetation and associated wildlife. Implementation of the Levee System Integrity Program would provide long-term protection for existing and restored wetland, riparian, upland, and agricultural habitats. Wildlife habitat on existing levees could be increased where upgraded levees are engineered to allow the establishment of natural habitat. Overall, the Program would increase the quantity and quality of terrestrial habitat compared to the No Action Alternative.

The Program would increase the quantity and quality of terrestrial habitat compared to the No Action Alternative.

Implementation of the Program elements also would cause potentially significant adverse impacts. Adverse effects of the Ecosystem Restoration Program and Watershed Program could include the temporary loss, fragmentation, or disturbance of wetland, riparian, and agricultural wildlife foraging habitats as a result of construction and habitat management (for example, from noise, human activity, and removal of vegetation). These activities also could temporarily disturb special-status species habitat. The Levee System Integrity Program could result in temporary or permanent fragmentation of existing riparian corridors, or loss of adjacent habitat if levee bases are extended. Surface storage reservoirs and associated facilities would permanently inundate existing agricultural, wetland, riparian, annual grassland, woodland, and forest communities that support a variety of species, including special-status species. Storage reservoirs could fragment riparian corridors and wildlife use areas, and disrupt historical wildlife movement patterns. Reservoirs also could cause downstream impacts as a result of sediment supply interruption or alteration of hydrology. Levee setbacks associated with the Conveyance Element could result in habitat loss, as described for the Levee System Integrity Program. Channel dredging would cause temporary impacts in locations where dredged materials are drained.

Alternatives 1, 2, and 3. Except for conveyance elements, Alternatives 1, 2, and 3 would result in similar beneficial impacts as those identified for the Preferred Program Alternative. With the option of no storage for Alternatives 1, 2, and 3, less water may be available for Ecosystem Restoration Program restoration and enhancement. Adverse impacts would be less under Alternatives 1, 2, and 3 if no new storage is developed because habitat loss from inundation would not occur, riparian corridors would not be fragmented, and downstream impacts would not occur. Potential impacts on special-status species from storage facilities also would be avoided. Because Alternative 1 would implement less improvements to channel conveyance in the north Delta, about 4,000-5,000 acres of agricultural habitat would remain unchanged and 3,500 acres of created natural habitat would not occur. Alternative 2 would involve similar conveyance facilities in the Delta Region and therefore similar impacts as those of the Preferred Program Alternative. As described for Alternative 1, Alternative 3 would involve fewer improvements to channel conveyance in the north Delta. However, an isolated open-channel conveyance would be constructed under Alternative 3, resulting in habitat loss of about 1,000 acres over that of the Preferred Program Alternative.

Except for conveyance elements, Alternatives 1, 2, and 3 would result in similar beneficial impacts as those identified for the Preferred Program Alternative. With the option of no storage for Alternatives 1, 2, and 3, less water may be available for Ecosystem Restoration Program restoration and enhancement.

The following table presents the potentially significant adverse impacts and mitigation strategies associated with the Preferred Program Alternative. Mitigation strategies that correlate to each listed impact are noted in parentheses after the impact.

Potentially Significant Adverse Impacts and Mitigation Strategies Associated with the Preferred Program Alternative

Potentially Significant Adverse Impacts

Temporary or permanent loss or disturbance of wetland and riparian communities (1,2,3,4,5).

Temporary or permanent loss or disturbance of wintering waterfowl habitat (6,7,8).

Decrease in important wildlife habitat use areas (1,4, 9).

Temporary or permanent fragmentation of riparian habitats and/or wildlife movement corridors (1,3,4,5,10).

Loss of habitat or direct impacts on special-status species (1,2,3,4,5,11,12,13).

Loss of portions of rare natural communities and significant natural areas (1,2,3,4).

Temporary loss or disturbance to habitat due to construction (1,4,14).

Permanent loss of incidental wetland and riparian habitats that depend on agricultural inefficiencies (3).

Reduction in quantity or quality of forage for species of concern (2,6,7,8,13).

Mitigation Strategies

1. Avoiding wetland and riparian communities or other sensitive habitat.
2. Designing program features to permit on-site mitigation of wetland, riparian, or other sensitive habitat.
3. Restoring or enhancing in-kind wetland and riparian habitat or other sensitive habitat at off-site locations before, or at the time that, project impacts are incurred.
4. Restoring habitat temporarily disturbed by on-site construction activities immediately following construction.
5. Phasing the implementation of Ecosystem Restoration Program actions to offset temporary habitat losses and to restore habitat before, or at the same time that, project impacts associated with the Ecosystem Restoration Program are incurred.
6. Restoring or enhancing waterfowl foraging habitat near existing use areas.
7. Phasing the Ecosystem Restoration Program to initially restore natural waterfowl foraging habitat on agricultural lands with low forage value while restored habitat with high forage value develops.
8. Phasing the Ecosystem Restoration Program to initially restore wetland habitat with high forage value to offset the loss of agricultural foraging habitat that may result from the Ecosystem Restoration Program.
9. Enhancing or restoring habitat areas (including modification of existing land management practices) within affected watersheds or in other watersheds.
10. Phasing the implementation of modifications to levees that would be necessary to meet PL 84-99 standards in order to minimize the effects of fragmentation of riparian habitats and associated wildlife.
11. Avoiding construction or maintenance activities within or near habitat areas occupied by special-status wildlife species during the breeding season or other periods when species may be sensitive to disturbance.
12. Establishing additional populations of special-status species in protected suitable habitat elsewhere within their historical range for species for which relocation or artificial propagation is feasible.
13. Altering agricultural practices to improve habitat conditions for affected special-status species that use agricultural lands. This could include planting and managing crops to increase the availability or quantity of forage for affected species.
14. Implementing BMPs.

Bold indicates a potentially significant unavoidable impact.

6.2.2 AREAS OF CONTROVERSY

Under CEQA, areas of controversy involve factors that are currently unknown or reflect differing opinions among technical experts. Unknown information includes data that are not available and cannot readily be obtained. The opinions of technical experts can differ, depending on which assumptions or methodology they use. Below is a brief description of the areas of controversy for this resource category. Given the programmatic nature of this document, many of these areas of controversy cannot be addressed; however, subsequent project-specific environmental analysis will evaluate these topics in more detail.

There is disagreement within the professional community regarding the potential for success of habitat creation and enhancement, and the ability of created or enhanced habitat to support special-status species.

The Program's position on ecosystem quality is contained in the Program mission statement and objective, contained in Chapter 1.

Success of Habitat Restoration Efforts. There is disagreement within the professional community regarding the potential for success of habitat creation and enhancement, and the ability of created or enhanced habitat to support special-status species. Several ongoing Program activities will address the uncertainty of species and ecosystem responses, including the Strategic Plan for the Ecosystem Restoration Program, the Comprehensive Monitoring and Research Program (CMARP), and the development of a Multi-Species Conservation Strategy (Conservation Strategy). Refer to Section 8.1.2 for a more detailed discussion of the Conservation Strategy.

Confusion exists concerning the relationship of Ecosystem Restoration Program habitat restoration and the separate mitigation that will be necessary for implementation of other Program actions, such as those for water supply reliability and levee system integrity.

Mitigation vs. Ecosystem Restoration Program Implementation. Confusion exists concerning the relationship of Ecosystem Restoration Program habitat restoration and the separate mitigation that will be necessary for implementation of other Program actions, such as those for water supply reliability and levee system integrity. Improvements and increases in aquatic and terrestrial habitats, and improvements in ecosystem function in the Bay-Delta are goals of the Ecosystem Restoration Program. These goals are aimed primarily at the rehabilitation of ecological processes throughout the Bay-Delta and watersheds to the Bay-Delta. The Ecosystem Restoration Program is not designed as mitigation for projects to improve water supply reliability or levee system integrity, or for other Program actions. Separate mitigation measures will be required for proposed actions to improve water supply reliability or levee system integrity, or implementation of other Program elements.

Certain elements in the Ecosystem Restoration Program may conflict with national or state policy.

Conflicts with Current National and State Environmental Policies. Various commentors have identified certain elements in the Ecosystem Restoration Program that may conflict with national or state policy. For example, proposals for reduction of fuel loads in forests and possible impacts on special-status species may conflict with the Endangered Species Act (ESA). A second example is a comment from the Delta Protection Commission that relates to maintaining salinity standards if Delta islands are breached. These issues cannot be resolved at the programmatic level because proposals are not site specific and cannot address individual species' requirements. As specific projects are identified, compliance with existing policies will be addressed.

Potential for Change in the Salinity Regime of the San Francisco Estuary. The comment was made that the EIS/EIR should address impacts on biological resources that may result from increased salinity intrusion when large areas (approximately 10% of the Delta) are restored to tidal action, as proposed in the Ecosystem Restoration Program. The anticipated flow regime (fresh-water inflow) to Suisun Marsh also has been pointed out as an issue that should be addressed.

Salinity standards in the Delta are set by the SWRCB. These standards will be met as long as they are in place, regardless of structural changes initiated under the Program.

Improvements to Water Supply and Reliability Leading to Induced Growth or Planned Growth. Several regional planning agencies disagree with the conclusion that improvements in water supply and reliability would lead to induced growth. Projections by these agencies indicate that growth would occur due to a variety of factors unrelated to water supply and other infrastructure. Planning documents produced by these agencies indicate that planned growth would require water as a mitigation measure. The difference in opinion between the conclusion reached in this document and various planning agencies remains unresolved. This difference in opinion does not change the conclusion reached in the impact analysis—that future growth associated with adequate water supply and reliability would lead to potential adverse impacts on habitat and species.

Several regional planning agencies disagree with the conclusion that improvements in water supply and reliability would lead to induced growth.

Location of Storage Facilities. Various groups have commented that specific locations for storage facilities must be identified for an accurate discussion of environmental impacts. The Program needs additional site-specific information about each storage site before deciding on its preferred sites, which is part of the ongoing Integrated Storage Investigation. This level of detail is not possible or appropriate for the programmatic analysis presented here. The impact analysis does identify that the higher levels of environmental restoration may not be feasible without new storage and improved conveyance.

6.2.3 AFFECTED ENVIRONMENT/ EXISTING CONDITIONS

6.2.3.1 DELTA REGION

Agricultural lands and associated wildlife species dominate habitats in the Delta Region. Agricultural lands occupy approximately 72% of the total land area in the region. The remaining portions of the region contain mostly open-water, wetland, and riparian habitats. Years of agriculture and development in the Delta Region have resulted in the reduction or elimination of many natural habitats and species, especially those associated with native grasslands and tidal wetlands.

Agricultural lands occupy approximately 72% of the total land area in the Delta Region.

Natural and Agricultural Communities. Until the early 1800s, the Delta Region was dominated by approximately 400,000 acres of tidal marshland. The Delta's more than 60 islands were mostly marshy, with some riparian areas and upland shrubs.

Prior to the mid-1800s, agriculture in the Delta Region consisted primarily of dryland farming and irrigated agriculture from artesian wells, groundwater pumping, and some creek canals. By 1900, about one-half of the Delta's historical wetland areas had been reclaimed. Extensive reclamation continued through the 1930s and 1940s. As of 1985, it was estimated that of the original 400,000 acres of tidal marshland about 18,000 acres remained.

Historically, native grasslands and vernal pools occurred in the Delta Region but were not common. As leveed lands and agriculture increased, non-native grasslands emerged in unfarmed areas and abandoned agricultural fields.

Today, the Delta Region contains approximately 546,000 acres of agricultural land that dominate its lowland areas. Other dominant habitats in the region include valley foothill riparian and fresh and saline emergent wetlands. Hundreds of miles of waterways divide the Delta Region into islands, some of which are 25 feet below sea level. The Delta Region relies on more than 1,000 miles of levees to protect these islands. Many species occurring in the Delta Region have survived changes and reductions to their habitats, including reductions in their ranges and breeding populations. Many species have adapted to agricultural land uses, although agricultural lands often do not supply all life cycle requirements.

Major Delta Region crops and cover types in agricultural production include small grains (such as wheat and barley), field crops (such as corn, sorghum, and safflower), truck crops (such as tomatoes and sugar beets), forage crops (such as hay and alfalfa), pastures, orchards, and vineyards. Vegetable crops are the most abundant crops in the region. The distribution of seasonal crops in the Delta Region varies annually, depending on crop-rotation patterns and market forces. Recent agricultural trends in the Delta include an increase in the acreage of orchards and vineyards.

Grassland and ruderal habitats are present throughout the Delta Region. Although typically small, these habitats can provide relatively high wildlife values because intensive and extensive agriculture have greatly reduced the available natural upland habitats. The extent of use by wildlife depends on the type of vegetation present and the adjacent land uses. Vernal pools that occur in grasslands along the fringes of the Delta Region support a wide diversity of native plants and invertebrates. In particular, the Jepson Prairie Preserve contains vernal pools that support several special-status species.

Although typically small, the grassland and ruderal habitats can provide relatively high wildlife values because intensive and extensive agriculture have greatly reduced the available natural upland habitats.

Riparian scrub and woodland areas typically occur on channel islands on levees and along unmaintained, narrow channel banks of Delta Region creeks, waterways, and major tributaries. The major rivers of the Delta Region include the Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras. Approximately 7,000 acres of riparian vegetation occur primarily on the levees of Delta islands and along the Cosumnes and Mokelumne Rivers. The riparian zone along leveed islands is usually very narrow, but more extensive

riparian areas occur along the San Joaquin River just below its confluence with the Stanislaus River and along the Cosumnes River.

Seasonal fresh-water wetlands include inland fresh-water marshes that maintain surface water during only a portion of the year and vernal pools associated with grasslands. Seasonal wetland conditions also are created when harvested cornfields are flooded in the Delta Region during fall and winter to reduce soil salinity and control weeds. Large seasonal wetlands managed for waterfowl are located in the northwestern part of the Delta Region, west of the Sacramento Deep Water Ship Channel. These seasonal fresh-water wetlands are of great importance to migratory waterfowl and shorebird populations for the forage that they provide during fall, winter, and spring—when bird populations in the Delta increase dramatically.

Seasonal wetland conditions also are created when harvested cornfields are flooded in the Delta Region during fall and winter to reduce soil salinity and control weeds.

Nontidal fresh-water marsh occurs on the landward side of Delta Region levees and in the interiors of Delta Region islands, mostly in constructed waterways and ponds in agricultural areas. Dominant nontidal fresh-water marsh species include tule (*Scirpus* sp.), bulrush (*Scirpus* sp.), cattail (*Typha* sp.), watergrass (*Echinochloa crusgalli*), and nutgrass (*Cyperus* sp.). Common floating aquatic species include pretty water smartweed (*Polygonum amphibium*) and water weed (*Elodea* sp.).

Tidal fresh-water and brackish-water emergent marsh habitat is dominated by tules (*Scirpus* spp.) and cattails (*Typha* spp.), with common reed (*Phragmites australis*), buttonbush (*Cephalanthus occidentalis*), sedges (*Carex* spp.), and rushes (*Juncus* spp.). This habitat occurs on in-stream islands and along mostly unleveed, tidally influenced waterways. Tidal emergent marsh provides habitat for many species, including the following special-status species: Mason's lilaeopsis (*Lilaeopsis masonii*), Delta mudwort (*Limosella subulata*), California hibiscus (*Hibiscus lasiocarpus*), Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), California black rail (*Laterallus jamaicensis coturniculus*), and tricolored blackbird (*Agelaius tricolor*).

Open water in the Delta Region includes sloughs and channels in the Delta, flooded islands, ponds, and bays. Deep open-water areas are largely unvegetated; beds of aquatic plants occasionally occur in shallower open-water areas. Typical aquatic plant species include water hyacinth (*Eichhornia crassipes*, a non-native noxious weed) and water milfoil (*Myriophyllum* sp.). Open water provides resting and foraging habitat for water birds, including loons (*Gavia* sp.), pelicans (*Pelecanus* sp.), gulls (*Larus* sp.), cormorants (*Phalacrocorax* sp.), and diving ducks. These species forage primarily on invertebrates and fish.

Special-Status Species. Prior to agricultural development and reclamation of wetland habitats, the Delta Region contained diverse communities of wetland, riparian, and upland plant species. The relatively small portions of native grassland and upland areas were among the first areas of the Delta Region to be converted to agricultural lands.

The Delta Region once supported more than 250 species of wildlife, including large mammal species such as the grizzly bear and gray wolf. Several species that historically were present in the Delta Region are now extinct from the region. The Ecosystem

Restoration Program would evaluate the appropriateness of restoring experimental populations of extirpated species.

Generally, the existing distribution of plant and animal species in the Delta Region is closely linked with the distribution of one or more habitat types on which a species depends. Dozens of special-status plants and wildlife occur in the Delta Region. Most of the special-status species occur in grassland and vernal pools. The remaining special-status plants occur in the region's other habitat types.

Generally, the existing distribution of plant and animal species in the Delta Region is closely linked with the distribution of one or more habitat types on which a species depends.

Most of the special-status wildlife species are associated with fresh-water emergent wetlands, marshes, open water, and agricultural lands.

Vernal pools and other fresh-water seasonal wetlands support several special-status crustaceans, including tadpole shrimp (*Lepidurus packardi*) and fairy shrimp (*Branchinecta lynchi*). Although severely declining due to a dramatic shrinkage of suitable habitat, the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*, which is federally listed as threatened) has been found in the Delta Region on McCormack-Williamson and New Hope Tracts. Several special-status invertebrates occur in the Antioch Dunes area.

See the Conservation Strategy for more detail on special-status species.

Waterfowl and Shorebirds. Resident and migratory waterfowl and shorebirds suffered perhaps the largest declines resulting from development and agriculture in the Delta Region. The declines in resident and migratory waterfowl populations before the early twentieth century have been attributed to hunting and the large-scale reclamation of tidal marshes that occurred between 1860 and 1910. Loss of wetlands in other portions of the state also contributed to these declines.

Resident and migratory waterfowl and shorebirds suffered perhaps the largest declines resulting from development and agriculture in the Delta Region.

Changes in agricultural cropping patterns since the 1970s have increased the quality of waterfowl and shorebird habitat in the Delta Region. As a result, populations of waterfowl and shorebirds in the Delta have been increasing.

Waterfowl and shorebirds forage primarily in natural and artificial wetlands and agricultural lands. The Delta supports approximately 10% of the Central Valley's wintering waterfowl and shorebird populations. Several waterfowl species are particularly dependent on the Delta, including tundra swans (*Cygnus columbianus*), white-fronted geese (*Anser albifrons*), snow geese (*Chen caerulescens*), greater sandhill cranes (*Grus canadensis*), northern pintails (*Anas acuta*), and mallards (*Anas platyrhynchos*).

More than 30 species of shorebirds regularly use the Delta Region. Six species nest in the Delta Region, and the rest overwinter there or pass through during spring and fall migration. During the 1992-93 winter, 28,500 shorebirds were counted in the Delta Region, primarily dunlins (*Calidris alpina*) and long-billed dowitchers (*Limnodromus scolopaceus*). Shorebirds prey extensively on invertebrates. Important foraging habitats include permanent saline, brackish, and fresh-water marshes; seasonal wetlands; and agricultural cropland.

6.2.3.2 BAY REGION

The Bay Region includes the entire watershed for the San Francisco Bay (exclusive of the Delta and its tributary watersheds). Issues associated with the Program occur primarily in the area of Suisun Marsh, Suisun Bay, and northern San Pablo Bay. Therefore, the description of existing conditions focuses on these areas.

Suisun and San Pablo Bays support large areas of tidal flats that provide important foraging habitat for shorebirds. Suisun Marsh supports saline emergent wetland, which provides habitat for salt marsh species that prefer infrequently flooded salt marsh habitat, and coastal brackish marsh, which provides habitat for species that prefer tidal marshes with lower salinity.

The Bay Region is dominated by open water; tidal flats; diked managed wetlands; and some non-leveed lowlands, which support wetlands that change in character from salt marsh (in the western portions) to brackish marsh (in the eastern portions). The sections below describe the vegetation and wildlife resources for the entire watershed of the Bay Region.

Marsh reclamation and water diversions have not been as severe in the Bay Region as in the Delta Region, but extensive hydraulic mining upstream during the late 1800s resulted in the deposition of millions of cubic yards of sediment and debris into low-lying areas and channels in the Bay Region.

Wetland and terrestrial habitats in the Bay Region have undergone changes over time as a result of marsh reclamation, water diversions, industrialization, and the effects of sedimentation caused by hydraulic mining. Marsh reclamation and water diversions have not been as severe in the Bay Region as in the Delta Region, but extensive hydraulic mining upstream during the late 1800s resulted in the deposition of millions of cubic yards of sediment and debris into low-lying areas and channels in the Bay Region.

Natural and Agricultural Communities. Until the early nineteenth century, the Bay Region was dominated by very large, productive wetlands and tidal flats, with deeper channels and open-water areas that drained over 40% of the state. Although these communities are still present in the region, they have been reduced in size by agricultural development and industry.

The greatest adverse effect on natural communities in the Bay Region was the removal of tidal influence. The placement of levees between many wetland areas and the channels prevented water from reaching communities at the higher elevations in the wetlands as it had before when the waters advanced and subsided. Many species in these natural communities could no longer survive and perished. Some of these areas now support agricultural grain production.

The greatest adverse effect on natural communities in the Bay Region was the removal of tidal influence.

The hydraulic mining practices in upstream watersheds in the Bay Region resulted in the deposition of millions of cubic yards of sediment and debris. In addition to adversely affecting the numerous wetlands in the region, this sedimentation reduced channel depths, making dredging necessary to keep the waterways navigable.

Today, the Bay Region contains extensive areas of tidal flats remaining from pre-settlement eras. Tidal flats include shoals, sandy mud bars, and portions of stream

beds that are exposed at low tide. Tidal flats are largely unvegetated, although some emergent vegetation may be present. Bay Region tidal flats provide resting and foraging habitat for several bird groups. California (*Larus californicus*) and ring-billed gulls (*Larus delawarensis*) use tidal flats as resting areas. During spring and fall migration, large numbers of shorebirds congregate to forage on invertebrates in and on tidal flat substrates. Mammals such as raccoons (*Procyon lotor*) and skunks (*Spilogale* and *Memphitis* sp.) also forage on Bay Region tidal flats.

Saline emergent wetland is confined to the Suisun Bay/Marsh boundaries and along the northern shore of San Pablo Bay. Common plant species associated with saline emergent wetland include cordgrass (*Spartina* sp.), pickleweed (*Salicornia* sp.), and saltgrass (*Distichlis spicata*). Each plant species typically occupies a specific elevational band in relation to the mean tidal water level. Unmanaged coastal brackish marsh occurs along sloughs and channels of Suisun Marsh, and is dominated by tules and cattails. The largest extent of wetlands in Suisun Marsh consists of fresh-water and brackish marshes that are managed mostly as waterfowl habitat.

Saline emergent wetland is confined to the Suisun Bay/Marsh boundaries and along the northern shore of San Pablo Bay.

Upland communities exist on hills and plateaus that surround the Bay Region lowlands. The dominant community in these areas is non-native grassland, with a varied shrub and oak overstory. Agricultural uses in these areas include cattle grazing and vineyards.

Special-Status Species. Prior to agricultural development and settlement in the Bay Region, diversity of plant species was higher than it has been since, but was never as high as in the Delta Region (although the two regions shared many of the same species). Many species were dependent on the tidally influenced lowlands.

Many, if not all, of the large mammals once present in the Delta Region also historically were present in the Bay Region. These species met similar fates. Habitat fragmentation and destruction, as well as subsistence and market hunting, combined to eliminate many species from the Bay Region. Some species that used the higher upland and cliff parts in the region lingered for some time into the twentieth century but eventually were driven off by activities associated with continued industrial and residential development.

Habitat fragmentation and destruction, as well as subsistence and market hunting, combined to eliminate many large mammal species from the Bay Region.

Dozens of special-status wildlife and plants occur in the Bay Region. The saline and brackish emergent marsh habitat of Suisun Marsh supports populations of plant species that are federally listed as endangered, including the Suisun thistle (*Cirsium hydrophilum* var. *hydrophilum*) and soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*). Mason's lilaeopsis (*Lilaeopsis masonii*) (state listed as rare, no federal listing status) occurs in brackish or fresh-water tidal marshes of Suisun Bay/Marsh.

The majority of special-status wildlife species are associated with upland grasslands and fresh-water emergent wetlands, and are restricted in their range because of the fragmentation and low diversity of habitats. Species such as the bald eagle (*Haliaeetus lencocephalus*) and peregrine falcon (*Falco mexicanus*) are seasonal visitors to the Bay Region. Two federally listed and state-listed endangered species occur in saline emergent wetlands in the Bay Region: the salt marsh harvest mouse (*Reithrodontomys raviventris*) and the California clapper rail (*Rallus longirostris obsoletus*). The salt marsh harvest mouse

is known from occurrences in Suisun Marsh, islands in Suisun Bay, and saline emergent marshes south of Suisun Bay. The California clapper rail is known from occurrences in Suisun Marsh and islands in Suisun Bay. California black rails (*Laterallus jamaicensis coturniculus*) occur in saline emergent wetlands of Suisun Marsh, islands of Suisun Bay, and saline emergent marshes along the Contra Costa shoreline. California black rails are state listed as threatened. The salt marsh common yellowthroat (*Geothlypis trichas sinuosa*) uses the tall emergent vegetation that grows in the more brackish areas.

See the Conservation Strategy for more detail on special-status species.

Waterfowl and Shorebirds. The Bay Region has always been a major waterfowl and shorebird area due to the presence of its wetlands and the extensive open-water habitats. As with the Delta Region, the Bay Region suffered losses of wetlands and subsequently waterfowl and shorebirds, beginning in earnest during the 1800s. Development, agriculture, and water diversions were not as extensive as those in the Delta Region. Therefore, losses of waterfowl and shorebirds in the Bay Region, although severe at times, never reached the extent that occurred in the Delta Region. Much of the decline in waterfowl numbers in the Bay Region during the nineteenth and twentieth centuries can be attributed to losses incurred in other portions of the state.

The Bay Region is a particularly important area for shorebirds, supporting more shorebirds than all other California coastal wetlands combined.

Today, the Bay Region is an important waterfowl area for the Pacific Flyway and may contain more than 1 million birds as they migrate through the area. Mid-winter waterfowl surveys in 1991 estimated nearly 268,700 waterfowl in the entire Bay Region, including approximately 265,000 ducks—primarily scaups (*Aythya* sp.), scoters (*Melanitta* sp.), canvasbacks (*Aythaya valisineria*), ruddy ducks (*Oxyura jamaicensis*), and northern pintail (*Anus acuta*).

The Bay Region is a particularly important area for shorebirds, supporting more shorebirds than all other California coastal wetlands combined. An estimated 300,000-400,000 shorebirds in fall, and from 600,000 to 1 million shorebirds in spring, can be found in the region.

6.2.3.3 SACRAMENTO RIVER REGION

Grasslands and wooded upland communities are more abundant in Sacramento River Region than in the Delta and Bay Regions. Agricultural lands also occupy a significant portion of the region.

The Sacramento River Region contains the entire drainage of the Sacramento River and its tributaries, and extends from Collinsville in the south to the Oregon border in the north. The Sacramento River Region contains a large diversity of both lowland and upland habitats and species. Along most of the Sacramento River and its tributaries remnants of riparian communities are all that remain of once very productive and extensive riparian areas. However, along the upper reaches of the Sacramento River more riparian vegetation is still intact. Wetlands occupy many areas along Sacramento River Region waterways but are not as extensive as wetlands found in the Delta Region. On the other hand, grasslands and wooded upland communities are more abundant in this region than in the previously described Delta and Bay Regions. Agricultural lands also occupy a significant portion of the Sacramento River Region. Open-water areas occur mainly on

the larger waterways, where waterways converge, and in reservoirs. The sections below describe the vegetation and wildlife resources for the upper and lower watershed areas in the region.

See the Conservation Strategy for more detail on special-status species.

Natural and Agricultural Communities. Perhaps the most drastic difference between historical and existing conditions in the Sacramento River Region is the reduction of lush, unbroken riparian areas. Development, dams, agriculture, fuel, and construction needs removed and fragmented most riparian areas, especially between the early nineteenth and mid-twentieth centuries. Native perennial grasslands covered vast areas in the region but have since been farmed or invaded by non-native annuals.

Perhaps the most drastic difference between historical and existing conditions in the Sacramento River Region is the reduction of lush, unbroken riparian areas.

Low-lying areas in the region once were routinely flooded, replenishing nutrients and providing water to many portions of the region not situated along waterways. However, diking and construction of levees to protect agricultural lands and residential areas have changed this, and many former communities dependent on regular floods perished. Marshes and emergent wetlands were never as abundant in the Sacramento River Region as in the Delta and Bay Regions due to inherent differences in the geomorphology of the regions. Vernal pools are important wetland resources that were historically abundant and have decreased dramatically with agriculture and development in the last two centuries.

The higher elevations in the Sacramento River Region are dominated by conifers and hardwoods. These areas have sustained some development and logging but have suffered less of a decline than the other communities in the region.

Special-Status Species. Prior to the habitat and community changes resulting from settlement and development of the Sacramento River Region, several plants and animals were present that have since been extirpated from the region. Over 100 special-status wildlife and plants occur in the Sacramento River Region. The largest number of special-status plant species in this region occurs in grassland, which includes vernal pools. The next-largest number of special-status plant species occurs in chaparral and montane hardwood.

Many of the special-status species in the region have been listed by federal and state wildlife agencies because of habitat loss associated with agricultural development and water projects.

The majority of the special-status wildlife species are associated with grasslands, fresh-water emergent wetlands, lakes, and rivers on the valley floor. Many of these species have been listed by federal and state wildlife agencies because of habitat loss associated with agricultural development and water projects.

See the Conservation Strategy for more detail on special-status species.

Waterfowl and Shorebirds. Waterfowl in the Sacramento River Region outnumber shorebirds. Populations of both groups have fluctuated over the last two centuries due to market hunting, conversion of natural habitat to agricultural and urban uses, weather conditions, and conditions on breeding grounds. Market hunting until the 1920s affected many waterfowl populations in the Sacramento River Region. Conversion of natural

Waterfowl in the Sacramento River Region outnumber shorebirds.

habitats to agricultural and urban uses, and drought conditions contributed to declines in numbers of waterfowl and shorebirds using the Sacramento River Region. After the mid-1930s, waterfowl populations increased in the Sacramento River Region. Favorable weather patterns on the Canadian breeding grounds and a reduction in hunters during World War II may have contributed to these increases. Also, labor shortages extended the time required for harvesting rice and other grains, which provided additional forage for waterfowl. Declines in Sacramento River Region waterfowl and shorebird populations due to unfavorable conditions on their breeding grounds occurred during the late 1950s and during the mid-1980s. Populations recovered appreciably after these periods of decline.

Today, private duck clubs and state and federal refuges in the Sacramento Valley provide essential habitat for wintering waterfowl and shorebirds in the Sacramento River Region. Approximately 60% of the Pacific Flyway waterfowl population winters in the Sacramento Valley.

Sacramento Valley wetlands also provide important habitat for shorebirds. The Sacramento Valley is particularly important to shorebirds in spring, when shorebirds use wetlands in the valley as staging areas during migration to northern breeding grounds.

6.2.3.4 SAN JOAQUIN RIVER REGION

The San Joaquin River Region's riparian regions are not and have never been as extensive as those found in the Sacramento River Region; the San Joaquin River Region holds more land devoted to agriculture.

The San Joaquin River Region has many similarities to the Sacramento River Region, including terrain, climate, habitats, and species. Historical and present differences between the two regions do exist, however. For example, the San Joaquin River Region's riparian regions are not and have never been as extensive as those found in the Sacramento River Region; the San Joaquin River Region holds more land devoted to agriculture. Many riparian communities in the region were lost when historical waterways ran dry as water was diverted through irrigation channels and artificial drainages. Isolated riparian communities exist in the lower portions of the San Joaquin River Region, and more intact communities can be found along the eastern reaches in the region. Wetlands are situated in the northern and western reaches in the region but are less abundant in other parts of the region. The section below describes the vegetation and wildlife resources for the upper and lower watershed areas in the San Joaquin River Region.

Historically, the lowlands were a large floodplain in the San Joaquin River that supported vast expanses of permanent and seasonal marshes, lakes, and riparian areas.

Natural and Agricultural Communities. As with the Sacramento River Region, the San Joaquin River Region has lost most of its historical riparian areas, mostly due to agriculture. Agriculture developed early and quickly in the region and has remained the dominant land use. Historically, the lowlands were a large floodplain in the San Joaquin River that supported vast expanses of permanent and seasonal marshes, lakes, and riparian areas. Almost 70% of the lowlands have been converted to irrigated agriculture, with wetland acreage reduced to 120,300 acres.

Upland shrubs and oak woodlands that surround the San Joaquin River Region to the east, west, and south are less intact today than they were prior to the twentieth century.

Development and water diversions adversely affected some communities in these areas. Wetland areas were once very common in the northern, southern, and parts of the western reaches of the San Joaquin River Region; but since the mid-nineteenth century wetlands have been reduced to a fraction of their historical acreage by minerals, salts, pesticides, diversions, and reclamation activities.

Special-Status Species. Similarly to all of the other Program regions, changes in the natural landscape of the San Joaquin River Region took their toll on plant and wildlife species. Over 100 special-status wildlife and plants occur in the San Joaquin Rive Region. The largest number of special-status plant species occurs in grassland and valley foothill woodland.

Most of the special-status wildlife species are associated with grasslands, fresh-water emergent wetlands, lakes, and rivers that occur on the valley floor. Many of the species have been listed by federal and state wildlife agencies because of habitat losses associated with agricultural development and water projects.

See the Conservation Strategy for more detail on special-status species.

Waterfowl and Shorebirds. Waterfowl and shorebird numbers in the San Joaquin River Region historically were greater than those for the Sacramento River Region. In addition to the factors that reduced waterfowl and shorebird populations in the Sacramento River Region, the loss of additional wetlands in the San Joaquin River Region due to the accumulation of minerals and pesticides resulted in a compounded detrimental effect on waterfowl and shorebird numbers. Initially, waterfowl and shorebird recovery in the San Joaquin River Region was not as successful as in the Sacramento River Region. Recent efforts to restore damaged wetlands, prevent harmful runoff from entering the wetlands, and manage agricultural lands to favor waterfowl and shorebirds during winter have aided the recovery of these species in the region. The San Joaquin River Region supports approximately 25% of the Central Valley waterfowl and shorebird populations, and up to 30% of the wintering duck population.

Waterfowl and shorebird numbers in the San Joaquin River Region historically were greater than those for the Sacramento River Region. Currently, the San Joaquin River Region supports approximately 25% of the Central Valley waterfowl and shorebird populations, and up to 30% of the wintering duck population.

6.2.3.5 Other SWP and CVP Service Areas

The Other SWP and CVP Service Areas region includes two distinct, noncontiguous areas: in the north, are the San Felipe Division's CVP service area and the South Bay SWP service area; to the south, are the SWP service areas. The northern section of this region encompasses parts of the central coast counties of Santa Clara, San Benito, Santa Cruz, and Monterey. The southern portion includes parts of Imperial, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura Counties.

The Other SWP and CVP Service Areas contain a large diversity of both lowland and upland habitats and species. Urban growth has reduced the area and connectivity of important habitats that are critical to sustaining a wide variety of unique plants and

Urban growth in the Other SWP and CVP Service Areas has reduced the area and connectivity of important habitats that are critical to sustaining a wide variety of unique plants and animals.

animals. The conflict between urban growth and conservation of native habitat has resulted in the listing of a number of plants and animals that were threatened with extinction. In response, local land use agencies working with state and federal fish and wildlife agencies, and development and environmental stakeholders have initiated and begun to implement large-scale conservation planning efforts to reduce the conflicts between development and recovery of listed species.

The most dramatic difference between historical and existing conditions is the fragmentation of what were once large contiguous blocks of habitat, such as chamise-redshank chaparral, coastal sage scrub, grassland, oak woodland, oak savanna, southern oak woodland-forest, riparian woodland-forest, succulent scrub, sand dune habitat, alkali desert scrub, desert riparian habitat, desert wash, fresh-water/salt-water marsh, and coastal strand. These habitats were located in three subareas: the Central Coast Service Area, South Coast Service Area, and Southern Deserts Service Area.

Natural and Agricultural Communities. Significant changes to the natural landscape in the region occurred in the late 1800s and early 1900s with land conversions to agriculture, a pattern similar to the San Joaquin River Region. That pattern shifted dramatically compared to the San Joaquin River Region, as urban growth in the region that started in the 1900s began to displace agricultural lands and convert large areas of remaining native habitats.

Special-Status Species. Similarly to the San Joaquin River Region, changes in the natural landscape in the Other SWP and CVP Service Areas took a toll on plant and wildlife species. The California condor, light-footed clapper rail, California least tern, least Bell's vireo, Belding's savannah sparrow, southwestern willow flycatcher, California gnatcatcher, Mohave ground squirrel, Morro Bay kangaroo rat, Santa Ana River woollystar, and Santa Ynez false-lupine are examples of species that have been listed.

6.2.4 ASSESSMENT METHODS

The plant community classification system that is used is a modified Holland system. Generally, impacts are assessed at the community level. This community approach assumes that those species dependent on a plant community generally would be affected in the same direction by a particular Program action; that is, if a plant community is adversely affected, the associated plants and animals most likely would be similarly affected.

Generally, impacts are assessed at the community level. This community approach assumes that those species dependent on a plant community generally would be affected in the same direction by a particular Program action.

Some Program actions could directly affect specific environmental variables, such as flow, water quality, and substrate. Changes in these environmental variables could affect plant communities by changing rates of erosion, sedimentation, or water availability; by directly creating new plant communities; or by removing, converting, or fragmenting existing communities. These impact mechanisms may cause changes in the quality or quantity of plant communities and associated wildlife. Changes also may affect the number of wildlife special-status species or the area or quality of rare natural communities

by altering existing foraging, living, and breeding areas. These changes in quality and quantity are the measures used to determine impacts of the alternatives being considered. At the next level of analysis (site specific) the interactions between quantity and quality, or habitat and temporal scale and disturbance regimes associated with habitat quality will be evaluated. Indirect impacts, such as noise or human disturbance, also could affect habitat quality but cannot be used to differentiate between alternatives at the programmatic level.

Several general categories of impact measures were used to assess the level of impact of the Program alternatives on vegetation, wildlife, and special-status species, including:

- Area of natural plant communities, including associated wildlife and plant species.
- Quality of natural plant communities, including the associated wildlife and plant species, and changes in non-indigenous and introduced species.
- Area and quality of agricultural land providing habitat value.
- Habitat patterns for plant communities (for example, spatial orientation of habitats, connectivity, and landscape-level diversity).
- Number of known special-status species or areas with a critical habitat designation.
- Area and quality of plant communities occupied by special-status species.
- Area and quality of rare natural communities or significant natural areas.

Two types of analysis have been included to address plant communities and associated wildlife species: (1) changes in areal extent due to direct increase, loss, or conversion; and (2) changes in quality. Changes to the areal extent of vegetation have been defined and analyzed using various tools in geographic information system (GIS) and hard-copy mapping that focus primarily on spatial analysis of a plant community area. The change in acreage of each plant community is used as the quantitative measure of impacts on wetland and terrestrial habitats, associated vegetation and wildlife, or species groups. The assessment of qualitative impacts on plant communities considers geographic extent, distribution, quality, and spatial configuration. A project that affects the continuity of a linear riparian plant community or drainage patterns in wetlands, for example, may result in a greater impact than those resulting from changes in areal extent. The severity of impacts is determined by the magnitude of changes in quality or condition of the plant communities.

Two types of analysis have been included to address plant communities and associated wildlife species: (1) changes in areal extent due to direct increase, loss, or conversion; and (2) changes in quality.

Geographic comparisons have been made using electronic databases and hard-copy maps of plant community distributions. Results of this analysis provided information on the likelihood of affecting a given plant community or special-status species with the implementation of a particular alternative.

The best available information has been used for special-status species. The DFG's National Diversity Data Base (NDDB) location information on special-status plants and animal species has been used in the analysis.

Approximate impact footprints corresponding to proposed alternative features were generated using GIS and the NDDB. A list of special-status plant and animal species potentially occurring within these footprints was produced.

The habitat requirements of each species, as defined in the literature (RAREFIND and California Native Plant Society data bases 1997), were used to evaluate the effect of changes resulting from alternative features on these special-status species. Each species was identified as potentially being either positively affected, negatively affected, or not significantly affected (more information can be found in the March 1998 Vegetation and Wildlife Technical Report). Mitigation strategies are presented that would minimize or eliminate these negative impacts.

It was assumed that the distribution and abundance of special-status species is proportional to the amount and quality of habitat available. Assessment of impacts is based on the potential of a Program action to affect a special-status species, its critical habitat, or its range.

It was assumed that the distribution and abundance of special-status species is proportional to the amount and quality of habitat available.

Rare natural communities and significant natural areas were treated qualitatively, in part because specific data on the location of the project features in relation to specific areas or communities were not generally available. DFG mapping of vernal pools, and the NDDB and files were used to obtain some quantitative information regarding effects on rare natural communities.

6.2.5 SIGNIFICANCE CRITERIA

The significance of any of the Program actions would vary, depending on the environmental setting in which the activity occurs. Thresholds of significance for a given impact may include flexible standards that recognize differences in the environmental setting. Thresholds also may be qualitative or quantitative. The general nature of the planning and the broad range of settings and impacts dictate the use of qualitative thresholds of significance at this programmatic stage. The thresholds can and will be made more definitive and more quantitative at the project-specific level.

The significance criteria identified for evaluation of impacts on vegetation and wildlife resources are:

- Temporary or permanent removal, filling, grading, or disturbance of wetlands and riparian communities (for criteria related to agricultural crop loss, refer to Section 7.1, "Agricultural Land and Water Use").

- Substantial decreases in the size of important wildlife habitat or use areas in watersheds of major tributaries to the Sacramento and San Joaquin Rivers.
- Substantial fragmentation or isolation of wildlife habitats or movement corridors, especially riparian and wetland habitats.
- Decrease in the amount of available forage, including forage from agricultural lands for wintering waterfowl.
- Increase in the potential for outbreaks of wildlife diseases.
- The permanent loss of occupied special-status species habitat or direct mortality of special-status species.
- Reduction in the area or extent of special-status communities.
- Reduction in the area or habitat value of critical habitat areas designated under the federal ESA.

6.2.6 NO ACTION ALTERNATIVE

6.2.6.1 DELTA REGION

Although project operations and surface water and groundwater storage would change under the No Action Alternative, Delta inflow and outflow most likely would be similar to flows under existing conditions. Project operations rules and demands, similar under both the No Action Alternative and existing conditions, would limit the ability to change flow patterns and the associated salinity distribution in the Delta. The quantity and quality of wetland and riparian vegetation in the Delta would diminish over time as other non-Program projects are implemented. Changes that could occur are not quantifiable at a programmatic level of analysis.

Although project operations and surface water and groundwater storage would change under the No Action Alternative, Delta inflow and outflow most likely would be similar to flows under existing conditions.

Sediment supply and movement could be affected by the Delta Levees Subvention Project and actions upstream of the Delta, including land retirement and the Sacramento River Flood Control Project (SRFCP). None of the projects would substantially change the structure of the existing ecosystem, and change in sediment supply and movement most likely would be minimal. Any changes to the quantity or quality of habitat cannot be quantified at this programmatic level of analysis.

Contaminant input and movement could be reduced by land retirement from the San Joaquin drainage problem lands and, possibly, by restoration associated with the Stone Lakes NWR. Contaminant input under the 2020 level of development, however, could increase or decrease. Relative to existing sources of contaminants, the change in contaminant input most likely would be small. Change in flow also could affect the

movement and dilution of contaminants; however, information on flow change is currently unavailable.

Productivity and nutrient input is affected by the processes discussed above and the changes in structural characteristics described below. Relative to existing conditions, projects under the No Action Alternative that could increase biological productivity and nutrient input, and movement in the terrestrial ecosystem include changes in wildlife refuge operations and restoration associated with the Stone Lakes NWR, Delta Levees Subvention Project, and SRFCP. Restoration of riparian, shaded riverine aquatic, and tidal marsh areas could slightly increase productivity through increased production and input of organic carbon, and could provide a small benefit to Delta species.

Structural characteristics of the Delta would be similar for both the No Action Alternative and existing conditions. Projects that could affect structural characteristics of the Delta ecosystem and species habitat include the Delta Levees Subvention Project and Stone Lakes NWR. Change in structural characteristics is considered a beneficial effect when the change moves toward a natural condition. Restoration of tidal marsh and connecting sloughs in the Stone Lakes NWR, and changes in levee maintenance practices to allow development of natural riparian and marsh communities would result in a small beneficial effect relative to the existing Delta system. For example, an additional 1,300 acres of habitat added to the Stone Lakes NWR under the No Action Alternative would benefit several plant communities (including wetlands) by assisting the recovery of special-status species and adding linkage between refuge habitats.

Structural characteristics of the Delta would be similar for both the No Action Alternative and existing conditions.

6.2.6.2 BAY REGION

Under the No Action Alternative, effects on vegetation and wildlife communities in the Bay Region primarily would depend on the movement of contaminants, sediment, nutrients, and production from the Delta Region. The small increase in productivity and nutrient input identified for the Delta could be transported to the Bay and provide small benefits to the wetlands and adjacent upland habitats surrounding waters in the Bay Region.

6.2.6.3 SACRAMENTO RIVER REGION

Although operations and surface water and groundwater storage would change under the No Action Alternative, Sacramento River and tributary flows most likely would be similar to flows under existing conditions. Project operations rules and demands, similar under both the No Action Alternative and existing conditions, would limit the ability to change flow patterns. Changes to the quality and quantity of riparian and wetland communities would be small, and not measurable at a programmatic level of analysis.

Although operations and surface water and groundwater storage would change under the No Action Alternative, Sacramento River and tributary flows most likely would be similar to flows under existing conditions.

The SRFCP could affect structural characteristics of the Sacramento and American Rivers. Change in structural characteristics is considered a beneficial effect when the

change moves toward a more natural condition. Changes in levee maintenance practices to allow development of natural riparian and shaded riverine aquatic communities would result in small benefits relative to the existing levee system. The structural changes could result in a slight increase in the quantity and quality of habitats that support species (including special-status species) that are associated with riparian and shaded riverine terrestrial habitats.

6.2.6.4 SAN JOAQUIN RIVER REGION

San Joaquin River and tributary flows most likely would be similar to flows under existing conditions. Mokelumne River and Tuolumne River flows could be altered to improve spawning and rearing conditions, providing a benefit primarily to chinook salmon but also potential small benefits to riparian vegetation. The New Melones Conveyance Project could reduce water available for release down the Stanislaus River, adversely affecting flow conditions and possibly riparian vegetation.

Water quality conditions in most rivers in the San Joaquin River Region under the No Action Alternative would be similar to water quality conditions under existing conditions. Retirement of 45,000 acres of agricultural lands in the drainage problem area could reduce the input of contaminants (primarily selenium and salts) to the San Joaquin River, and benefit the plant and animal species that obtain materials and food supply from areas affected by contaminants.

The water supplies to 10 NWRs, 4 Wildlife Management Areas (WMAs), and private wetlands in the Grasslands Water District would be at Level 4 under the No Action Alternative. Level 4 is the amount of water required for full development of the land lying within the 1988 refuge boundaries, in contrast to Level 2 under existing conditions, which is the average amount of water the refuges had received for approximately 10 years. In general, Level 4 water supplies would allow for greater flexibility and consistency in providing water for full development of wetlands, and water to support waterfowl and other species relying on refuge habitat. The increasing quantity and quality of habitat supported by Level 4 water supplies are not quantifiable at a programmatic level of detail.

6.2.6.5 OTHER SWP AND CVP SERVICE AREAS

The impact of the 2020 level of development on upland, wetland, and riparian habitat in the Other SWP and CVP Service Areas cannot be quantified with available information.

In general, the projects proposed consist of new water conveyance (for example, the Coastal Aqueduct), water storage (for example, the Eastside Reservoir Project), and groundwater storage/groundwater recharge (for example, the Semitropic Groundwater Banking Project). Projects such as the Eastside Reservoir Project would displace up to 4,500 acres of habitat but would support smaller acreages of wetlands bordering the reservoir. Groundwater storage/recharge projects, such as the Semitropic Groundwater

Banking Project, would retain terrestrial habitat as a result of conveyance groundwater wells and pumps but also could provide benefits to vegetation communities able to tap groundwater, particularly near springs. Groundwater recharging involving spreading basins also would add open-water habitat and small wetland areas that could be used by waterfowl and other species.

Groundwater recharging involving spreading basins also would add open-water habitat and small wetland areas that could be used by waterfowl and other species.

6.2.7 CONSEQUENCES: PROGRAM ELEMENTS COMMON TO ALL ALTERNATIVES

For vegetation and wildlife resources, the environmental consequences of the Ecosystem Restoration, Water Quality, Levee System Integrity, Water Use Efficiency, Water Transfer, and Watershed Programs and the Storage element are similar under all Program alternatives as described below. The environmental consequences of the Conveyance Element vary among Program alternatives, as described in Section 6.2.8.

Additional discussion of potential impacts of the Preferred Program Alternative on special-status plant and wildlife species is provided in the Conservation Strategy.

6.2.7.1 DELTA REGION

Ecosystem Restoration Program

Ecosystem Restoration Program actions proposed for the Delta Region that could affect vegetation and wildlife resources are summarized in the Conservation Strategy. The Ecosystem Restoration Program could result in a net increase in the following natural plant community types: tidal fresh-water emergent wetland, nontidal fresh-water emergent wetland, tidally influenced channels and distributary sloughs, shallow-water habitat, shoals, open-water areas in restored fresh-water emergent wetland areas, seasonal wetlands, riparian habitat, perennial grassland, and inland dune scrub habitat. The program also would improve habitat values of agricultural lands for waterfowl and other wildlife through cooperative management agreements with landowners.

The Ecosystem Restoration Program would improve habitat values of agricultural lands for waterfowl and other wildlife through cooperative management agreements with landowners.

Measures to restore and enhance natural habitats would result in a net increase in the area of target habitats supporting plant and wildlife species, including special-status species. Species that would benefit from these measures and the magnitude of the benefits would depend on where measures are implemented and the specific habitat restoration designs (for example, the restored habitat patch size) or habitat management prescriptions employed. Measures will include provisions to protect natural habitats from future activities that could result in their loss or degradation.

Restoration of large tracts of wetlands within existing agricultural lands would create a habitat pattern that could result in a more uniform distribution in the Delta of wildlife that breed or rest in wetlands and forage in nearby agricultural habitats.

Restoration of combinations of shallow-water, wetland, and riparian habitats would reconstitute a historical pattern of habitats to the Delta Region. These habitats would be established along an elevational gradient from open water at lower elevations, gradually transitioning to wetland, and then to riparian habitat at higher elevations. Restoration of large tracts of wetlands within existing agricultural lands would create a habitat pattern that could result in a more uniform distribution in the Delta of wildlife that breed or rest in wetlands and forage in nearby agricultural habitats.

Implementation of the Ecosystem Restoration Program would cause temporary impacts on vegetation and wildlife resources. These impacts would result primarily from construction- and habitat management-related disturbances that are associated with restoration activities, such as noise, human activity, and removal of vegetation. Permanent impacts of implementing the program primarily would result from conversion of existing habitats to different habitat types and changes in land management practices (for example, changes in cropping patterns on agricultural lands or vegetation management practices). Most habitat restoration acreage would be created by restoring existing agricultural lands to natural habitats. Relatively small acreages of some natural plant communities would be converted to open-water or other natural plant communities. These potentially significant impacts can be mitigated to a less-than-significant level.

Most habitat restoration acreage would be created by restoring existing agricultural lands to natural habitats. Relatively small acreages of some natural plant communities would be converted to open-water or other natural plant communities.

The adverse impacts of implementing the Ecosystem Restoration Program could include the temporary loss, fragmentation, or disturbance to wetland, riparian, and agricultural wildlife foraging habitats. Construction- and habitat management-related activities could result in temporary disturbance to, or mortality of, special-status species that may be present on or near areas where program measures are implemented. Implementation of the program could result in conversion of up to approximately 115,000 acres of agricultural lands to natural habitats, and conversion of annual grassland and ruderal habitat areas to other natural habitat types. The loss of agricultural lands could result in a reduction in available forage for such species as Swainson's hawks, greater sandhill cranes, and wintering waterfowl, if natural and agricultural habitats restored or enhanced under the program provide less forage than is provided by the affected lands. The net increase in community types and habitat associated with Ecosystem Restoration Program in conjunction with proposed mitigation strategies are expected to reduce these impacts to a less-than-significant level. The potential impact of the Ecosystem Restoration Program on agriculture (for example, loss of agricultural acreage) is discussed further in Section 7.1, "Agricultural Land and Water Use," Section 7.2, "Agricultural Economics," and Section 7.3, "Agricultural Social Issues."

Implementation of the Ecosystem Restoration Program also could make certain contaminants in sediments, such as mercury, more available in the water column. Although mercury mobilization is not well understood, discussion in Section 5.3, "Water Quality," indicates that under anaerobic conditions mercury is methalyzed by anaerobic bacteria and thus mobilized in the water column. Consequently, in areas with a mercury source, the combination of wetlands and anaerobic conditions may enhance the formation of methyl mercury. Methyl mercury in the water column then would be available to fish and other members of the food chain. In areas with mercury in

Implementation of the Ecosystem Restoration Program also could make certain contaminants in sediments, such as mercury, more available in the water column.

sediments, creation of wetlands should be avoided or anaerobic conditions should be prevented. Further discussion of methyl mercury impacts and mitigation is included in the March 1998 Water Quality Technical Report.

Water Quality Program

Implementation of the Water Quality Program could reduce the loadings of organic and inorganic constituents (such as metals and insecticides) to the Delta and its tributaries from mine drainage, urban and industrial runoff, wastewater and industrial discharge, and agricultural drainage. Loadings in these constituents would be reduced through source control and treatment.

In general, improvements in water quality would benefit Delta habitats and associated plant and wildlife species. Implementation of best management practices (BMPs) for application of insecticides could reduce drift to adjacent habitats. Reduction of insecticide drift would increase the availability of prey for species that feed on invertebrates and reduce the likelihood for bioaccumulation of compounds in the food web. Reduction in loadings of organic and inorganic constituents in the aquatic ecosystem would reduce bioaccumulation of these compounds in the Delta's food web and, consequently, in wildlife that feed directly on aquatic organisms or on terrestrial organisms that feed on aquatic species.

Reduction in loadings of organic and inorganic constituents in the aquatic ecosystem would reduce bioaccumulation in these compounds in the Delta's food web and, consequently, in wildlife that feed directly on aquatic organisms or on terrestrial organisms that feed on aquatic species.

Actions to improve water quality may require changes in agricultural practices (for example, changes in cropping patterns), relocation or construction of new facilities, or reduction in agricultural drainage. Changes in agricultural practices could result in a loss of habitat for some wildlife that use agricultural lands (for example, wintering waterfowl) if such changes reduce the amount or availability of forage on affected lands. Measures that may result in ground disturbance, such as relocating water intakes, could cause localized and temporary disturbances to riparian vegetation and associated wildlife in some locations. These impacts are considered less than significant. Reduction in selenium loadings to the Delta from agricultural drainage that is achieved through increased water use efficiency could result in localized loss of wetland or riparian habitat areas that depend on existing drainage practices (see discussion for "Water Use Efficiency Program").

Levee System Integrity Program

Implementation of the Levee System Integrity Program would provide long-term protection of existing wetland, riparian, and upland habitats, as well as agricultural lands with high wildlife habitat value, from flooding that could result from levee failures. The program also would protect habitats enhanced or restored on Delta islands under the Ecosystem Restoration Program from levee failure. The quantity of wildlife habitat associated with existing levees could be increased, and adverse effects of the program on vegetation and wildlife resources could be reduced, where upgraded levees are engineered to allow establishment of wetland and riparian habitats.

Implementation of the Levee System Integrity Program would provide long-term protection of existing wetland, riparian, and upland habitats as well as agricultural lands with high wildlife habitat value, from flooding that could result from levee failures.

Depending on specific project design, levee land bases and heights may be increased. Approximately 75% of the existing levee area supports grassland and ruderal vegetation or largely unvegetated riprap, and 25% supports riparian vegetation. Increasing the land bases of levees could remove agricultural land and some grassland and wetlands adjacent to existing levees. Temporary and permanent loss of levee and adjacent habitats would reduce the availability in these habitat areas for associated plant and wildlife species, including special-status species. Depending on the type of levee upgrade design, implementation of the program also could result in temporary or permanent fragmentation of existing riparian corridors that provide cover for some species during migration or local movements. Some long-term activities associated with maintaining upgraded levees (for example, periodic control of vegetation) also could result in impacts on levee habitats and associated plants and wildlife.

The overall benefits of increasing wetland and riparian habitat associated with construction of setback levees, in conjunction with proposed mitigation strategies, are expected to reduce these impacts to less-than-significant levels.

Water Use Efficiency Program

The Water Use Efficiency Program could result in increased quantity or quality of wetland and riparian habitats, and would benefit associated plant and wildlife species if water saved under the program is allocated to environmental uses (for example, restoration of wetlands). In some instances, tailwater return systems would be built as an efficiency measure. Tailwater ponds included in the return systems can be designed to incorporate beneficial habitat areas (for example, fresh emergent wetlands). Program implementation also could lessen adverse impacts that are associated with constructing and operating new storage facilities, if the amount of water conserved under the program results in reducing the amount of new storage capacity that is needed to meet water supply objectives.

Program implementation also could lessen adverse effects that would be associated with constructing and operating new storage facilities, if the amount of water conserved under the program results in reducing the amount of new storage capacity that is needed to meet water supply objectives.

Adverse impacts of the program would be associated with measures to increase the efficiency of water used for agriculture. Generally, efficiency measures could result in temporary losses of wetland and riparian communities (for example, from land grading and construction activities) and permanent losses (for example, from reduced or lost flows to habitats, including on-farm flows and flows in district-level delivery canals). Increasing irrigation and drainage efficiencies, for example, could result in less water available to incidental habitats that depend on existing inefficiencies. Incidental habitats include wetlands at the end of a field, or riparian vegetation in a drainage ditch or channel. Many seasonal wetlands, riparian corridors, and other habitats have developed as a result of water losses leaving a field and traveling to another field or to a surface stream or drain. Locally, these habitat areas can provide significant habitat value; and their loss could adversely affect wildlife, including special-status species, that depend on them. This is considered a potentially significant unavoidable impact.

The area of agricultural lands that provides relatively high wildlife habitat value could be reduced in some years if cropland is fallowed or could be permanently lost if cropland

that provides relatively high wildlife values is converted to produce crops that provide lower wildlife values. Changes in cropping patterns, depending on the location and types of cropland that would be affected, could result in a reduction in the quantity or quality of forage for wintering waterfowl, Swainson's hawks, and greater sandhill cranes. This impact is considered potentially significant. Mitigation is available to reduce the impact to a less-than-significant level.

Water Transfer Program

The Water Transfer Program would not generate sources of water but would provide the mechanisms necessary to reallocate water among uses and users, including beneficial uses for wildlife and their habitats. Transfers of water for environmental uses could include water necessary to enhance or restore wetland and riparian habitats, which would improve the quantity and quality of habitat available for associated plants and wildlife, including special-status species. Some transfers of water could locally reduce the availability of habitat for some species (for example, transfer of irrigation water used to farm crops with high wildlife forage value). Under the program, however, a transfer would not be authorized if it would harm wildlife or their habitats. Consequently, implementation of the program is not expected to result in a net adverse impact on vegetation and wildlife resources, and would increase the quantity and quality of habitat for some species—especially if the transfer is directed at such needs (for example, water transferred to state or federal wildlife refuges).

Transfers of water for environmental uses could include water necessary to enhance or restore wetland and riparian habitats, which would improve the quantity and quality of habitat available for associated plants and wildlife, including special-status species.

Watershed Program

The watershed areas in the Delta encompass the entire drainage basin of the Sacramento River and San Joaquin River watersheds. Therefore, the upper watershed areas for the Delta Region are discussed under the Sacramento River and San Joaquin River Regions. Many of the proposed activities are expected to improve water quality and flows in the watershed areas, and also would improve water quality and flows in the Delta. Improvements in water quality and flows are expected to benefit Delta habitats and associated plant and wildlife species, including special-status species.

Many of the proposed activities expected to improve water quality and flows in the upper watershed areas also would improve water quality and flows in the Delta. Improvements in water quality and flows are expected to result in beneficial effects on Delta habitats and associated plant and wildlife species, including special-status species.

Storage

If an in-Delta storage facility is constructed on one or more Delta islands, up to approximately 15,000 acres of open-water habitat of varying depth would be created, increasing the quantity of open-water habitat area in the Delta for associated wildlife. Seasonal wetland and mudflat habitats also could develop in the facility during reservoir drawdown periods, which could provide temporary foraging habitat for shorebirds, waterfowl, and other water birds.

A storage facility would permanently remove up to an estimated 15,000 acres of primarily agricultural habitat and could remove or disturb existing emergent wetland, riparian, and

grassland and ruderal habitat on affected islands. Specific affected acreages of natural communities would depend on the size and location of the storage facility. Inundation of various habitats and removal of associated habitat values are considered potentially significant impacts that can be mitigated to less-than-significant levels.

Seasonal wetland and mudflat habitats also could develop in the in-Delta storage facility during reservoir drawdown periods, which could provide temporary foraging habitat for shorebirds, waterfowl, and other water birds.

Construction of storage facilities also would result in potentially significant impacts on special-status plants and animals, and possibly on rare natural communities. These impacts may be unavoidable, depending on where storage facilities are located. This site-specific information will not be known until the conclusion of the ongoing Integrated Storage Investigation. Because of this uncertainty, it is concluded that some storage sites could result in potentially significant unavoidable impacts.

6.2.7.2 BAY REGION

Ecosystem Restoration Program

Ecosystem Restoration Program actions proposed for the Bay Region that could affect vegetation and wildlife resources are summarized in the Ecosystem Restoration Program Plan Appendix (three volumes). The Ecosystem Restoration Program could result in a net increase in the following natural plant community types: shallow tidal perennial aquatic habitat, tidally influenced saline and brackish emergent wetland, tidally influenced sloughs and deep open-water areas adjacent to nontidal wetlands, seasonal wetlands, riparian scrub, and perennial grassland. The Ecosystem Restoration Program also would enhance existing, degraded, and seasonal wetlands, including vernal pools.

The Ecosystem Restoration Program also would enhance existing, degraded, and seasonal wetlands, including vernal pools.

Implementation of the program would result in the loss of agricultural lands and conversion of existing diked nontidal saline and brackish emergent wetlands to tidal saline and brackish emergent wetlands. Saline emergent wetland communities and associated wildlife, however, would benefit from reestablishment of tidal flows to historical saline emergent wetland areas. An unpredictable quantity of tidal flats also could be associated with restoration of saline emergent wetlands. Some existing wetland, riparian, and grassland habitats could be lost or converted to open water or other natural plant communities. The types of beneficial and adverse impacts on vegetation and wildlife resources in the Bay Region, including special-status species, resulting from implementation of the program would be similar to those described for the Delta Region.

Water Quality Program

The types of impacts on vegetation and wildlife resources in the Bay Region from implementing the Water Quality Program would be similar to those described for the Delta Region.

Levee System Integrity Program

The Levee System Integrity Program could result in improving and providing long-term maintenance on approximately 155 miles of existing levees in the Suisun Marsh to reduce the potential for levee failures. Activities to rehabilitate levees could disturb an estimated 300-750 acres of natural and agricultural habitat. The types of impacts on vegetation and wildlife resources from implementing the Levee System Integrity Program would be similar to those described for the Delta Region.

The Levee System Integrity Program could result in improving and providing long-term maintenance on approximately 155 miles of existing levees in the Suisun Marsh to reduce the potential for levee failures.

The Levee System Integrity Program would directly affect vegetation and wildlife resources only in the Delta and Bay Regions and is not discussed further in the region-specific discussions that follow.

Water Use Efficiency and Water Transfer Programs

The types of impacts on vegetation and wildlife resources in the Bay Region from implementing the Water Use Efficiency and Water Transfer Programs would be similar to those described for the Delta Region.

Water transfers would affect water quality primarily through changes to river flow and water temperatures. In addition, the source of water for a transfer and the timing, magnitude, and pathway of each transfer would determine the potential for significant impacts. Potential beneficial water quality impacts are a function of the ability of a transfer to decrease the concentration of various contaminants through both increased streamflow and the potential for obtaining higher quality water from several sources. Because specific transfers can invoke both beneficial and adverse impacts, at times on the same resource, net effects must be considered on a case-by-case basis.

Watershed Program

The types of impacts on vegetation and wildlife resources in the Bay Region from implementing the Watershed Program would be similar to those described below for the Sacramento River and San Joaquin River Regions, but to a lesser degree.

Storage

No storage facilities are proposed in the Bay Region; therefore, no impacts on vegetation and wildlife associated with the Storage element are anticipated in the region.

6.2.7.3 SACRAMENTO RIVER AND SAN JOAQUIN RIVER REGIONS

Ecosystem Restoration Program

Ecosystem Restoration Program actions proposed for the Sacramento River and San Joaquin River Regions that could affect vegetation and wildlife resources are summarized in the Ecosystem Restoration Program Plan Appendix (three volumes).

The primary objective of the Ecosystem Restoration Program in the Sacramento River and San Joaquin River Regions is to improve ecological processes and habitat conditions that are critical to sustaining and improving anadromous fish populations. Proposed program activities include restoring and protecting stream meander belts; maintaining or improving the floodwater and sediment detention and retention capacity of important hydrologic basins; restoring floodplain processes, such as overbank flooding of floodplains and stream channel migration; and restoring, enhancing, or protecting riparian vegetation to provide shaded riverine aquatic cover. Partial restoration of the ecological processes that sustain healthy riverine ecosystems on affected streams would result in more natural patterns of stream channel migration, bank erosion, and overbank flooding that are important factors in maintaining healthy riparian and other associated floodplain habitats.

Partial restoration of the ecological processes that sustain healthy riverine ecosystems on affected streams would result in more natural patterns of stream channel migration, bank erosion, and overbank flooding that are important factors in maintaining healthy riparian and other associated floodplain habitats.

Implementation of the Ecosystem Restoration Program could increase the area of open-water and wetland communities that are associated with stream courses and flood basins. Actions that restore channel meander could result in the creation of oxbow lakes in future years as channels migrate across their floodplains. Increasing the area over which floodwaters are detained, the amount of floodwater detained, or the frequency of floodwater detention in overflow basins would potentially increase the area of seasonal wetland and open-water habitats.

Implementation of the program also would enhance existing seasonal wetlands and the wildlife values associated with agricultural lands through cooperative programs with landowners. These actions could improve the quantity and availability of forage for species such as the wintering waterfowl and shorebirds that use seasonal wetlands and agricultural lands in the Central Valley. Actions to enhance agricultural lands would include specific management activities to improve habitat values for wintering greater sandhill cranes in the San Joaquin River Region.

The Ecosystem Restoration Program would result in the direct and indirect protection, enhancement, and restoration of riparian and associated floodplain habitats along the San Joaquin and Sacramento Rivers and their major tributaries, including habitat areas occupied by the riparian brush rabbit along the Stanislaus River. Implementation of the program is expected to result in substantial increases in the quantity and quality of riparian habitats, and in increased connectivity among existing fragmented riparian habitat areas that are associated with the San Joaquin and Sacramento Rivers and their major tributaries.

Implementation of the program is expected to result in substantial increases in the quantity and quality of riparian habitats, and increased connectivity among existing fragmented riparian habitat areas associated with the San Joaquin and Sacramento Rivers and their major tributaries.

Restoration of floodplain habitats could result in the loss of agricultural lands adjacent to streams and rivers. A relatively small area of native plant communities could be temporarily or permanently affected by floodplain habitat improvements, depending on the type of improvement actions that are implemented. Types of actions that could beneficially or adversely affect these communities include levee setbacks, modification of levee maintenance practices to increase the area and quality of riparian vegetation, modification of stream flows, and exclusion of livestock from stream channels and adjacent banks. These impacts are considered less than significant.

Water Quality Program

The types of impacts on vegetation and wildlife resources from implementing the Water Quality Program would be similar to those described for the Delta Region. Agricultural land conversion in the San Joaquin River Region is included as a potential measure to improve water quality by reducing discharges from drainage lands with selenium problems. Program policies do not include conversion of land uses to reduce water demands. However, depending on water supply and water transfer opportunities available under the various alternatives, farmers may choose to change cropping patterns, temporarily fallow land, or permanently remove land from agricultural production. Impacts on vegetation and wildlife resources from conversion of cropland would be similar to those identified for the Water Use Efficiency and Water Transfer Programs.

Program policies do not include conversion of land uses to reduce water demands.

Water Use Efficiency and Water Transfer Programs

The types of impacts on vegetation and wildlife resources from implementing the Water Use Efficiency and Water Transfer Programs would be similar to those described for the Delta Region.

Watershed Program

A conceptual description of the types of watershed activities that might take place and their potential impacts follows. Impacts are characterized as local (those occurring in the general vicinity of project construction) and regional (those extending beyond the immediate project area).

Habitat restoration activities undertaken as part of the Watershed Program would restore or improve habitat types—such as oak woodland, wetland, or riparian habitat—or improve specific habitat values targeted at specific plant or wildlife species, including special-status species. Temporary impacts could include displacement of resident species, local erosion and siltation of nearby streams and waterways, and disturbance of resident species as a result of construction activities. Adverse impacts of construction related to watershed improvement projects on wildlife likely would be temporary and would depend on the type and quality of the habitat being converted or restored. Other potential impacts could include the temporary displacement of species dependent on the

Habitat restoration activities undertaken as part of the Watershed Program would restore or improve habitat types—such as oak woodland, wetland, or riparian habitat—or improve specific habitat values targeted at specific plant or wildlife species, including special-status species.

habitat being restored or, in the case of conversion, a shift in wildlife species. These impacts are considered less than significant.

The types of beneficial impacts could include, but would not be limited to, improved habitat for target species populations; increased habitat diversity in the region; and an increase in the quality or quantity of limiting factors, such as nesting or feeding habitat for target species. These effects may occur locally, such as improved feeding areas for deer; or may extend outside the region if the restoration would affect migratory species, such as neotropical migratory birds. Presumably, restoration projects would be implemented only if the created habitat was of higher value than the habitat being replaced. It was assumed that the proposed activities would be designed to avoid adverse impacts on special-status species and significant natural areas.

Improving wastewater and stormwater treatment, controlling mine waste, implementing erosion control, and improving forest and land use management practices would result in improved water quality conditions in streams and reservoirs. Some activities, such as land use management, may increase stream flows and would directly benefit riparian vegetation. These water quality and quantity changes also may benefit vegetation and wildlife in downstream areas. Potentially significant adverse impacts could include temporary disturbances to wildlife, temporary erosion and siltation, and temporary losses of vegetation as a result of construction activities. Mitigation strategies are presented that are expected to reduce impacts to a less-than-significant level.

Improving wastewater and stormwater treatment, controlling mine waste, implementing erosion control, and improving forest and land use management practices would result in improved water quality conditions in streams and reservoirs.

Structural watershed improvement activities might include improved maintenance of roadways; removal of old roadways; installation of erosion control structures; and channel improvements, such as realignment, bank stabilization, and revegetation. Since improvements will be conducted in areas already heavily disturbed, it is anticipated that little or no permanent impact on vegetation and wildlife resources would occur from these actions. Temporary impacts on vegetation and wildlife could include increased erosion and siltation during construction. These impacts are expected to be local and restricted to construction periods, and therefore are considered less than significant. Removal of roadways would increase natural vegetation and associated wildlife, and minimize access, thereby reducing human disturbance to wildlife resources.

Structural watershed improvement activities might include improved maintenance of roadways; removal of old roadways; installation of erosion control structures; and channel improvements, such as realignment, bank stabilization, and revegetation.

Storage

Surface storage reservoirs and associated facilities (for example, conveyance facilities to and from off-stream storage facilities) could inundate up to an estimated 8,500 acres in the San Joaquin Valley and up to 32,000 acres in the Sacramento Valley. Surface storage could be increased by either enlarging existing reservoirs or constructing new off-stream storage facilities. Off-aqueduct storage reservoirs and associated facilities also could be constructed in the San Joaquin Valley. Creation of storage pools would increase the availability of habitat for wildlife that use lake habitats and reduce habitat for plant and wildlife species that use the habitats that would be inundated. Habitats most likely to be affected by increasing surface storage capacity include wetland, riparian, annual grassland, chaparral, woodland, and forest communities. The actual areas and habitat types that would be

Creation of storage pools would increase the availability of habitat for wildlife that use lake habitats and result in a reduction of habitat for plant and wildlife species that use the habitats that would be inundated.

affected by construction of off-aqueduct storage facilities depends on the siting, design, and operations of facilities. Increase in storage capacity also may make more water available for Ecosystem Restoration Program actions.

Construction of storage facilities would inundate various habitats, such as wetlands, riparian, annual grasslands, chaparral, woodland, and forest communities. These impacts are considered potentially significant but can be mitigated to a less-than-significant level. If off-stream and off-aqueduct reservoirs are located in watersheds that support riparian vegetation, reservoirs also could lead to the loss or degradation of riparian habitat downstream of the reservoirs as a result of sediment supply interruption to the stream channel and alteration of stream hydrology. Habitat values of lands adjacent to surface storage reservoirs could be degraded for some wildlife species if public access and levels of recreation substantially increase as a result. These potentially significant impacts can be mitigated to a less-than-significant level.

Construction of storage facilities would inundate various habitats, such as wetlands, riparian, annual grasslands, chaparral, woodland, and forest communities.

Construction of off-stream and off-aqueduct storage facilities could potentially fragment riparian corridors and disrupt historical movement patterns of some wildlife. This impact is considered potentially significant and unavoidable. Construction of storage facilities also would result in potentially significant impacts on special-status plants and animals, rare natural communities, and significant natural areas. These impacts may be unavoidable, depending on where storage facilities are located. This site-specific information will not be known until the conclusion of the ongoing Integrated Storage Investigation and selection of preferred sites. Because of the uncertainty that is inherent for the current programmatic analysis, it is concluded that some reservoir sites under construction could result in potentially significant unavoidable impacts.

Because of the uncertainty that is inherent for the current programmatic analysis, it is concluded that some reservoir sites under construction could result in potentially significant unavoidable impacts.

If groundwater storage is achieved by percolating water through water-spreading grounds, construction of water-spreading grounds and associated facilities could result in the temporary or permanent loss of annual grassland and agricultural habitat types, assuming that they are constructed in lowland areas in the San Joaquin and Sacramento Valleys. The actual habitat area and habitat types that would be affected by construction and operation of groundwater recharge facilities depend on the siting, design, and operations of the facilities. Shallow open-water habitat could be created when surface water is retained on spreading grounds. Mudflats and bare ground could be created as surface water is drawn down. To maintain percolation efficiency, however, spreading grounds likely would be maintained devoid of vegetation. Consequently, these created habitats likely would provide only low forage and cover values for associated wildlife.

Changes in project operations are not anticipated to adversely affect vegetation and wildlife resources in the Sacramento River or San Joaquin River Region. Flows and timing of flows may be changed in the Sacramento River and Feather River as a result of reservoir release changes made in response to operations changes at the water export pumps in the Delta. These changes are not expected to adversely affect vegetation and wildlife, and are considered less than significant. Variations in water storage levels at San Luis Reservoir may occur due to changes in the amounts of water exported at the pumping plants, but these changes are not expected to adversely affect vegetation and wildlife resources.

Changes in project operations are not anticipated to adversely affect vegetation and wildlife resources in the Sacramento River and San Joaquin River Regions.

6.2.7.4 Other SWP and CVP Service Areas

All Programs

Less-than-significant impacts on vegetation and wildlife resources in the Other SWP and CVP Service Areas are anticipated. For example, as discussed for the other Program regions, implementation of the Water Use Efficiency Program could result in decreases of wetlands or riparian areas associated with return flows. Changes in urban or rural landscaping could result from changes in water use patterns.

6.2.8 CONSEQUENCES: PROGRAM ELEMENTS THAT DIFFER AMONG ALTERNATIVES

For vegetation and wildlife resources, the Conveyance element results in environmental consequences that vary among the alternatives, as described below. These consequences affect only the Delta Region.

The environmental consequences on vegetation and wildlife relating to the Conveyance element would affect only the Delta Region.

6.2.8.1 Preferred Program Alternative

This section includes a description of the consequences of a pilot diversion project. If the pilot project is not built, these consequences would not be associated with the Preferred Program Alternative.

South Delta modifications could result in the temporary or permanent loss of an estimated 140 acres of wetland, riparian, and grassland and ruderal habitat, and less than 50 acres of agricultural habitats. The flow and stage control facilities would disrupt tidal flow sufficiently to result in the loss of tidal wetlands or cause a change in the plant species composition of wetlands upstream of the barrier.

Conveyance capacity in the Old River could be increased through channel dredging or construction of levee setbacks. Construction of setback levees could result in the loss of wetland, riparian, and grassland and ruderal habitats, if existing levees are removed; and would result in the loss of agricultural habitats. The types and amount of habitat area that would be affected depend on the location and design of levee setbacks. The quantity of wildlife habitat associated with setback levees could be increased, and the adverse impacts associated with constructing levee setbacks on vegetation and wildlife resources could be reduced if setback levees are engineered to allow the establishment of wetland and riparian habitat. Dredging Old River could affect riparian and emergent wetland vegetation along the river. Because dredged material would be disposed of on agricultural lands, natural communities would not be affected. Dredged material was assumed to be

held on agricultural lands for 2 years for draining and settling. Consequently, affected agricultural habitats could be temporarily lost until those lands were returned to production after removal of the dredged material. These impacts are considered less than significant. To the extent that dredging reduces the amount of land that setback levees require, dredging could result in a lesser impact. Dredging would not provide opportunities for habitat creation that setback levees may offer.

Improvements to the CVP and SWP include construction of an intertie between the Tracy Pumping Plant and CCFB. Construction of the intertie could result in the permanent loss of wetland, riparian, grassland and ruderal, and agricultural habitat areas. These impacts are considered to be potentially significant but can be mitigated to a less-than-significant level. The types and amounts of habitats that would be affected depend on the location and design of the intertie.

Construction of a pilot diversion facility near Hood could remove or disturb wetland, riparian, grassland and ruderal, and agricultural habitat areas. The type and amount of habitat affected would depend on facility design and location. Conveyance capacity of channels along the southwestern portion of Glanville Tract and along McCormack-Williamson Tract would be increased through dredging channels or constructing levee setbacks. Effects of dredging would be similar to those described for enlarging the channel capacity in the Old River. Constructing setback levees would remove and disturb wetland, riparian, and grassland and ruderal habitat, and could result in the loss of up to approximately 1,800-2,000 acres of habitat. Constructing the setback levees, however, could create approximately 1,900-2,100 acres of open-water, wetland, riparian, and grassland habitats. Although wetland and riparian plant communities would be created, the pilot diversion facility nevertheless would result in a net loss of agricultural habitat that supports wintering wildlife. Potential impacts would be reduced by mitigation that is committed to replacement of net habitat value loss, not only acreage lost. Consequently, the adverse impacts associated with the pilot diversion facility near Hood are considered less than significant.

Construction of the setback levees could create approximately 1,900-2,100 acres of open-water, wetland, riparian, and grassland habitats. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage.

North Delta channel modifications could include enlarging channel capacity through dredging or constructing setback levees. Effects of dredging would be similar to those described for enlarging the channel capacity in the Old River. Setback levees along the North Mokelumne River from I-5 to the San Joaquin River could result in the loss of an estimated 1,000-1,200 acres of agricultural habitat area. Some acreage of existing wetland, riparian, and grassland and ruderal habitat also could be removed and disturbed in locations where levees are breached. Setting back the levees would create approximately 1,200-1,400 acres of habitat that would include open-water and emergent wetland habitats; and would create riparian scrub and woodland along the levees, and grassland and ruderal vegetation on levee slopes. The created acreage of wetland and riparian plant communities is expected to exceed the affected existing acreage. As a result, the adverse impacts associated with north Delta channel modifications are considered less than significant.

Changes in project operations are not anticipated to adversely affect vegetation and wildlife resources in any Program region. Flows and timing of flows may be changed within Delta waterways due to changes in pumping patterns at the export pumps, but

Flows and timing of flows may be changed within Delta waterways due to changes in pumping patterns at the export pumps, but these changes are not expected to adversely affect vegetation and wildlife.

these changes are not expected to adversely affect vegetation and wildlife under any alternative. This topic is not discussed again for the Program alternatives.

6.2.8.2 ALTERNATIVE 1

Impacts associated with south Delta modifications would be the same as those described for the Preferred Program Alternative. Beneficial and adverse impacts associated with levee setbacks or dredging are the same as those discussed for the Preferred Program Alternative.

Beneficial and adverse impacts associated with levee setbacks or dredging are the same as those discussed for the Preferred Program Alternative.

Other north Delta improvements to conveyance capacity described for the Preferred Program Alternative would not occur. Therefore, the beneficial and adverse effects of channel dredging and levee setbacks would not occur. About 4,000-5,500 acres of habitat (primarily agricultural lands) affected by the Preferred Program Alternative would remain unchanged under Alternative 1. About 3,500 acres of created open-water, wetland, riparian, and grassland habitat under the Preferred Program Alternative would not be realized under Alternative 1.

Impacts associated with the pilot diversion facility would not occur under Alternative 1.

6.2.8.3 ALTERNATIVE 2

Conveyance improvements would result in the same impacts on vegetation and wildlife resources as those described for the Preferred Program Alternative. The increased capacity of a new diversion facility compared to the Preferred Program Alternative would not result in additional potentially significant impacts because it is assumed that the construction/operational footprint would be the same for canal capacities in this range.

6.2.8.4 ALTERNATIVE 3

Most conveyance improvements would result in the same impacts as those described for the Preferred Program Alternative, except that the pilot diversion facility from near Hood to the Mokelumne River and improvement of channel conveyance downstream to the San Joaquin River would not occur. Beneficial and adverse effects of channel dredging and levee setbacks on the Mokelumne River described for the Preferred Program Alternative would not occur.

In addition to conveyance improvements discussed for the Preferred Program Alternative, an isolated open-channel facility would be constructed along the east side of the Delta. Construction of the isolated conveyance facility could remove and disturb an estimated 100-200 acres of wetland, riparian, and grassland and ruderal habitats; and could result in the loss of an estimated 700-900 acres of agricultural habitat. Permanent direct impacts on

large riparian areas and associated wetlands at major stream crossings would be avoided by properly designed siphons, but construction of the siphons could result in temporary impacts on riparian and wetland habitats and associated wildlife.

6.2.9 PROGRAM ALTERNATIVES COMPARED TO EXISTING CONDITIONS

This section presents the comparison of the Preferred Program Alternative and Alternatives 1, 2, and 3. This programmatic analysis found that the potentially beneficial and potentially significant adverse impacts from implementing any of the Program alternatives when compared to existing conditions were the same impacts as those identified in Sections 6.2.7 and 6.2.8, which compare the Program alternatives to the No Action Alternative.

The analysis indicates that an overall benefit to vegetation and wildlife resources would result when the Program alternatives are compared to existing conditions.

The analysis indicates that an overall benefit to vegetation and wildlife resources would result when the Program alternatives are compared to existing conditions.

At the programmatic level, the comparison of the Program alternatives to the existing conditions did not identify any additional potentially significant environmental consequences than were identified in the comparison of Program alternatives to the No Action Alternative.

The following potentially significant impacts are associated with the Preferred Program Alternative:

- Temporary or permanent loss or disturbance of wetland and riparian communities.
- Temporary or permanent loss or disturbance of wintering waterfowl habitat.
- Potential for increased waterfowl disease.
- Decrease in important wildlife habitat use areas.
- **Temporary or permanent fragmentation of riparian habitats.**
- **Loss of habitat or direct impacts on special-status species.**
- **Loss of portions of rare natural communities and significant natural areas.**
- Temporary loss or disturbance to habitat due to construction.
- Permanent loss of incidental wetland and riparian habitats that depend on agricultural inefficiencies.
- Reduction in quantity or quality of forage for species of concern.

Bold indicates a potentially significant unavoidable impact.

6.2.10 ADDITIONAL IMPACT ANALYSIS

Cumulative Impacts. The incremental impact of the Preferred Program Alternative, when added to other past, present, and reasonably foreseeable future actions, could result in cumulative impacts on vegetation and wildlife resources. For a summary of cumulative impacts for all resource categories, please refer to Chapter 3. For the list and a description of the projects and programs considered in this analysis of cumulative impacts, please see Attachment A.

Projects and actions that are assumed to be included under existing conditions and under the No Action Alternative were described earlier, along with the discussion of impacts of the No Action Alternative compared to existing conditions. Related past, present, and probable future projects and actions have been evaluated for their potential to contribute to cumulative effects. The cumulative impacts of all of these projects combined with the Preferred Program Alternative are listed below.

The following projects would result in negligible or beneficial effects on vegetation and wildlife resources: CCWD Multi-Purpose Pipeline Project, Hamilton City Pumping Plant Fish Screen Improvement Project, Montezuma Wetlands Project, Reclamation's Red Bluff Diversion Dam Fish Passage Program, West Delta Watershed Program, and the Sacramento River Conservation Area Program. The Trinity River Restoration Project and ISDP would cause vegetation and wildlife resource effects in the Program study area that were considered in the environmental impact analysis presented in Sections 6.2.7 and 6.2.8 of this chapter. These impacts are not considered cumulative effects. Consequently, these projects would not contribute to cumulative impacts on vegetation and wildlife resources, and are not considered further in this cumulative impact analysis.

The American River Watershed Project, American River Water Resource Investigation, CVPIA Anadromous Fish Restoration Program and other CVPIA actions not yet fully implemented, Delta Wetlands Project, Pardee Reservoir Enlargement Project, Sacramento Water Forum Process, Supplemental Water Supply Project, Sacramento County Municipal and Industrial Water Supply Contracts, urbanization, and Program actions potentially include activities that would result in construction of facilities, land conversion, and destruction or fragmentation of vegetation and wildlife habitat. These projects combined with Program actions would cause potentially significant cumulative impacts on vegetation and wildlife resources.

Program and non-Program actions potentially include activities that would result in construction of facilities, land conversion, and destruction or fragmentation of vegetation and wildlife habitat. These projects combined with Program actions would cause potentially significant cumulative impacts on vegetation and wildlife resources.

Mitigation strategies have been identified that may reduce the impacts for Program actions and the projects included in Attachment A (see Section 6.2.11 below). Nevertheless, cumulative impacts are considered potentially significant.

Growth-Inducing Impacts. On the whole, the Program is expected to improve vegetation, along with wildlife habitats, populations, and diversity—primarily as a result of Ecosystem Restoration Program actions. In addition, some farmland would be converted to ecosystem uses either purposely or as a result of other factors. No actions are proposed to revert significant areas of homes or urban lands to habitat. Projected growth, on the

other hand, is expected to result in large-scale conversion of agricultural lands to urban and residential uses, independent of any proposed Program actions.

Improvements to vegetation, habitats, and wildlife populations and diversity would improve the quality of the environment and associated recreational and aesthetic values. While these improvements would increase the attractiveness of the Program study area to residents and immigrants—especially those in certain cultural, socioeconomic, recreational, special interest, and age groups—they would not attract population growth to a similar degree as factors such as desirable and plentiful jobs, good socioeconomic conditions, and affordable housing. While important, the number of new jobs available in the recreational, sport hunting, environmental, and scientific sectors that might be influenced by improvements to habitats and wildlife populations tend to be dwarfed by those in the industrial, commercial, and agricultural sectors.

Program improvements to vegetation, habitats, and wildlife populations and diversity would improve the quality of the environment and associated recreational and aesthetic values.

Together with other infrastructure needs, additional water supplies and improved reliability of those supplies may contribute to increased urban and industrial development. Additional losses to important upland habitats, such as coastal sage scrub, riparian vegetation, and wetlands, may result from increased contaminant inputs, increased incidence of human-caused disturbances, and other factors. Urban and industrial growth would result in the loss or degradation of wetland and riparian communities, and the loss or degradation of important wildlife habitats and use areas.

If improvements in water supply are caused by the Preferred Program Alternative, the Preferred Program Alternative could induce growth, depending on how the additional water supply was used. If the additional water was used to expand agricultural production or urban housing development, the proposed action would foster economic and population growth. Expansion of agricultural production and population could affect vegetation and wildlife resources, but the significance of the vegetation and wildlife resources impact would depend on where the agricultural or population growth occurred and how it was managed.

Expansion of agricultural production and population could affect vegetation and wildlife resources, but the significance of the vegetation and wildlife resources impact would depend on where agricultural or population growth occurred and how it was managed.

Short- and Long-Term Relationships. Construction activities would cause some unavoidable short-term adverse impacts on vegetation and wildlife resources in local areas. However, their adverse effects would be mitigated to the maximum extent possible. Mitigation would be accomplished through minimization of adverse effects; containment of impacts; application of best on-site land, vegetation, habitat, and wildlife management practices during construction; and off-site development of comparable resources to at least an equivalent level. Adaptive management would be used to measure and readjust actions implemented to provide for long-term productivity. The overall benefits to long-term productivity of any facilities; changes in land forms; and resultant or independent changes in vegetation, habitats, and wildlife that are selected for implementation generally would outweigh short-term adverse impacts. If the reverse were true, the proposed action would be eliminated from consideration during screening.

Production of long-term ecological benefits is a primary objective of the Ecosystem Restoration Program. During implementation of the Ecosystem Restoration Program Plan, design principles and criteria that would affect vegetation, habitat, and wildlife

resources or their resources would be selected on the basis of their ability to avoid short-term adverse impacts and to enhance and maintain long-term productivity. The vision for the program is that important water-dependent vegetation and habitat resources in the state be restored to conditions approaching their historically rich levels of biological productivity in targeted areas.

Selection of design principles and criteria for all Program elements would be based in part on their ability to avoid short-term adverse impacts, and to enhance and maintain long-term productivity with respect to vegetation and wildlife resources.

Selection of design principles and criteria for all Program elements would be based in part on their ability to avoid short-term adverse impacts, and to enhance and maintain long-term productivity with respect to vegetation and wildlife resources.

Irreversible and Irretrievable Commitments. Implementation of the Ecosystem Restoration Program would result in some irreversible and irretrievable commitments of existing vegetation, habitats, and wildlife population resources. Short-term direct habitat losses would result from construction activities. Vegetation and habitat conversions included in the Ecosystem Restoration Program design specifications would be difficult, if not impossible, to fully reverse once earth moving and construction had commenced. After the new species, habitats, and ecosystems had become established, it would be even more difficult to restore converted areas to pre-existing conditions. However, restoration activities would not proceed until the designers are confident of the desirability of the results. Moreover, adaptive management would be used during the course of the Program to identify situations that could lead to undesirable or less-than-optimum results. In this way, potential mistakes could be identified early, and plans altered to minimize any unintentional adverse results.

Implementation of the Ecosystem Restoration Program would result in some irreversible and irretrievable commitments of existing vegetation, habitats, and wildlife population resources.

The biologic environment is complex, with many unique interrelationships about which little is known. There is uncertainty involved in anticipating the effect of Program actions on the ecosystem. Because of the lack of knowledge on how the ecosystem may respond to Program actions, it is possible that restoration actions may fail to achieve the Program objectives. It also is possible that individual projects may cause some negative impacts in achieving their ultimate objective. The adaptive management program is intended to address these uncertainties. Adaptive management is a key component of the Program, as it provides a decision support system for stakeholders and resource managers. Adaptive management addresses risks and uncertainties by increasing opportunities to redirect management with new information. More information on adaptive management can be found in the Revised Phase II Report Appendix.

Constructed components of the Water Quality, Levee System Integrity, and Watershed Programs, and the Storage and Conveyance elements could result in irreversible and irretrievable commitments of existing vegetation, habitats, and wildlife population resources. The most pertinent examples would occur in cases where lands and resources are converted to new or increased reservoir storage, levees, or conveyance facilities. Mitigation strategies would be used to minimize the adverse impacts of such commitments.

Constructed components of the Program elements could result in irreversible and irretrievable commitments of existing vegetation, habitats, and wildlife population resources.

6.2.11 MITIGATION STRATEGIES

These mitigation strategies will be considered during specific project planning and development. Specific mitigation measures will be adopted, consistent with the Program goals and objectives and the purposes of site-specific projects. Not all mitigation strategies will be applicable to all projects because site-specific projects will vary in purpose, location, and timing.

This section summarizes potential mitigation strategies by impact. Additional conservation measures that could be implemented to offset potential adverse impacts on special-status species are described in the Conservation Strategy. Where the Ecosystem Restoration Program would cause adverse impacts, the program would be phased to help mitigate potential adverse impacts resulting from restoration actions. The Ecosystem Restoration Program will not provide mitigation or compensation for the adverse impacts on vegetation and wildlife resources from implementing other Program element actions, or the effects of construction and operation of storage and conveyance facilities. All adverse impacts caused by other programs will need to be mitigated separately.

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Potential mitigation strategies may include:

- Avoiding wetland and riparian communities.
- Restoring or enhancing sufficient in-kind wetland and riparian habitat areas at off-site locations (near project sites) before, or when, project impacts are incurred to offset habitat losses.
- When feasible, designing program features to permit on-site mitigation of wetland and riparian communities. In some instances, for example, levee or conveyance improvements could be designed to allow for the establishment and long-term maintenance of wetland or riparian habitat areas.
- Initially implementing habitat restoration (to the extent feasible) to offset temporary habitat losses and to restore sufficient wetland and riparian habitats before, or when, project impacts associated with the program are incurred.
- Restoring wetland and riparian communities temporarily disturbed by construction activities onsite immediately following construction. Types of actions could include direct planting of native plants, controlling non-native plants to improve conditions for the natural reestablishment of native plants, or enhancing or restoring the original site hydrology to allow for the natural reestablishment of the affected plant community.
- Restoring or enhancing sufficient waterfowl foraging habitat near existing use areas to offset impacts on the abundance, quality, and availability of waterfowl forage. Types of restoration and enhancement actions could include restoring and managing seasonal wetlands for wintering waterfowl, increasing the area of land farmed to

produce crops with high forage value (such as corn or rice), or modifying farming practices to increase forage availability (for example, leaving a portion of forage crops unharvested through winter or shallowly flooding fields).

- Phasing implementation of habitat restoration and enhancement to restore sufficient natural waterfowl foraging habitats on agricultural lands that provide little or no existing waterfowl forage values in order to enhance forage values associated with existing natural and agricultural habitats.

- Avoiding important wildlife habitat areas, such as critical deer winter range and fawning habitat.

- Planting and maintaining native species to restore important wildlife habitat areas temporarily disturbed by on-site construction activities immediately following construction.

- Enhancing or restoring habitat areas within affected watersheds or in other watersheds when sufficient habitat for enhancement is unavailable within the affected watershed. This could include modifying existing land management practices (for example, grazing and fire management practices) to improve conditions for the natural reestablishment and long-term maintenance of affected plant communities and habitats.

- Avoiding riparian vegetation.

- Restoring or enhancing sufficient riparian habitat areas at off-site locations (near project sites) in a manner that reduces the degree of existing habitat fragmentation before, or when, project impacts are incurred to offset habitat losses.

- Phasing riparian habitat restoration to restore sufficient riparian corridor habitat before, or when, project impacts are incurred to offset habitat losses.

- Restoring riparian vegetation disturbed by on-site construction activities immediately following construction.

- Phasing the implementation of modifications to levees that would be necessary to meet PL 84-99 standards over a sufficient period to minimize the effects of fragmentation of riparian habitats and associated wildlife.

- Avoiding habitat areas occupied by special-status species.

- Avoiding construction or maintenance activities within or near habitat areas occupied by special-status wildlife species during the breeding season or other periods when species may be sensitive to disturbance.

- Restoring habitat areas occupied by special-status species that are temporarily disturbed by construction activities onsite immediately following completion of construction.

- Restoring or enhancing suitable habitat areas that are occupied by, or are near and accessible to, special-status species that have been adversely affected by the permanent removal of occupied habitat areas.

- Phasing habitat restoration actions to restore sufficient suitable habitat to minimize the adverse affects of impacts on occupied special-status species habitats before impacts are incurred.

- For species for which relocation or artificial propagation is feasible, establishing additional populations of special-status species adversely affected by the Program in protected suitable habitat areas elsewhere within their historical range.

- Altering agricultural practices to improve habitat conditions for affected special-status species that use agricultural lands. This could include planting and managing crops to increase the availability or quantity of forage for affected species.

- Avoiding rare natural communities and significant natural areas.

- Restoring or enhancing disturbed rare natural communities or significant natural areas at other locations before, or when, Program impacts are incurred.

- Restoring rare natural communities or significant natural areas at affected locations after Program activities are completed.

- Altering the timing of construction to avoid sensitive periods, such as nesting or migration seasons.

- Demarcating and avoiding construction activities near sensitive features within construction areas, such as wetlands.

- Implementing BMPs, such as avoiding disturbance to highly erodible soils or installing siltation barriers or detention basins, to reduce the potential for siltation of nearby wetlands.

- Enhancing nearby habitat to provide for displaced species.

6.2.12 POTENTIALLY SIGNIFICANT UNAVOIDABLE IMPACTS

If off-stream reservoirs are built in the Sacramento River and San Joaquin River Regions, existing riparian habitat corridors on the small or ephemeral tributaries could be permanently fragmented as a result of inundation, potentially blocking the movement and interchange of populations of some wildlife species from upper to lower watershed locations. This impact cannot be mitigated to a less-than-significant level and is considered potentially significant and unavoidable.

Fragmentation of wildlife movement corridors and permanent loss of habitat area caused by inundation are considered potentially significant unavoidable impacts.

If surface water storage facilities are built, potentially significant impacts on special-status plants and animals, rare natural communities, and significant natural areas could occur. These impacts may be unavoidable, depending on where storage facilities are located. This site-specific information will not be known until the conclusion of the ongoing Integrated Storage Investigation and selection of preferred sites. Because of the uncertainty that is inherent for the current programmatic analysis, it is concluded that some reservoir sites under consideration could result in potentially significant unavoidable impacts. This impact cannot be mitigated to a less-than-significant level.