Chapter 6
Biological Environment

This chapter provides environmental analyses relative to biological parameters of the project area. Components of this study include a setting discussion, impact analysis criteria, project effects and significance, and applicable mitigation measures. This chapter is organized as follows:

- Section 6.1, Fish;
- Section 6.2, Vegetation and Wetlands; and
- Section 6.3, Wildlife.

6.1 Fish

Introduction

This assessment covers species within aquatic environments potentially affected by the SDIP, including the Sacramento, American, Feather, San Joaquin, and Trinity Rivers, the Delta, and Suisun Bay. Although many fish species occur within the affected aquatic environment, the assessment focuses on Central Valley fall-/late fall–run Chinook salmon (ESA, candidate), Sacramento River winter-run Chinook salmon (ESA and CESA, endangered), Central Valley spring-run Chinook salmon (ESA and CESA, threatened), Southern Oregon/northern California coasts coho salmon (ESA and CESA, threatened), Central Valley steelhead (ESA, threatened), delta smelt (ESA and CESA, threatened), splittail (ESA, listing withdrawn), striped bass (an important sport fish), and green sturgeon (ESA, proposed threatened). The response of the selected species to project actions provides an indicator of the potential response of other species. The full range of environmental conditions and fish habitat elements potentially affected is encompassed by the assessment for the species specifically discussed.

This section includes the following information:

- a summary of significant impacts that could result from implementation of the SDIP alternatives;
- a description of the affected environment, including the life histories and existing environmental conditions for factors that may affect the abundance and survival of the selected species;
- a description of the assessment methods that were used to evaluate potential impacts of the SDIP alternatives; and
- a description of the effects (i.e., environmental consequences) for each SDIP alternative on fish and fish habitat, including identification of significant impacts and measures to mitigate significant impacts.

Summary of Significant Impacts

Implementation of the SDIP alternatives includes construction and operation of gates in the south Delta, dredging, and water supply operations that affect fish and fish habitat in the Delta and rivers upstream of the Delta. Construction of the gates results in less-than-significant impacts because environmental commitments (Chapter 2, “Project Description”) and BMPs will be implemented and the area disturbed by construction of gates would be similar to the existing footprint of the temporary barriers. Operation of the permanent gates would have less-than-significant impacts given that effects on net and tidal flow would be similar to conditions with the existing temporary barriers, and operability would increase flexibility to minimize existing effects. Dredging would increase channel depth, but habitat area and quality would be similar to pre-dredged conditions, and a dredge monitoring program will be implemented to confirm minimal effects of dredging on fish habitat (Chapter 2, "Project Description").

Water supply operations would have only slight effects on spawning habitat area, rearing habitat area, migration habitat conditions, water temperature, and food availability in the rivers upstream of the Delta and in the Delta and Suisun Bay. These upstream impacts are determined to be less than significant. The changes in SWP and CVP monthly pumping for Alternative 2B are relatively small, and entrainment-related losses would have a less-than-significant impact on any fish population. Significant impacts occur because of increased SWP pumping under Alternatives 2A and 2C. Increased SWP pumping during March through June increases entrainment-related losses of San Joaquin fall-run Chinook salmon, spring-run Chinook salmon, winter-run Chinook salmon, steelhead, delta smelt, and striped bass. Impacts and mitigation measures are identified by species and time of impact. Therefore, Mitigation Measures Fish-MM-1, Fish-MM-2, and Fish-MM-3 would together mitigate all significant impacts on fish to a less than significant level during the specified months. The combined effects of these mitigation measures can be summarized with the following avoidance and crediting system for entrainment impacts that could occur between November 1 and June 30 (if an expanded EWA is not implemented by CALFED):

1. ***Avoidance Measure.*** All pumping at SWP Banks that is in excess of the existing permitted capacity from November 1 through June 30 will be tracked by EWA and SWP/CVP operations staff. When EWA actions reduce exports for fish protection during this period, any pumping at SWP Banks that is above the existing permitted capacity will be reduced without cost to the EWA account, limited only by the amount of pumping reduction funded by the EWA (i.e., maximum of 100% match with EWA action).
2. ***Crediting Measure.*** From November 1 through March 31, pumping-reduction credits will be given to the EWA (ranging from 10% to up to 30%) for all non-EWA pumping that is above the existing permitted capacity. Under this mitigation component, for each 100 taf of non-EWA pumping above the existing permitted capacity, a pumping reduction credit, ranging from 10 taf to 30 taf, could be used by EWA to reduce pumping during periods of high fish density.

This relatively simple avoidance of impacts during periods of EWA actions, in addition to an EWA credit for mitigation of periods with remaining pumping above the existing permitted capacity, will reduce the entrainment impacts to a less than significant level. DWR and Reclamation will coordinate with DFG, NOAA Fisheries, and USFWS to determine the appropriate credit percentage. When an expanded EWA (i.e., greater than CALFED ROD EWA) is implemented by CALFED, as assumed in the 2004 OCAP documents, this SDIP avoidance and crediting system (composed of Fish-MM-1, Fish-MM-2, and Fish-MM-3) would no longer be required because the expanded EWA is assumed to be sufficient to mitigate any entrainment impacts from the incremental pumping above the existing permitted capacity. In addition, as part of DWR and Reclamation ongoing environmental assurances, the CALFED Conveyance Program initiative to investigate and improve CVP and SWP fish salvage, handling, and release facilities and procedures will be supported for a 5-year period. Short-term changes in procedures and facilities that are recommended by the South Delta Fish Facilities Forum may be funded by DWR and Reclamation as part of this commitment. If these facility upgrades or procedural changes are determined to be equivalent to the avoidance and crediting system described above, these salvage facility and procedural changes may be substituted for the pumping restrictions as alternative cost-effective mitigation.

Table 6.1-S presents a summary of the significant impacts on fish and associated mitigation measures for each project alternative. The mitigation measure will provide effective protection for each of these identified impacts and reduce the aggregate impacts to less than significant.

Table 6.1-S. Summary of Significant Fish Impacts and Mitigation Measures

Operations Related Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
Fish-46: Operations-Related Increases in Entrainment-Related Losses of Fall-/Late Fall–Run Chinook Salmon from the San Joaquin River Basin.	2A, 2C	Significant	Fish-MM-1: Minimize Entrainment-Related Losses of Juvenile Fall-/Late Fall–Run Chinook Salmon from the San Joaquin River Basin That May Be Caused by Increased SWP Pumping from May 16 through May 31.	Less than Significant
Fish-47: Operations-Related Increases in Entrainment-Related Losses of Chinook Salmon from the Sacramento River Basin.	2A, 2C	Significant	Fish-MM-2: Minimize Entrainment-Related Losses of Juvenile Winter- and Spring-Run Chinook Salmon That May Be Caused by Increased SWP Pumping from March 1 through April 14 and May 16 through May 31.	Less than Significant
Fish-58: Operations-Related Increases in Entrainment Losses of Steelhead.	2A, 2C	Significant	Fish-MM-1: Minimize Entrainment-Related Losses of Juvenile Fall-/Late Fall–Run Chinook Salmon from the San Joaquin River Basin That May Be Caused by Increased SWP Pumping from May 16 through May 31.	Less than Significant
			Fish-MM-2: Minimize Entrainment-Related Losses of Juvenile Winter- and Spring-Run Chinook Salmon That May Be Caused by Increased SWP Pumping from March 1 through April 14 and May 16 through May 31.	

Operations Related Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
Fish-63: Operations-Related Increases in SWP Pumping and Resulting Entrainment Losses of Delta Smelt.	2A, 2C	Significant	Fish-MM-3: Minimize Entrainment Losses of Delta Smelt Associated with Increased SWP Pumping.	Less than Significant
Fish-64: Operations-Related Reduction in Food Availability for Delta Smelt.	2A, 2C	Significant	Fish-MM-3: Minimize Entrainment Losses of Delta Smelt Associated with Increased SWP Pumping.	Less than significant
Fish-73: Operations-Related Increases in SWP Pumping and Resulting Entrainment Losses of Striped Bass.	2A, 2C	Significant	Fish-MM-1: Minimize Entrainment-Related Losses of Juvenile Fall-/Late Fall–Run Chinook Salmon from the San Joaquin River Basin That May Be Caused by Increased SWP Pumping from May 16 through May 31. Fish-MM-2: Minimize Entrainment-Related Losses of Juvenile Winter- and Spring-Run Chinook Salmon That May Be Caused by Increased SWP Pumping from March 1 through April 14 and May 16 through May 31. Fish-MM-3: Minimize Entrainment Losses of Delta Smelt Associated with Increased SWP Pumping.	Less than Significant
Fish-74: Operations-Related Reduction in Food Availability for Striped Bass.	2A, 2C	Significant	Fish-MM-3: Minimize Entrainment Losses of Delta Smelt Associated with Increased SWP Pumping.	Less than significant

Affected Environment

This section describes the life history, habitat requirements, and factors that affect the abundance of species selected for the assessment of impacts of the SDIP. Central Valley steelhead, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley fall-/late fall–run Chinook salmon, delta smelt, splittail, and green sturgeon are native species that occur in streams of the Central Valley and the Delta. Striped bass is an abundant nonnative fish that occurs in the Central Valley and the Delta. Southern

Oregon/northern California coasts coho salmon occurs in the Trinity River. The coho salmon is included in the impact analysis because operation of the SWP and CVP in response to changes in Delta operations has the potential to affect Trinity River flows. Although a court ruling has upheld the Trinity River ROD, which mandated restoration flows to be released from the Trinity River, thereby isolating the Trinity River from operations in the Central Valley and reducing potential SDIP effects, an assessment of the Trinity River potential SDIP effects is presented. Table 6.1-1 lists some of the native and nonnative fishes that occur in the Central Valley system.

Table 6.1-1. Central Valley Species Potentially Affected by the Proposed Alternatives

Common Name—Origin	Scientific Name	Distribution
Lamprey (2 species)—native	*Lampetra* spp.	Central Valley rivers; Delta; San Francisco Bay estuary
Chinook salmon (winter-, spring-, fall-, and late fall–runs)—native	*Oncorhynchus tshawytscha*	Central Valley rivers; Delta; San Francisco Bay estuary
Chum salmon—rare	*Oncorhynchus keta*	Central Valley rivers; Delta and San Francisco Bay estuary
Kokanee—nonnative	*Oncorhynchus nerka*	Central Valley reservoirs
Steelhead/rainbow trout—native	*Oncorhynchus mykiss*	Central Valley rivers; Delta and San Francisco Bay estuary
Brown trout—nonnative	*Salmo trutta*	Central Valley reservoirs
White sturgeon—native	*Acipenser transmontanus*	Central Valley rivers; Delta; San Francisco Bay estuary
Green sturgeon—native	*Acipenser medirostris*	Central Valley rivers; Delta; San Francisco Bay estuary
Longfin smelt—native	*Spirinchus thaleichthys*	Delta and San Francisco Bay estuary
Delta smelt—native	*Hypomesus transpacificus*	Delta and San Francisco Bay estuary
Wakasagi—nonnative	*Hypomesus nipponensis*	Central Valley rivers and reservoirs; Delta
Sacramento sucker—native	*Catostomus occidentalis*	Central Valley rivers; Delta
Sacramento pikeminnow—native	*Ptychocheilus grandis*	Central Valley rivers; Delta
Splittail—native	*Pogonichthys macrolepidotus*	Central Valley rivers; Delta and San Francisco Bay estuary
Sacramento blackfish	*Orthodon microlepidotus*	Central Valley rivers; Delta
Hardhead—native	*Mylopharodon conocephalus*	Central Valley rivers; Delta
Speckled dace—native	*Rhinichthys osculus*	Sacramento River and tributaries
California roach—native	*Lavinia symmetricus*	Central Valley Rivers
Hitch—native	*Lavina exilicauda*	Central Valley rivers; Delta
Golden shiner—nonnative	*Notemigonus crysoleucas*	Central Valley rivers and reservoirs; Delta
Fathead minnow—nonnatve	*Pimephales promelas*	Central Valley rivers and reservoirs; Delta

Common Name—Origin	Scientific Name	Distribution
Goldfish—nonnative	*Carassius auratus*	Central Valley rivers and reservoirs; Delta
Carp—nonnative	*Cyprinus carpio*	Central Valley rivers and reservoirs; Delta
Threadfin shad—nonnative	*Dorosoma petenense*	Central Valley rivers and reservoirs; Delta
American shad—nonnative	*Alosa sapidissima*	Central Valley rivers; Delta; San Francisco Bay estuary
Black bullhead—nonnative	*Ictalurus melas*	Central Valley rivers and reservoirs; Delta
Brown bullhead—nonnative	*Ictalurus nebulosus*	Central Valley rivers and reservoirs; Delta
White catfish—nonnative	*Ictalurus catus*	Central Valley rivers; Delta
Channel catfish—nonnative	*Ictalurus punctatus*	Central Valley rivers and reservoirs; Delta
Mosquito fish—nonnative	*Gambusia affinis*	Central Valley rivers and reservoirs; Delta
Inland silverside—nonnative	*Menidia audena*	Central Valley rivers; Delta
Threespine stickleback—native	*Gasterosteus aculaetus*	Central Valley rivers; Delta; San Francisco Bay estuary
Striped bass—nonnative	*Morone saxatilis*	Central Valley rivers and reservoirs; Delta; San Francisco Bay estuary
Bluegill—nonnative	*Lepomis macrochirus*	Central Valley rivers and reservoirs; Delta
Green sunfish—nonnative	*Lepomis cyanellus*	Central Valley rivers and reservoirs; Delta
Redear sunfish—nonnative	*Lepomis microlophus*	Central Valley rivers and reservoirs; Delta
Warmouth—nonnative	*Lepomis gulosus*	Central Valley rivers and reservoirs; Delta
White crappie—nonnative	*Pomoxis annularis*	Central Valley rivers and reservoirs; Delta
Black crappie—nonnative	*Pomoxis nigromaculatus*	Central Valley rivers and reservoirs; Delta
Largemouth bass—nonnative	*Micropterus salmoides*	Central Valley rivers and reservoirs; Delta
Redeye Bass--nonnative	*Micropterus coosae*	Central Valley rivers and reservoirs
Spotted bass—nonnative	*Micropterus punctulatus*	Central Valley rivers and reservoirs; Delta
Small mouth bass—nonnative	*Micropterus dolomieui*	Central Valley rivers and reservoirs; Delta
Bigscale logperch—nonnative	*Percina macrolepida*	Central Valley rivers; Delta
Yellowfin goby—nonnative	*Acanthogobius flavimanus*	Delta and San Francisco Bay estuary
Chameleon goby—nonnative	*Tridentiger trigonocephalus*	Delta and San Francisco Bay estuary
Prickly sculpin—native	*Cottus asper*	Central Valley rivers
Tule perch—native	*Hysterocarpus traskii*	Central Valley rivers; Delta

Life Histories

This section describes the key environmental requirements for each life stage of the selected species. Table 6.1-2 shows the assumed months for each life stage

Table 6.1-2. Assumed Life Stage Timing and Distribution of Selected Species Potentially Affected by the Proposed SDIP Alternatives

	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Late Fall–Run Chinook Salmon													
Adult Migration	SF Bay to Upper Sac River and Tributaries, Mokelumne River, and SJR Tributaries	■	■								■	■	■
Spawning	Upper Sacramento River and Tributaries, Mokelumne River and SJR Tributaries	■	■	■									
Egg Incubation	Upper Sacramento River and Tributaries, Mokelumne River and SJR Tributaries	■	■	■	■	■							
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries, Mokelumne River and SJR Tributaries			■	■	■	■	■	■	■	■	■	
Juvenile Movement and Rearing	Upper Sacramento River and Tributaries, Mokelumne River and SJR Tributaries	■	■	■	■	■	■				■	■	■
Fall-Run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River and Tributaries							■	■	■	■	■	■
Spawning[1]	Upper Sacramento River and Tributaries										■	■	■
Egg Incubation[1]	Upper Sacramento River and Tributaries	■	■	■							■	■	■
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■	■	■	■						
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay		■	■	■	■	■						
Spring-Run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River and Tributaries			■	■	■	■	■	■	■			
Spawning	Upper Sacramento River and Tributaries								■	■	■		
Egg Incubation	Upper Sacramento River and Tributaries								■	■	■	■	■
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries	■	■	■	■	■	■	■	■	■	■	■	■

Table 6.1-2. Continued

	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay												
Winter-Run Chinook Salmon													
Adult Migration and Holding	SF Bay to Upper Sacramento River												
Spawning	Upper Sacramento River												
Egg Incubation	Upper Sacramento River												
Juvenile Rearing (Natal Stream)	Upper Sacramento River to SF Bay												
Juvenile Movement and Rearing	Upper Sacramento River to SF Bay												
Steelhead													
Adult Migration	SF Bay to Upper Sacramento River and Tributaries												
Spawning	Upper Sacramento River and Tributaries												
Egg Incubation	Upper Sacramento River and Tributaries												
Juvenile Rearing	Upper Sacramento River and Tributaries to SF Bay												
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay												
Southern Oregon/Northern California Coasts Coho Salmon													
Adult Migration	Trinity River												
Juvenile Rearing	Trinity River												
Juvenile Movement	Trinity River												

Table 6.1-2. Continued

	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Splittail													
Adult Migration	Suisun Marsh, Upper Delta, Yolo and Sutter Bypasses, Sacramento River and SJR												
Spawning	Suisun Marsh, Upper Delta, Yolo and Sutter Bypasses, Lower Sacramento and SJ Rivers												
Larval and Early Juvenile Rearing and Movement	Suisun Marsh, Upper Delta, Yolo Bypass, Sutter Bypass, Lower Sacramento and San Joaquin Rivers												
Adult and Juvenile Rearing	Delta, Suisun Bay												
Delta Smelt													
Adult Migration	Delta												
Spawning	Delta, Suisun Marsh												
Larval and Early Juvenile Rearing	Delta, Suisun Marsh												
Estuarine Rearing: Juveniles and Adults	Lower Delta, Suisun Bay												

Notes:

SF Bay = San Francisco Bay.

SJR = San Joaquin River.

[1] Spawning and incubation occurs from October to February in the Feather, American, and Mokelumne Rivers

Sources: Brown 1991; Wang and Brown 1993; U.S. Fish and Wildlife Service 1996; McEwan 2001; Moyle 2002; Hallock 1989.

that were included in the calculations of habitat conditions for the SDIP alternatives. Actual occurrence and relative abundance may vary between months and from year to year.

Chinook Salmon

After 2–5 years in the ocean, adult Chinook salmon leave the ocean and migrate upstream in the Sacramento and San Joaquin rivers. The names of the Chinook salmon runs (i.e., fall, late fall, winter, and spring) reflect the variability in timing of the adult life stage (Table 6.1-2). Spawning occurs in the cool reaches of Central Valley rivers that are downstream of the terminal dams and in tributary streams. After the eggs hatch, juvenile Chinook salmon remain in fresh water for 3–14 months.

Historical records indicate that adult spring-run Chinook salmon enter the mainstem Sacramento River in March, and continue to their spawning streams where they hold until September in deep cold pools (Table 6.1-2). Spring-run Chinook salmon are sexually immature during their spawning migration. Spawning occurs in gravel beds in late August through October, and emergence begins in December. Spring-run Chinook salmon migrate downstream as young-of-year or yearling juveniles. Young-of-year juveniles move between February and June, and yearling juveniles migrate from October to March, with peak migration in November (Cramer, S.P. 1996).

Adult fall-/late fall–run Chinook salmon enter the Sacramento and San Joaquin River systems from July through February and spawn from October through March (Table 6.1-2). Optimal water temperatures for egg incubation is 44 to 54°F (6.7 to 12.2°C) (Rich 1997). Newly emerged fry remain in shallow, lower-velocity edgewaters (California Department of Fish and Game 1998). Juveniles migrate to the ocean from October to June (Table 6.1-2).

Adult winter-run Chinook salmon leave the ocean and migrate through the Delta into the Sacramento River from December through July (Table 6.1-2). Adults migrate upstream past RBDD on the Sacramento River from mid-December through July, and most (85%) of the spawning population has passed RBDD by mid-May, trailing off in late June (Table 6.1-2). Spawning takes place from mid-April through August, and incubation continues through October (Table 6.1-2). The primary spawning grounds in the Sacramento River are above RBDD. Juvenile winter-run Chinook salmon rear and migrate in the Sacramento River from July through March (Hallock and Fisher 1985; Smith pers. comm.). Juveniles move downstream in the Sacramento River above RBDD from August through October and possibly November, rearing as they move downstream. Juveniles have been observed in the Delta during October through December, especially during high Sacramento River discharge in response to fall and early-winter storms. Winter-run salmon juveniles migrate through the Delta to the ocean from December through as late as May (Stevens 1989).

During spawning, the female digs a redd (a nest in clean gravel) and deposits eggs. A male fertilizes the eggs during the creation of the redd. Optimal water temperature for egg incubation is 44 to 54°F (6.7 to 12.2°C) (Rich 1997). Newly emerged fry remain in shallow, lower-velocity edgewaters (California Department of Fish and Game 1998). Juveniles rear in their natal streams, the mainstem of the Sacramento River, and in the Delta.

Cover, space, and food are necessary components for Chinook salmon rearing habitat. Suitable habitat includes areas with instream and overhead cover in the form of cobbles, rocks, undercut banks, downed trees, and large, overhanging tree branches. The organic materials forming fish cover also provide sources of food, in the form of both aquatic and terrestrial insects.

Juvenile Chinook salmon move downstream in response to many factors, including inherited behavior, habitat availability, flow, competition for space and food, and water temperature. The number of juveniles that move and the timing of movement are highly variable. Storm events and the resulting high flows appear to trigger movement of substantial numbers of juvenile Chinook salmon to downstream habitats. In general, juvenile abundance in the Delta appears to be higher in response to increased flow (U.S. Fish and Wildlife Service 1993).

Steelhead

Steelhead have one of the most complex life histories of any salmonid species. Steelhead are anadromous, but some individuals may complete their life cycle within a given river reach. Freshwater residents typically are referred to as rainbow trout, while anadromous individuals are called steelhead (National Marine Fisheries Service 1996a).

Historical records indicate that adult steelhead enter the mainstem Sacramento River in July, peak in abundance in September and October, and continue migrating through February or March (Table 6.1-2) (McEwan and Jackson 1994; Hallock 1989). Most steelhead spawn from December through April (Table 6.1-2), with most spawning occurring from January through March. Unlike Pacific salmon, some steelhead may survive to spawn more than one time, returning to the ocean between spawning migrations.

The female digs a redd in which she deposits her eggs. The duration of egg incubation in the gravel is determined by water temperature, varying from approximately 19 days at an average water temperature of 60°F (15.6°C) to approximately 80 days at an average temperature of 40°F (4.4°C). Steelhead fry usually emerge from the gravel 2 to 8 weeks after hatching (Barnhart 1986; Reynolds et al. 1993). Newly emerged steelhead fry move to shallow, protected areas along streambanks and move to faster, deeper areas of the river as they grow. Most juveniles occupy riffles in their first year of life and some of the larger steelhead live in deep fast runs or in pools. Juvenile steelhead feed on a variety of aquatic and terrestrial insects and other small invertebrates.

Juvenile migration to the ocean generally occurs from December through August (Table 6.1-2). Most Sacramento River steelhead migrate in spring and early summer (Reynolds et al. 1993). Sacramento River steelhead generally migrate as 1-year-olds at a length of 6 to 8 inches (15.2 to 20.3 centimeters [cm]) (Barnhart 1986; Reynolds et al. 1993). Although steelhead have been collected in most months at the state and federal pumping plants in the Delta, the peak numbers salvaged at these facilities occur in March and April in most years.

After 2–3 years of ocean residence, adult steelhead return to their natal stream to spawn as 3- or 4-year-olds (National Marine Fisheries Service 1998).

Coho Salmon

Coho salmon are anadromous fish that migrate as adults into the Trinity River and other coastal streams and rivers to spawn. Adult migration occurs from mid-September through December, and spawning typically takes place between November and January (Table 6.1-2) (Moyle 2002). Coho salmon adults spawn in waters with velocities of 0.82–1.0 feet/sec (0.25–0.31 meter per second (m/sec) and depths of 11.8–12.2 inches (0.3–0.31 meter) (Hampton 1988). Redds are formed near the heads of riffles in medium-to-small gravel that provide good flow and aeration. Spawning occurs over about a week. Embryos hatch after 8–12 weeks depending on the water temperature, and remain in the gravel for 4–10 weeks until their yolk sacs are absorbed (Leidy and Leidy 1984). After hatching, the juveniles move to shallow water along the stream margins (Moyle 2002).

Habitat includes backwaters, side channels, and stream margins adjacent to large, slow runs or pools. Coho salmon will shift their habitat use depending on the season, but use mostly deep pools with overhead cover in the summer (Moyle 2002). Cover is the most important rearing habitat feature; coho salmon seek areas with overhanging vegetation (e.g., brush and logs) and thick clusters of aquatic vegetation (Hampton 1988). Optimal growth temperature ranges from 53.1 to 57°F (11.7 to 13.9°C), and they prefer velocities of 0.3 to 1.5 feet/sec (0.09 to 0.46 m/sec) (Moyle 2002). Juveniles are absent from tributaries that reach temperatures warmer than 64°F (17.8°C) for more than a week.

Juvenile coho salmon rear in tributary streams for up to 15 months before migrating to the ocean. Downstream migration occurs from March through May, with peak occurrence in late April through mid-May when conditions are favorable (Table 6.1-2) (Moyle 2002).

Delta Smelt

Estuarine rearing habitat for juvenile and adult delta smelt is typically found in the waters of the lower Delta and Suisun Bay where salinity is between 2 and 7 ppt. Delta smelt tolerate 0 ppt to 19 ppt salinity. They typically occupy open shallow waters but also occur in the main channel in the region where fresh water and brackish water mix. The zone may be hydraulically conducive to their ability to maintain position and metabolic efficiency (Moyle 2002).

Adult delta smelt begin spawning migration into the upper Delta beginning in December or January (Table 6.1-2). Migration may continue over several months. Spawning occurs between January and July, with peak spawning during April through mid-May (Moyle 2002). Spawning occurs in along the channel edges in the upper Delta, including the Sacramento River above Rio Vista, Cache Slough, Lindsey Slough, and Barker Slough. Spawning has been observed in the Sacramento River up to Garcia Bend during drought conditions, possibly attributable to adult movement farther inland in response to saltwater intrusion (Wang and Brown 1993). Eggs are broadcast over the bottom, where they attach to firm substrate, woody material, and vegetation. Hatching takes approximately 9 to 13 days, and larvae begin feeding 4 to 5 days later. Newly hatched larvae contain a large oil globule and are semibuoyant. Larval smelt feed on rotifers and other zooplankton. As their fins and swim bladder develop, they move higher into the water column. Larvae and juveniles gradually move downstream toward rearing habitat in the estuarine mixing zone (Wang 1986).

Critical Habitat

Critical habitat for delta smelt is designated as all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in the existing contiguous waters within Suisun Bay and the Delta (59 Federal Register [FR] 852; January 6, 1994). The primary constituent elements for the critical habitat are adult migration, spawning habitat, larval and juvenile transport, and rearing habitat and are described below:

- **Adult migration**—the Sacramento and San Joaquin River channels and tributaries, including Cache and Montezuma Sloughs and their tributaries. Unrestricted access must be provided to suitable spawning habitat in a period that may extend from December to July. Adequate flow and suitable water quality must be maintained, and channels should be protected from physical disturbance and flow disruption.
- **Spawning habitat**—fresh or slightly brackish backwater sloughs and edgewaters of the Delta, Suisun Bay, and Montezuma Slough and its tributaries. Spawning habitat must provide suitable water quality and substrates for egg attachment. Spawning may start as early as December and extend until July.
- **Larval and juvenile transport**—channels of the Delta, Suisun Bay, and Montezuma Slough and its tributaries must be protected from physical disturbance and flow disruption (e.g., water diversions and in-channel gates). Depending on the timing of peak spawning, channel flow must be adequate to transport larvae from upstream spawning areas to rearing habitat in Suisun Bay and to prevent interception of larvae and juveniles by diversions.
- **Rearing habitat**—an area extending eastward from Carquinez Strait, including Suisun Bay, Grizzly Bay, Honker Bay, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Threemile Slough, and south along the San Joaquin River, including Big Break.

Suitable water quality must be available, and X2 must be maintained according to historical salinity conditions. Rearing habitat protection may be required from the beginning of February through the summer.

All of the above critical habitat elements are addressed in the Environmental Consequences section. The environmental correlates used in this EIS/EIR reflect the primary constituent elements of critical habitat above.

Splittail

Adult splittail migrate from Suisun Bay and the Delta to upstream spawning habitat during December through March (Table 6.1-2). Surveys conducted indicate that the Yolo and Sutter Bypasses provide important spawning habitat (Sommer et al. 1997). Both male and female splittail become sexually mature by their second winter at about 3.9 inches (10 cm) in length. Female splittail are capable of producing more than 100,000 eggs per year (Daniels and Moyle 1983; Moyle et al. 1989). Adhesive eggs are deposited over flooded terrestrial or aquatic vegetation when water temperature is between 48°F and 68°F (8.9°C and 20°C) (Moyle 2002; Wang 1986). Splittail spawn in late April and May in Suisun Marsh and between early March and May in the upper Delta and lower reaches and flood bypasses of the Sacramento and San Joaquin Rivers (Moyle et al. 1989). Spawning has been observed to occur as early as January and may continue through early July (Table 6.1-2) (Wang 1986; Moyle 2002).

The diet of adults and juveniles includes decayed organic material; earthworms, clams, insect larvae, and other invertebrates; and fish. The mysid *Neomysis mercedis* is a primary prey species, although decayed organic material constitutes a larger percentage of the stomach contents (Daniels and Moyle 1983).

Larval splittail are commonly found in shallow, vegetated areas near spawning habitat. Larvae eventually move into deeper and more open-water habitat as they grow and become juveniles. During late winter and spring, young-of-year juvenile splittail (i.e., production from spawning in the current year) are found in sloughs, rivers, and Delta channels near spawning habitat (Table 6.1-2). Juvenile splittail gradually move from shallow, nearshore areas to deeper, open water habitat of Suisun and San Pablo Bays (Wang 1986). In areas upstream of the Delta, juvenile splittail can be expected to be present in the flood bypasses when these areas are inundated during the winter and spring (Jones & Stokes Associates 1993; Sommer et al. 1997).

Striped Bass

Striped bass are nonnative and spend most of their lives in San Pablo and San Francisco Bays and move upstream to spawn. Spawning peaks in May and June, and its location depends on water temperature, flow, and salinity. Spawning occurs in the Delta and in the Sacramento River during the spring. Striped bass are open-water spawners, and their eggs must remain suspended in the current to prevent mortality. Embryos and larvae in the Sacramento River are carried into the Delta and Suisun Bay where rearing appears to be best (Moyle 2002). Larval and juvenile striped bass feed mainly on invertebrates, including copepods and opossum shrimp. Fish become a more important part of their diet as they grow in size (Moyle 2002). Young striped bass tend to accumulate in or just upstream of the estuary's freshwater/saltwater mixing zone and this region is critical nursery habitat (California Department of Fish and Game 1991a). Female striped bass reach maturity at 4 to 6 years of age, and males can reach maturity as early as the end of their first year but most reach maturity at 2–3 years of age. Adult striped bass are open-water predators and opportunistic feeders at the top of the aquatic food web. (Moyle 2002.)

Striped bass populations in the Delta have been in steady decline since the late 1970s. A changing atmospheric-oceanic climate may be at the root of this decline. The decline in striped bass abundance may be related to increasing ocean temperatures (Bennett and Howard 1999).

Green Sturgeon

Although green sturgeon are anadromous, they are the most marine-oriented species of sturgeon and are found in nearshore marine waters from Mexico to the Bering Sea (70 FR 17386). In freshwater, green sturgeon occur in the lower reaches of large rivers from British Columbia south to the San Francisco Bay. The southernmost spawning population of green sturgeon occurs in the Sacramento River system (Moyle 2002).

Green sturgeon have been divided into two distinct population segments: the northern and southern distinct population segments. The northern distinct population segment consists of green sturgeon populations extending from the Eel River northward, while the southern distinct population segment includes populations extending from south of the Eel River to the Sacramento River. Spawning populations have only been confirmed, however, in the Rogue (Oregon), Klamath, and Sacramento Rivers (70 FR 17386). In the Central Valley, spawning occurs in the Sacramento River upstream of Hamilton City, perhaps as far upstream as Keswick Dam (Adams et al. 2002), and possibly in the lower Feather River (Moyle 2002). Although no green sturgeon have ever been documented in the San Joaquin River upstream of the Delta, it is unclear whether they use this system for spawning; however, no efforts have been made to document sturgeon spawning in the San Joaquin River system (70 FR 17386). In the Trinity River, adult green sturgeon are known to occur as far upstream as Grays Falls (at River Mile [RM] 43), but there is no evidence of spawning upstream of RM 25 (Adams et al. 2002). There is no evidence that green sturgeon spawn in the South Fork Trinity River (Moyle et al. 1992b).

Adults migrate upstream into rivers between late February and late July, and spawn between March and July, when the water temperature is 46–57°F. Peak spawning occurs from mid-April to mid-June. Green sturgeon are believed to spawn every 3 to 5 years (Tracy 1990), although recent evidence indicates that spawning may be as frequent as every 2 years (70 FR 17386). Little is known about the specific spawning habitat preferences of green sturgeon. It is believed that adult green sturgeon broadcast their eggs in deep, fast water over large cobble substrate where the eggs settle into the interstitial spaces (Moyle 2002). Spawning may also occur over substrates ranging from clean sand to bedrock (Moyle 2002). Eggs hatch in approximately 8 days at 55ºF (Moyle 2002).

Larval green sturgeon begin feeding 10 days after hatching, and metamorhosis to the juvenile stage is complete within 45 days of hatching. Larvae grow quickly, reaching 74 mm in the first 45 days after hatching and 300 mm by the end of the their first year. Juveniles spend 1 to 3 years in freshwater before they enter the ocean. (70 FR 17386.)

Little is known about the movements and habits of green sturgeon. Green sturgeon have been salvaged at the state and federal fish collection facilities in every month, indicating that they are present in the Delta year-round. Between January 1993 and February 2003, a total of 99 green sturgeon were salvaged at the state and federal fish salvage facilities; no green sturgeon were salvaged in 2004 or 2005 (IEP 2005). Although it is assumed that green sturgeon are present throughout the Delta and rivers during any time of the year, salvage numbers probably indicate that their abundance, at least in the south Delta, is low. The diet of adult green sturgeon seems to mostly include bottom invertebrates and small fish (Ganssle 1966). Juveniles in the Delta feed on opossum shrimp and amphipods (Radtke 1966).

Other Species

The species discussed above are explicitly included in the assessment of impacts for the SDIP. Central Valley rivers and reservoirs support many other native and nonnative fish species that may be affected by the SDIP (Table 6.1-1). These other species are not afforded legal protection and therefore are not discussed beyond this section. In general, the effects of the SDIP on other fish species are assumed to be similar and encompassed by the assessment for the selected species.

In general, native species, such as Sacramento pikeminnow, hardhead, Sacramento sucker, and California roach, spawn early in the spring. With some exceptions, nonnative species, such as green sunfish, bluegill, white and channel catfish, and largemouth bass, spawn later in the spring and in the summer. Nonnative species are more successful in disturbed environments than native species. In general, they are adapted to warm, slow-moving, and nutrient-rich waters (Moyle 2002). Nonnative species dominate the fish communities in the Delta and lower reaches of the Sacramento and San Joaquin Rivers and their tributaries.

Trinity, Shasta, Lewiston, Oroville, Folsom, Pardee, San Luis, New Melones, and Camanche Reservoirs support coldwater and warmwater fisheries that are composed primarily of nonnative fishes. Coldwater species include rainbow trout, kokanee, and brown trout. Warmwater species include largemouth bass, smallmouth bass and other sunfish, channel catfish and bullheads, and common carp. The exact species composition of each reservoir varies according to different species introductions and hatchery supplementation (Moyle 2002). Most reservoirs are relatively artificial ecosystems that rarely meet all the needs of the species present. Factors such as water-level fluctuation, limited cover and spawning habitat, and inadequate forage base may affect the reproductive success of reservoir species and the capacity for supporting sustainable populations. However, minimal changes in reservoir storage, especially for San Luis, result from SDIP operation (see Section 7.4) and, therefore, no change in reservoir fish numbers would be expected.

Factors That Affect Abundance of Fish Species

Information relating abundance with environmental conditions is most available for special-status species, especially Chinook salmon. The following section focuses on factors that have potentially affected the abundance of special-status species in the Central Valley. Although not all species are discussed, many of the factors affecting the special-status species have also affected the abundance of other native and nonnative species.

Spawning Habitat Area

Spawning habitat area may limit the production of juveniles and subsequent adult abundance of some species. Spawning habitat area for fall-/late fall–run Chinook salmon, which compose more than 90% of the Chinook salmon returning to the Central Valley streams, has been identified as limiting their population abundance. Spawning habitat area has not been identified as a limiting factor for the less-abundant winter-run and spring-run Chinook salmon (National Marine Fisheries Service 1996b; U.S. Fish and Wildlife Service 1996), although habitat may be limiting in some streams (e.g., Butte Creek) during years of high adult abundance.

Spawning habitat area is defined by a number of factors such as gravel size and quality and water depth and velocity. Although maximum usable gravel size depends on fish size, a number of studies have determined that Chinook salmon require gravel ranging from approximately 0.1 inch (0.3 cm) to 5.9 inches (15 cm) in diameter (Raleigh et al. 1986). Steelhead prefer substrate no larger than 3.9 inches (10 cm) (Bjornn and Reiser 1991). Water depth criteria for spawning vary widely, and there is little agreement among studies about the minimum and maximum values for depth (Healey 1991). Salmonids spawn in water depths that range from a few inches to several feet. A minimum depth of 0.8 foot (0.2 m) for Chinook salmon and steelhead spawning has been widely used in the literature and is within the range observed in some Central Valley rivers (California Department of Fish and Game 1991b). In general, water should be at least deep enough to cover the adult fish during spawning. Minimum water depth for steelhead spawning has been observed to be enough to cover the fish (Bjornn and Reiser 1991). Many fish spawn in deeper water. Velocity that supports spawning ranges from 0.8 feet/sec to 3.8 feet/sec (0.2 to 1.2 m/sec) (U.S. Fish and Wildlife Service 1994).

Delta smelt spawn in fresh water at low tide on aquatic plants, submerged and inshore plants, and over sandy and hard bottom substrates of sloughs and shallow edges of channels in the upper Delta and Sacramento River above Rio Vista (Wang 1986; Moyle 2002). Spawning habitat area has not been identified as a factor affecting delta smelt abundance (U.S. Fish and Wildlife Service 1996), but little is known about specific spawning areas and requirements within the Delta.

A lack of sufficient seasonally flooded vegetation may limit splittail spawning success (Young and Cech 1996; Sommer et al. 1997). Splittail spawn over flooded vegetation and debris on floodplains that are inundated by high flow from February to early July in the Sacramento River and San Joaquin River systems. The onset of spawning appears to be associated with rising water levels, increasing water temperature, and day length (Moyle 2002). The Sutter and Yolo Bypasses along the Sacramento River are important spawning habitat areas during high flow.

Green sturgeon spawn in deep, fast water. Spawning substrate can range from clean sand to bedrock, although the preferred substrate is probably large cobble. Currently, spawning takes place in the Sacramento, Klamath, and Rogue (Oregon) Rivers and may be the only spawning populations left in North America (Moyle 2002). Spawning habitat area has not been defined as a factor affecting abundance for green sturgeon. However, little is known about specific habitat requirements for wild spawning green sturgeon.

Rearing Habitat Area

Rearing habitat area may limit the production of juveniles and subsequent adult abundance of some species. The USFWS (1996) has indicated rearing habitat area in Central Valley streams and rivers limits the abundance of juvenile fall-run and late fall–run Chinook salmon and juvenile steelhead. Rearing habitat for salmonids is defined by environmental conditions such as water temperature, DO, turbidity, substrate, water velocity, water depth, and cover (Jackson 1992; Bjornn and Reiser 1991; Healey 1991). Chinook salmon also rear along the shallow vegetated edges of Delta channels (Grimaldo et al. 2000).

Environmental conditions and interactions between individuals, predators, competitors, and food sources determine habitat quantity and quality and the productivity of the stream (Bjornn and Reiser 1991). Everest and Chapman (1972) found juvenile Chinook salmon and steelhead of the same size using similar in-channel rearing area. Juvenile coho salmon use side-channel pools. Coho salmon prefer low velocity areas with good cover, especially in the winter (Bjornn and Reiser 1991).

Rearing area varies with flow. High flow increases the area available to juvenile Chinook salmon because they extensively use submerged terrestrial vegetation on the channel edge and the floodplain. Deeper inundation provides more overhead cover and protection from avian and terrestrial predators than shallow water (Everest and Chapman cited in Jackson 1992). In broad, low-gradient rivers, change in flow can greatly increase or decrease the lateral area available to juvenile Chinook salmon, particularly in riffles and shallow glides (Jackson 1992).

Rearing habitat for larval and early juvenile delta smelt encompasses the lower reaches of the Sacramento River below Isleton and the San Joaquin River below Mossdale. Estuarine rearing by juveniles and adults occurs in the lower Delta and Suisun Bay. The USFWS (1996) has indicated that loss of rearing habitat area would adversely affect the abundance of larval and juvenile delta smelt. The area and quality of estuarine rearing habitat is assumed to be dependent on the downstream location of approximately 2 ppt salinity (Moyle et al. 1992a). The condition where 2 ppt salinity is located in the Delta is assumed to provide less habitat area and lower quality than the habitat provided by 2 ppt salinity located farther downstream in Suisun Bay. During years of average and high outflow, delta smelt may concentrate anywhere from the Sacramento River around Decker Island to Suisun Bay (Moyle 2002). This geographic distribution may not always be a function of outflow and 2 ppt isohaline position. Outflow and the position of the 2 ppt isohaline may account for only about 25% of the annual variation in abundance indices for delta smelt (California Department of Water Resources and Bureau of Reclamation 1994).

Rearing habitat has not been identified as a limiting factor in splittail population abundance, but as with spawning, a lack of sufficient seasonally flooded vegetation may be limiting population abundance and distribution (Young and Cech 1996). Rearing habitat for splittail encompasses the Delta, Suisun Bay, Suisun Marsh, the lower Napa River, the lower Petaluma River, and other parts of San Francisco Bay (Moyle 2002). In Suisun Marsh, splittail concentrate in the dead-end sloughs that have small streams feeding into them (Daniels and Moyle 1983; Moyle 2002). As splittail grow, salinity tolerance increases (Young and Cech 1996). Splittail are able to tolerate salinity concentrations as high as 29 ppt and as low as 0 ppt (Moyle 2002).

Juvenile green sturgeon prefer deeper areas with rock structures to hide during the day, and forage and migrate at night (Kynard et al. 2005). Little is known about rearing habitat requirements for juvenile green sturgeon and has not been identified as a limiting factor in sturgeon population abundance.

Migration Habitat Conditions

The Sacramento, Feather, Yuba, American, and Mokelumne rivers and the Delta provide a migration pathway between freshwater and ocean habitats for adult and juvenile steelhead and all runs of Chinook salmon. The Trinity River provides a migration pathway for coho salmon, Chinook salmon, and steelhead.

Migration habitat conditions include streamflows that provide suitable water velocities and depths that provide successful passage. Flow in the Sacramento, Feather, Yuba, American, and Mokelumne rivers and in the Delta provide the necessary depth, velocity, and water temperature. Within the Delta, the channel pathways affect migration of juvenile Chinook salmon. Juvenile Chinook salmon survival is lower for fish migrating through the central Delta (i.e., diverted into the DCC and Georgiana Slough) than for fish continuing down the Sacramento River (Newman and Rice 1997). Similarly, juvenile Chinook salmon entering the Delta from the San Joaquin River appear to have higher survival if they remain in the San Joaquin River channel instead of moving into Old River and the south Delta (Brandes and McLain 2001).

Larval and early juvenile delta smelt are transported by currents that flow downstream into the upper end of the mixing zone of the estuary where incoming saltwater mixes with outflowing fresh water (Moyle et al. 1992a). Reduced flow may adversely affect transport of larvae and juveniles to rearing habitat.

Adult splittail gradually move upstream during the winter and spring months to spawn. Year class success of splittail is positively correlated with wet years, high Delta outflow, and floodplain inundation (Sommer et al. 1997; Moyle 2002). Low flow impedes access to floodplain areas that support rearing and spawning.

Green sturgeon adults and juveniles seem to prefer deeper water habitat such as pools. Lower flows could impede upstream migration of adults if low flow conditions cause barriers for migration.

Water Temperature

Fish species have different responses to water temperature conditions depending on their physiological adaptations. Salmonids in general have evolved under conditions in which water temperatures need to be relatively cool. Delta smelt and splittail can tolerate warmer temperatures. In addition to species-specific thresholds, different life stages have different water temperature requirements. Eggs and larval fish are the most sensitive to warm water temperature.

Unsuitable water temperatures for adult salmonids such as Chinook salmon, steelhead, and coho salmon during upstream migration lead to delayed migration and potential lower reproduction. Elevated summer water temperatures in holding areas cause mortality of spring-run Chinook salmon (U.S. Fish and Wildlife Service 1996). Warm water temperature and low DO also increase egg and fry mortality. The USFWS (1996) cited elevated water temperatures as limiting factors for fall and late fall–run Chinook salmon.

Juvenile salmonid survival, growth, and vulnerability to disease are affected by water temperature. In addition, water temperature affects prey species abundance and predator occurrence and activity. Juvenile salmonids alter their behavior depending on water temperature, including movement to take advantage of local water temperature refugia (e.g., movement into stratified pools, shaded habitat, and subsurface flow) and to improve feeding efficiency (e.g., movement into riffles).

Water temperature in Central Valley rivers frequently exceeds the tolerance of Chinook salmon and steelhead life stages. Based on a literature review, conditions supporting adult Chinook salmon migration are assumed to deteriorate as temperature warms between 54ºF and 70ºF (12.2°C and 21.1°C) (Hallock 1970 as cited in McCullough 1999). For Chinook salmon eggs and larvae, survival during incubation is assumed to decline with increasing temperature between 54ºF and 61ºF (12.2°C and 16.1°C). (Myrick and Cech 2001; Seymour 1956 cited in Alderice and Velsen 1978). For juvenile Chinook salmon, survival is assumed to decline as temperature warms from 64ºF to 75ºF (17.8°C to 23.9°C) (Myrick and Cech 2001; Rich 1987). Relative to rearing, Chinook salmon require cooler temperatures to complete the parr-smolt transformation and to maximize their saltwater survival. Successful smolt transformation is assumed to deteriorate at temperatures ranging from 63ºF to 73ºF (17.2°C to 22.8°C) (Marine 1997 cited in Myrick and Cech 2001; Baker et al. 1995).

For steelhead, successful adult migration and holding is assumed to deteriorate as water temperature warms between 52ºF and 70ºF (11.1°C and 21.1°C). Adult steelhead appear to be much more sensitive to thermal extremes than are juveniles (National Marine Fisheries Service 1996a; McCullough 1999). Conditions supporting steelhead spawning and incubation are assumed to deteriorate as temperature warms between 52ºF and 59ºF (11.1°C and 15°C) (Myrick and Cech 2001). Juvenile rearing success is assumed to deteriorate at water temperatures ranging from 63ºF to 77ºF (17.2°C to 25°C) (Raleigh et al. 1984; Myrick and Cech 2001). Relative to rearing, smolt transformation requires cooler temperatures, and successful transformation occurs at temperatures ranging from 43ºF to 50ºF (6.1°C to 10°C). Juvenile steelhead, however, have been captured at Chipps Island in June and July at water temperatures exceeding 68ºF (Nobriega and Cadrett 2001). Juvenile Chinook salmon have also been observed to migrate at water temperatures warmer than expected based on laboratory experimental results (Baker et al. 1995).

Delta smelt and splittail populations are adapted to water temperature conditions in the Delta. Delta smelt may spawn at temperatures as high as 72ºF (22.2°C) (U.S. Fish and Wildlife Service 1996) and can rear and migrate at temperatures as warm as 82ºF (Swanson and Cech 1995). Splittail may withstand temperatures as warm as 91ºF but prefer temperatures between 66ºF and 75ºF (18.9°C and 23.9°C) (Young and Cech 1996).

Green sturgeon prefer cool water temperatures for spawning, embryonic development and rearing. Spawning typically occurs when water temperatures are 46–57°F and embryonic development is optimal when water temperatures are 52–66°F. Temperatures above 68°F are lethal for embryos (Cech et al. 2000). Overwintering juveniles stop migrating downstream when temperatures reach 46°F (Kynard et al. 2005).

Entrainment

All fish species are entrained to varying degrees by the SWP and CVP Delta export facilities and other diversions in the Delta and Central Valley rivers. Fish entrainment and subsequent mortality is a function of the size of the diversion, the location of the diversion, the behavior of the fish, and other factors, such as fish screens, presence of predatory species, and water temperature. Low approach velocities are assumed to minimize stress and protect fish from entrainment.

Juvenile striped bass populations have steadily declined since the mid-1960s partially because of entrainment losses of eggs and young fish at water diversions (Foss and Miller 2001). The CVP and SWP fish facilities indicate entrainment of adult delta smelt during spawning migration from December through April (California Department of Water Resources and Bureau of Reclamation 1994). Juveniles are entrained primarily from April through June. Young-of-year splittail are entrained between April and August when fish are moving downstream into the estuary (Cech et al. 1979 as cited in Moyle 2002). Juvenile Chinook salmon are entrained in all months but primarily from November through June when juveniles are migrating downstream. Green sturgeon are rarely entrained at the CVP and SWP fish facilities; however, entrainment has occurred in every month (IEP 2005).

Contaminants

In the Sacramento and San Joaquin River basins, industrial and municipal discharge and agricultural runoff introduce contaminants into rivers and streams that ultimately flow into the Delta. Organophosphate insecticides, such as carbofuran, chlorpyrifos, and diazinon, are present throughout the Central Valley and are dispersed in agricultural and M&I runoff. These contaminants enter rivers in winter runoff and enter the estuary in concentrations that can be toxic to invertebrates (CALFED Bay-Delta Program 2000d). Because they accumulate in living organisms, they may become toxic to fish species, especially those life stages that remain in the system year-round and spend considerable time there during the early stages of development such as Chinook salmon, steelhead, splittail, delta smelt, and green sturgeon.

Predation

Nonnative species cause substantial predation mortality on native species. Studies at CCF estimated predator-related mortality of hatchery-reared fall-run Chinook salmon from about 60% to more than 95%. Although the predation contribution to mortality is uncertain, the estimated mortality suggests that striped bass and other predatory fish, primarily nonnative, pose a threat to juvenile Chinook salmon moving downstream, especially where the stream channel has been altered from natural conditions (California Department of Water Resources 1995d). Turbulence after passing over dams and other structures may disorient juvenile Chinook salmon and steelhead, increasing their vulnerability to predators. Predators such as striped bass, largemouth bass, and catfish also prey on delta smelt and splittail (U.S. Fish and Wildlife Service 1996). However, the extent that these predators may affect delta smelt and splittail populations is unknown. Predation is not a known cause for decline in green sturgeon populations (Adams et al. 2002).

Food

Food availability and type affect survival of fish species. Species such as threadfin shad and wakasagi may affect delta smelt survival through competition for food. Introduction of nonnative food organisms may also have an effect on delta smelt and other species survival. Nonnative zooplankton species are more difficult for small smelt and striped bass to capture, increasing the likelihood of larval starvation (Moyle 2002). Splittail feed on opossum shrimp, which in turn feed on native copepods that have shown reduced abundance, potentially attributable to the introduction of nonnative zooplankton and the Asiatic clam *Potamorcorbula amurensis*. In addition, flow affects the abundance of food in rivers, the Delta, and Suisun Bay. In general, higher flows result in higher productivity, including the higher input of nutrients from channel margin and floodplain inundation and higher production resulting when low salinity occurs in the shallows of Suisun Bay. Higher productivity increases the availability of prey organisms for delta smelt and other fish species.

Environmental Consequences

Assessment Approach and Methods

The assessment of effects considers the occurrence and potential occurrence of species and species' life stages relative to the magnitude, timing, frequency, and duration of project activities, including construction and operation of gates in the south Delta, dredging, and water supply operations. The assessment links project actions to changes in environmental correlates, where environmental correlates are environmental conditions or suites of environmental conditions that individually or synergistically affect the survival, growth, fecundity, and movement of a species. Environmental correlates addressed in this assessment include spawning habitat quantity, rearing habitat quantity, migration habitat condition, water temperature, food, and entrainment in diversions (Table 6.1-3).

The assessment of a species response to project actions begins with statements of the hypothetical relationships between changes in environmental correlates and the expected species response. The underlying principles, specific methods, and available scientific support are discussed. Additional supporting information relative to species occurrence, life history, biology and physiology, and factors that have affected the historical and current species abundance is provided in Affected Environment.

Table 6.1-3. Summary of Assessment Models and Tools by Environmental Correlate for Each Fish Species and Life Stage

Assessed Environmental Correlate	Simulated Environmental Condition	Models Used to Simulate Environmental Conditions	Analytical Tool	Species: Life Stage
Spawning Habitat Quantity	River Flow—Trinity River	CALSIM, Water years 1922–1994	Qualitative assessment of flow effects	Coho Salmon: spawning and incubation
	River Flow—Sacramento River at Keswick Dam, Colusa, and Verona	CALSIM, Water years 1922–1994	Flow-habitat relationship for salmon and steelhead; high flow assessment of floodplain inundation for splittail	Winter-run Chinook Salmon: spawning and incubation Spring-run Chinook Salmon: spawning and incubation Fall-run Chinook Salmon: spawning and incubation Late fall–run Chinook Salmon: spawning and incubation Steelhead: spawning and incubation Splittail: spawning and incubation
	River Flow—Feather River	CALSIM, Water years 1922–1994	Flow-habitat relationship	Spring-run Chinook Salmon: spawning and incubation Fall-run Chinook Salmon: spawning and incubation Steelhead: spawning and incubation
	River Flow—American River	CALSIM, Water years 1922–1994	Flow-habitat relationship	Fall-run Chinook Salmon: spawning and incubation Steelhead: spawning and incubation
	River Flow—San Joaquin	CALSIM, Water years 1922–1994	Qualitative assessment of flow effect	Fall-run Chinook Salmon: spawning and incubation Steelhead: spawning and incubation
	Delta Outflow (and X2)	CALSIM, Water years 1922–1994	Qualitative assessment of change in freshwater area in the Delta	Delta Smelt: spawning Striped Bass: spawning
	Reservoir Storage—Trinity, Shasta, Oroville, and Folsom	CALSIM, Water years 1922–1994	Qualitative assessment of changes in reservoir storage effects	Reservoir species: spawning and incubation

Table 6.1-3. Continued

Assessed Environmental Correlate	Simulated Environmental Condition	Models Used to Simulate Environmental Conditions	Analytical Tool	Species: Life Stage
Rearing Habitat Quantity	River Flow—Trinity River	CALSIM, Water years 1922–1994	Qualitative assessment of flow effects	Coho Salmon: juvenile
	River Flow—Sacramento River at Keswick Dam, Colusa, and Verona	CALSIM, Water years 1922–1994	Low flow assessment based on flow-habitat relationship for salmon and steelhead; high flow assessment based on floodplain inundation for salmon and splittail	Winter-run Chinook Salmon: juvenile Spring-run Chinook Salmon: juvenile Fall-run Chinook Salmon: juvenile Late fall–run Chinook Salmon: juvenile Steelhead: juvenile Splittail: juvenile
	River Flow—Feather River	CALSIM, Water years 1922–1994	Low flow assessment based on flow-habitat relationship	Spring-run Chinook Salmon: juvenile Fall-run Chinook Salmon: juvenile Steelhead: juvenile
	River Flow—American River	CALSIM, Water years 1922–1994	Low flow assessment based on flow-habitat relationship	Fall-run Chinook Salmon: juvenile Steelhead: juvenile
	River Flow—San Joaquin	CALSIM, Water years 1922–1994	Qualitative assessment of flow effects	Fall-run Chinook Salmon: juvenile Steelhead: juvenile
	Delta Outflow (and X2)	CALSIM, Water years 1922–1994	Change in rearing habitat area based on location of X2	Delta Smelt: juvenile and adult Striped Bass: juvenile
	Reservoir Storage—Trinity, Shasta, Oroville, and Folsom	CALSIM, Water years 1922–1994	Qualitative assessment of reservoir storage effects	Reservoir species: juvenile

Assessed Environmental Correlate	Simulated Environmental Condition	Models Used to Simulate Environmental Conditions	Analytical Tool	Species: Life Stage
Migration Habitat Conditions	River Flow—Sacramento River	CALSIM, Water years 1922–1994	Assessment of floodplain inundation for splittail; assessment of low flow effects for striped bass	Splittail: adult Striped Bass: egg and larvae
	Delta Channel Flows—Sacramento River, Delta Cross Channel, and Georgiana Slough	CALSIM, Water years 1922–1994	Pathway-survival relationship for chinook salmon and steelhead	Winter-run Chinook Salmon: juvenile Spring-run Chinook Salmon: juvenile Fall-run Chinook Salmon: juvenile Late fall–run Chinook Salmon: juvenile Steelhead: juvenile
	Delta Channel Flows—San Joaquin River and head of Old River	CALSIM, Water years 1922–1994	Pathway-survival relationship for chinook salmon and steelhead	Fall-run Chinook Salmon: juvenile Steelhead: juvenile
	Delta Channel Flows—South Delta	DWRDSM2	Qualitative assessment based on gate elevation and tidal flow volume	Fall-run chinook salmon: juvenile Delta Smelt: adult and larvae
	Dissolved Oxygen—San Joaquin River at Stockton	CALSIM, Water years 1922–1994; DWRDSM2	Qualitative assessment based on flow at Stockton	Fall-run Chinook Salmon: adult Steelhead: adult

Table 6.1-3. Continued

Assessed Environmental Correlate	Simulated Environmental Condition	Models Used to Simulate Environmental Conditions	Analytical Tool	Species: Life Stage
Water Temperature	Water Temperature—Trinity River	CALSIM, Water years 1922–1994; U.S. Bureau of Reclamation Monthly Water Temperature Model	Temperature-survival relationship	Coho Salmon: adult, incubation, juvenile, smolt
	Water Temperature—Sacramento River at Keswick Dam, Bend Bridge, and Red Bluff Diversion Dam	CALSIM, Water years 1922–1994; U.S. Bureau of Reclamation Monthly Water Temperature Model	Temperature-survival relationship	Winter-run Chinook Salmon: adult, incubation, juvenile, smolt Spring-run Chinook Salmon: adult, incubation, juvenile, smolt Fall-run Chinook Salmon: adult, incubation, juvenile, smolt Late fall–run Chinook Salmon: adult, incubation, juvenile, smolt Steelhead: adult, incubation, juvenile, smolt
	Water Temperature—Feather River	CALSIM, Water years 1922–1994; U.S. Bureau of Reclamation Monthly Water Temperature Model	Temperature-survival relationship	Spring-run Chinook Salmon: adult, incubation, juvenile, smolt Fall-run Chinook Salmon: adult, incubation, juvenile, smolt Steelhead: adult, incubation, juvenile, smolt
	Water Temperature—American River	CALSIM, Water years 1922–1994; U.S. Bureau of Reclamation Monthly Water Temperature Model	Temperature-survival relationship	Fall-run Chinook Salmon: adult, incubation, juvenile, smolt Steelhead: adult, incubation, juvenile, smolt
	River Flow—San Joaquin	CALSIM, Water years 1922–1994	Qualitative assessment of potential water temperature effects	Fall-run Chinook Salmon: adult, incubation, juvenile, smolt Steelhead: adult, incubation, juvenile, smolt

Assessed Environmental Correlate	Simulated Environmental Condition	Models Used to Simulate Environmental Conditions	Analytical Tool	Species: Life Stage
Food	River Flow—Trinity River	CALSIM, Water years 1922–1994	Qualitative assessment of flow effect	Coho Salmon: rearing
	River Flow—Sacramento River at Keswick Dam, Colusa, and Verona	CALSIM, Water years 1922–1994	Qualitative assessment of flow effect; high flow assessment of floodplain inundation	Winter-run Chinook Salmon: rearing Spring-run Chinook Salmon: rearing Fall-run Chinook Salmon: rearing Late fall–run Chinook Salmon: rearing Steelhead: in-river rearing Splittail: rearing
	River Flow—Feather River	CALSIM, Water years 1922–1994	Qualitative assessment of flow effect	Spring-run Chinook Salmon: rearing Fall-run Chinook Salmon: rearing Steelhead: rearing
	River Flow—American River	CALSIM, Water years 1922–1994	Qualitative assessment of flow effect	Fall-run Chinook Salmon: rearing Steelhead: rearing
	River Flow—San Joaquin	CALSIM, Water years 1922–1994	Qualitative assessment of flow effect	Fall-run Chinook Salmon: rearing Steelhead: rearing
	Delta Outflow (and X2)	CALSIM, Water years 1922–1994	Qualitative assessment of change X2 location	Delta Smelt: rearing Striped Bass: rearing
Entrainment in Delta diversions	SWP and CVP Exports; particle transport	CALSIM, Water years 1922–1994; DWRDSM2; Particle Tracking Model (DSM2-PTM)	Export volume-entrainment loss relationships; particle transport-entrainment loss relationships for passive and active fish behavior	Winter-run Chinook Salmon: juvenile Spring-run Chinook Salmon: juvenile Fall-run Chinook Salmon (from Sacramento, Mokelumne, and San Joaquin Rivers): juvenile Late fall–run Chinook Salmon: juvenile Steelhead: juvenile Delta Smelt: adult, larvae, juvenile Splittail: juvenile Striped Bass: egg, larvae, juvenile

Breadth of the Assessment

The SDIP may include construction of gates, dredging, and changes in exports and inflows that could affect environmental conditions within the Delta. Changes in water supply operations (i.e., Delta exports and inflows) potentially affect environmental conditions in the Sacramento River downstream of Keswick Dam, the American River downstream of Nimbus Dam, the Feather River downstream of the Thermalito Diversion Dam, the Trinity River downstream of Lewiston Reservoir, and Folsom, Oroville, Shasta and Trinity Reservoirs. The potential changes in water supply operations, affecting river flows, reservoir operations, and diversions and exports, are simulated by CALSIM over a range of conditions represented by the 1922–1994 hydrology (Section 5.1, Water Supply). The 1922–1994 hydrologies include wet and dry conditions and provide an indication of operations effects over variable sequences of hydrologic year types. The assessment of the effects of changes in water supply operations on fish species relies primarily on the simulated hydrology (Table 6.1-3).

This assessment focuses primarily on fish species listed under the ESA and CESA. Assessment methods have been developed to address effects on southern Oregon/northern California coasts coho salmon (i.e., Trinity River), Central Valley steelhead, Central Valley fall-/late fall–run Chinook salmon, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, delta smelt, splittail, striped bass, and green sturgeon (Table 6.1-3). Assessment methods are generally life stage specific.

Although not all fish species potentially affected are specifically included in the assessment, the response of the selected species to project actions provides an indication of the potential response by species with similar environmental needs. Where the analysis for the selected species does not capture the potential project effects on another species (e.g., reservoir species), specific effects on the other species are described.

Analytical Tools and Measures of Species Response

This section describes the tools applied to assess the potential effects of the SDIP on fish and other aquatic species (Table 6.1-3). Tools are identified for assessment of change in environmental correlates potentially affected by SDIP project actions that could cause a measurable species response (i.e., a measurable change in survival, growth, fecundity, and movement).

Conceptual models illustrate the environmental correlates identified for each life stage of delta smelt, Chinook salmon, and splittail (Figures 6.1-1, 6.1-2, and 6.1-3). Conceptual models are not provided for coho salmon, steelhead, striped bass, and green sturgeon. The conceptual models for coho salmon and steelhead would be similar to the model for Chinook salmon (Figure 6.1-2). The conceptual model for striped bass would be similar to the model for delta smelt (Figure 6.1-1), except that migration habitat condition is a "key" environmental correlate for the incubation life stage of striped bass (i.e., the eggs are semibuoyant and drift with flow). In addition, striped bass spawn in the lower Sacramento River and its tributaries as well as in the Delta. The conceptual model for green sturgeon is assumed to be encompassed by the models for delta smelt, Chinook salmon, and splittail combined.

Environmental correlates are expressed as some measurement unit, including linear feet or acres of habitat, degrees Fahrenheit, feet per second, thousand acre feet, cubic feet per second, and number of particles entrained. Hypotheses of the species response to variation in environmental correlates are identified for applicable species' life stages (Table 6.1-4) and are translated into equations or models that indicate the species response. The response of each species to change in environmental correlates is determined by the ecology and physiology of a species' life stage.

Measures of a species response to changes in environmental correlates ideally quantify predicted survival, growth, fecundity, and movement. Predicted survival and fecundity support the assessment of changes in a species' population abundance that facilitate the determination of impact significance (see Significance Criteria, below).

When feasible, change in an environmental correlate is related to effects on survival or fecundity. The relationship of change in an environmental correlate to a species response may be accomplished through various means. A model may estimate survival or fecundity. A water temperature-survival relationship is one example of a survival model. Another example of a survival model is the particle-tracking model that can be used to estimate entrainment of particles in diversions. The proportion of particles entrained may be assumed equivalent to entrainment-related mortality.

Existing tools may not quantify the potential change in survival or fecundity. Consequently, assessment of the change in survival and fecundity may be based on professional judgment and qualitative interpretation of the species responsiveness to changes in environmental conditions. For example, the responsiveness of a species to change in an environmental correlate could be described as ranging from low to very high (Table 6.1-5). Where appropriate, these ranges of responsiveness are used in the description of the assessment relationships for each species.

Table 6.1-4. Hypotheses and Measures of Species Response for All Environmental Correlates and Selected Species

Environmental Correlate	Species	Hypothesis Relating Change in the Environmental Correlate to a Species Response
Spawning Habitat Area	Chinook salmon	Spawning habitat area is a function of flow and reduced spawning habitat area will result in reduced fry production
	Steelhead	Spawning habitat area is a function of flow and reduced spawning habitat area will result in reduced fry production
	Delta smelt	Reduced spawning habitat area in response to flow (i.e., salinity intrusion) and physical disturbance will result in reduced larvae production
	Splittail	Spawning habitat area is a function of floodplain and bypass inundation and reduced spawning habitat area will result in reduced juvenile production
	Striped Bass	Reduced spawning habitat area in response to flow (i.e., salinity intrusion) and physical disturbance will result in reduced larvae production
Rearing Habitat Area	Chinook salmon	Rearing habitat area within the stream channel is a function of flow and reduced rearing habitat area will result in reduced juvenile production
		Rearing habitat area is a function of floodplain and bypass inundation and reduced rearing habitat area will result in reduced juvenile production
	Steelhead	Rearing habitat area within the stream channel is a function of flow and reduced rearing habitat area will result in reduced juvenile production
	Delta smelt	Reduced rearing habitat area in response to flow (i.e., estuarine salinity distribution) will result in reduced juvenile production
	Splittail	Rearing habitat area is a function of floodplain and bypass inundation and reduced rearing habitat area will result in reduced juvenile production
	Striped bass	Reduced rearing habitat area in response to flow (i.e., estuarine salinity distribution) will result in reduced juvenile production
Migration Habitat Conditions	Chinook salmon	Low dissolved oxygen conditions in the San Joaquin River channel near Stockton can delay adult migration and reduce spawning success
		Juvenile chinook salmon survival is lower for fish migrating into the Delta Cross Channel (DCC) and Georgiana Slough
		Juvenile chinook salmon survival is lower for fish migrating into Old River near Mossdale
	Steelhead	Same as chinook salmon

Table 6.1-4. Continued

Environmental Correlate	Species	Hypothesis Relating Change in the Environmental Correlate to a Species Response
	Delta smelt	A clear relationship has not been supported by the available data
	Splittail	Migration habitat conditions are a function of floodplain and bypass inundation and spawning success declines with reduced duration of inundation
	Striped bass	Egg survival is lower when Sacramento River inflow to the Delta is low
Water Temperature	Chinook salmon	Survival declines with increasing water temperature
	Steelhead	Survival declines with increasing water temperature
	Delta smelt	Not considered
	Splittail	Not considered
	Striped bass	Not considered
Food	Chinook salmon	Food production is a function of wetted channel area and inundated floodplain area and reduced food availability reduces survival
	Steelhead	Food production is a function of wetted channel area and reduced food availability reduces survival
	Delta smelt	An upstream shift in X2 results in lower food production and reduced food availability reduces survival
	Splittail	Food production is a function of inundated floodplain area and reduced food availability reduces survival
	Striped bass	An upstream shift in X2 results in lower food production and reduced food availability reduces survival
Entrainment	Chinook salmon	Entrainment loss is directly related to SWP and CVP pumping and an assumed density of fish in the water diverted
	Steelhead	Entrainment loss is directly related to SWP and CVP pumping and an assumed density of fish in the water diverted
	Delta smelt	Entrainment loss is directly related to SWP and CVP pumping and an assumed density of fish in the water diverted
	Splittail	Entrainment loss is directly related to SWP and CVP pumping and an assumed density of fish in the water diverted
	Striped bass	Entrainment loss is directly related to SWP and CVP pumping and an assumed density of fish in the water diverted

Table 6.1-5. Species Responsiveness to Change in an Environmental Correlate

Response	Definition
Low	Change in an environmental correlate causes a relatively small species response. Fecundity or life stage survival is expected to change by less than 2.5% in response to a 10% or larger change in an environmental correlate. Although the species response may be minimally affected by small changes in an environmental correlate (<10% change), significant impacts may result from larger changes.
Medium	Change in an environmental correlate causes a moderate response. Change in fecundity or life stage survival is approximately proportionate to change in the environmental correlate. That is, a 10% change in an environmental correlate would result in a 10% change in survival or fecundity.
High	Change in an environmental correlate causes a large species response. Fecundity or life stage survival is expected to change by more than 10% and up to 20% in response to a 10% change in an environmental correlate.
Very High	Change in an environmental correlate causes a very large species response. Change in fecundity or life stage survival may exceed 20% in response to a 10% change in the environmental correlate.

A discussion of certainty is included in the description of the assessment relationships and the expected species response for each environmental correlate. The description of certainty is qualitative, ranging from minimal to high (Table 6.1-6). Certainty is an important component in the assessment of impact significance (see Significance Criteria section) and in the development of effective mitigation of significant project impacts, including avoidance, minimization, and compensation measures.

Certainty indicates the potential that the species response or an index of the species response is reliable, adequate, accurate, and precise. An indication of certainty is the scientific support for the hypotheses, ranging from speculative relationships (minimal certainty) to those relationships that are thoroughly established, generally accepted, and supported by peer-reviewed evidence (high certainty). Certainty is also related to the accuracy and precision of measured or simulated environmental conditions and the resulting index of the species response.

Table 6.1-6. Certainty of the Assessment Relationships

Level of Certainty	Definition
Minimal	The relationship is speculative and has little empirical support.
Low	Some evidence from experiments and observation supports the theoretical relationship for cause and effect. The magnitude of species response cannot reliably be predicted from a given magnitude change in an environmental correlate. Contradictory theoretical relationships may be equally supported.
Medium	Evidence from experiments and observations support the theoretical relationship for cause and effect. The magnitude of species response can be predicted from a given magnitude change in an environmental correlate. The accuracy and precision of the relationship has not been statistically evaluated. Contradictory theoretical relationships are possible, but they are unlikely to be as well supported by experiments and observations.
High	Cause-and-effect relationships are thoroughly established, generally accepted, and supported by peer-reviewed evidence. The magnitude of species response can be predicted from a given magnitude change in an environmental correlate. The accuracy and precision of the relationship has been statistically evaluated. Contradictory theoretical relationships are unlikely and poorly supported.

The relationships applied in this assessment support the comparison of alternatives based on the available physical and biological information. Specific levels of environmental correlates and criteria used in the assessment of species' responses should not be considered as specific management recommendations or targets for flow, water temperature, or diversion management in Central Valley rivers and the Delta.

Assessment of Change in Spawning Habitat Quantity

Chinook Salmon

The assessment of changes in river flow on Chinook salmon spawning habitat is based on the hypotheses that reduction in spawning habitat will result in reduced fry production. Change in spawning habitat area is assumed to result in a medium level of response—the difference between the proportional spawning habitat area (relative to the maximum available habitat area) for two simulated flow scenarios equals the expected change in survival.

Simulated river flows for 1922–1994 hydrologies are used in the assessment of effects on spawning habitat area. Relative to the base case, a meaningful change in habitat is assumed to occur when the change in river flow equals or exceeds approximately 10%. Average monthly flow is simulated by CALSIM and is used in the assessment of habitat effects. For existing measured flow conditions, daily flows vary by more than 10% from the average monthly flow in the Sacramento, Feather, and American Rivers. Daily variability around the monthly average exceeds 10% even during controlled flow periods (i.e., June–October). During storm events and spring runoff, daily variability around the monthly average has been substantially greater than 10%. The 10% criterion accounts for probable inaccuracies of habitat estimates based on average monthly flow. A change in average flow of less than 10% for a given month would likely not result in a measurable change in spawning habitat area.

Assessment of flow effects is based on the estimated spawning habitat area provided by flows during the spawning and incubation period. Relationships between streamflow and spawning habitat area have been developed from existing instream flow studies (Jones & Stokes 1994). Spawning habitat peaks at about 1,500 to 2,000 cfs on the American River. Change in spawning habitat area in response to flow changes is greatest when flow is less than about 1,000 cfs. For flows higher than 1,000 cfs, changes in flow have little effect on habitat area. Habitat area peaks at about 5,500 cfs in the Sacramento River and at about 500 to 2,500 cfs in the Feather River. Reduced flows that are less than the peak flow and increased flows that are higher than the peak flow both reduce spawning habitat area. For the purpose of this assessment, variation in flows that are greater than the peak flow (i.e., the flow that provides the maximum habitat area) is assumed to have minimal effect and is not included in the assessment of effects on spawning habitat.

Spawning habitat area is the minimum area that is provided by flow during the month of spawning and during subsequent months of incubation. Chinook salmon fry are assumed to emerge from the redd after 3 months of incubation. Therefore, flows during three consecutive months are considered in the calculation of spawning habitat area for Chinook salmon. The assumed occurrence of spawning each month is based on the timing shown in Table 6.1-2.

The certainty of the assessment is low to medium. Evidence from existing research supports the relationship for cause and effect, but the magnitude of species response cannot reliably be predicted from a given magnitude change in spawning habitat area. Fish may use only small sections of the total area that appears suitable relative to gravel quality and flow depth and velocity. Superimposition of redds may be unpredictable. The proportion of spawning habitat used is not available; therefore, the assessment of effects on spawning habitat area assumes that all of the available spawning habitat is potentially used. The potential for redd superimposition is not considered.

High quality spawning habitat, including high quality spawning riffles and gravel, are more important than the “total area” used in this analysis. Flows can be used as a baseline to predict spawning and post-spawning success, but additional habitat measurements such as depth, velocity, spawning gravel quality, and water temperature are necessary for successful spawning and incubation. Burner (1951 in Healey 1991; Bjornn and Reiser 1991) observed Chinook salmon spawning in water as shallow as 0.16 feet (5 cm), Vronski (1972 in Healey 1991) found Chinook salmon spawning in water depths of 23.6 feet (720 cm). Thompson (1972 in Bjornn and Reiser 1991), who also studied water depth requirements for spawning, found Chinook salmon spawning in depths less than 0.8 foot (24 cm).

Flow velocity also affects spawning gravel selection; however, the range in water depth and velocity is very broad (Healey 1991). Literature values for water velocity range from 0.98 to 6.2 feet/sec (30 to 189 cm/s). Studies in northern California found that Chinook salmon from the Yuba and Sacramento Rivers preferred velocities ranging from 1.55 to 2.95 feet/sec (0.47 to 0.9 m/sec) and 0.9 to 2.7 feet/sec (0.27 to 0.8 m/sec), respectively (California Department of Fish and Game 1991c).

Generally, Chinook salmon require substrate that range in size from approximately 0.12 inch to 5.9 inches (0.3 cm to 15 cm) while steelhead prefer substrate no larger than 3.9 inches (10 cm) (Bjornn and Reiser 1991). Spawning habitat quality is correlated with gravel size and intra-gravel flow. Low intra-gravel flow may provide insufficient DO, contribute to growth of fungus and bacteria, and result in high levels of metabolic waste. High percentage of fines in gravel substrates can substantially limit intra-gravel flow, affecting the amount of spawning gravel available in the river (Healey 1991). Raleigh et al. (1986) concluded that optimal gravel conditions would include less than 5 to 10% fine sediments measuring 0.12 inch (0.3 cm) or less in diameter. In addition, alevins of Chinook salmon, steelhead, and coho salmon have been observed to have difficulty emerging in laboratory studies when gravels exceeded 30 to 40% fine sediments (Bjornn 1968; Phillips et al. 1975 in Bjornn and Reiser 1991; Waters 1995).

The assessment assumes saturation of the spawning habitat. Spawning habitat needs for different species and runs using the same stream may vary substantially. Needs also vary from year to year and, depending on the abundance of spawning adults, may vary by orders of magnitude. For example, the current abundance of winter-run Chinook salmon is substantially less than the abundance of fall-run Chinook salmon; therefore, the spawning habitat need is substantially less than it is for fall-run. However, fewer spawning reaches support winter-run spawning. Therefore, the relationship may reflect possible effects. More detailed evaluation of the magnitude of effects and other aspects of the relationships is warranted.

Steelhead

The assessment of changes in river flow on steelhead spawning habitat is based on the hypotheses that reduction in spawning habitat will result in reduced fry production. Change in spawning habitat area is assumed to result in a medium level of response—a change in spawning habitat area results in a proportional change in fry abundance. The assessment of river flow effects on steelhead spawning habitat area is the same as applied to Chinook salmon. Spawning habitat area is the minimum area that is provided by flow during the month of spawning and during subsequent months of incubation. Steelhead fry are assumed to emerge from the redd after 2 months of incubation. Therefore, flows during two consecutive months are considered in the calculation of spawning habitat area for steelhead. The assumed occurrence of spawning each month is based on the timing shown in Table 6.1-2.

The certainty of the assessment relationship is low, primarily because specific data on steelhead spawning in the Sacramento, Feather, and American Rivers are not extensive. Also, the magnitude of species response is weakly supported. It is possible that spawning habitat is not limiting and that the assessment overstates the habitat need. Adequate flows for spawning and incubation have been defined in previous years within different rivers. Flows can be used as a baseline to predict spawning and post-spawning success, but additional habitat measurements such as depth, velocity, spawning gravel quality, and water temperature are necessary for successful spawning and incubation. Flow-habitat relationships for steelhead are also substantially different from the relationships for Chinook salmon because substrate, depth, and velocity preferences differ. As with Chinook salmon, the relationships assume saturation of the spawning habitat. More detailed evaluation of the magnitude of effects and other aspects of the relationships is warranted.

Delta Smelt

The assessment of changes Delta inflow on delta smelt spawning habitat is based on the hypotheses that reduction in spawning habitat will result in reduced larval production. Implementation of the SDIP is unlikely to substantially affect environmental conditions (i.e., fresh water) that maintain the existing habitat area in the Delta. The extent of salinity intrusion into the Delta, as represented by the change in location of X2, will be evaluated to confirm minimal effect on spawning habitat area.

The certainty of the assessment relationship is minimal. Existing information does not indicate that spawning habitat is limiting. Very little is known about spawning habitat needs of delta smelt; therefore, the assumption that spawning habitat is not limiting is speculative. Spawning occurs in fresh water, based on collection of ripe females and larval catches. In drier years, most female and larval delta smelt have been found in the Sacramento River near Prospect Island and the Barker-Lindsey–Cache Slough complex (Wang and Brown 1993). In high outflow years, smelt are found in most of the Delta, Suisun Marsh, and the Napa River (Sweetnam 1999). In addition to poor understanding of spawning location, the primary spawning substrate in the Delta is unknown. Eggs are adhesive, and suitable substrate may be aquatic vegetation, rocks, or instream woody material (Moyle 2002).

Splittail

The assessment is based on the hypothesis that inundation of floodplain and bypasses during high flow years is needed to maintain population abundance. Change in spawning habitat area is assumed to result in a medium level of response—a change in spawning habitat area results in a proportional change in fry abundance.

Spawning habitat availability is dependent on inundation of floodplain and flood bypasses during January through April. The assessment is based on Sacramento River flow conditions that inundate the Sutter and Yolo Bypasses, the primary spawning areas for splittail. The Sutter Bypass is substantially inundated when Sacramento River flow near Colusa is greater than 25,000 cfs. The Yolo Bypass is substantially inundated when Sacramento River flow at Verona is greater than 65,000 cfs. Any reduction in the annual occurrence of flows that are greater than 25,000 cfs at Colusa and 65,000 cfs at Verona or reduction in duration of inundation periods lasting 4 to 8 weeks is considered to have an adverse effect. For simulated average monthly flow, inundation flows were assumed to be 14,000 cfs at Colusa and 40,000 at Verona. Lower flow volumes were used because the simulated monthly flows do not capture inundation that occurs in response to daily or weekly flow variation. Sacramento River flows that are reduced below 14,000 cfs at Colusa and 40,000 cfs at Verona are assumed to result in very large changes in habitat area and substantially affect spawning success. Loss of spawning conditions in any one year is assumed to adversely affect population abundance.

The certainty of the assessment relationship is medium to high based on the historical response of splittail populations to bypass flooding. A significant positive relationship exists between splittail year-class strength and Sacramento River outflow during the spawning season (Daniels and Moyle 1983; Meng and Moyle 1995; Sommer et al. 1997). Spawning has generally been reported to begin in late February or early March, with peaks in late March and April (Baxter et al. 1996) in flooded shallow areas with flowing water (Moyle et al. 2001). Adult splittail forage and spawn among a variety of vegetation types that includes trees, brush, and herbaceous vegetation. Splittail use a number of habitats for spawning, including vegetated tidal slough and Delta channel edges, inundated floodplain, and possibly vegetated edges of riverine pools and backwaters. Inundated floodplain appears to provide the best conditions for successful spawning. Splittail are believed to spawn in open areas less than 4.9 feet (1.5 meters) deep covered with dense annual vegetation, where water temperature does not exceed about 60.8°F (16ºC) (Moyle et al. 2001), and salinity ranges from 0 to 10 ppt. Adults remain in the flooded areas until spawning is completed or water depth and temperatures trigger movement. The highest population levels are seen during wet years and when floodplain is inundated for an extended period of time. Evidence from both the Yolo Bypass and the Cosumnes floodplain suggests that strong year classes of splittail develop mainly in years when floodplains are inundated continuously during March and April (Sommer et al. 1997; Moyle et al. 2001). Two major conclusions are that the population is dominated by year classes produced in wet years and that the timing and duration of floodplain inundation in these years are key factors in determining the strength of these year classes. Variation in year-class strength appears to be controlled primarily by the extent to which floodplain habitat is available for spawning and early rearing. A positive relationship between days of bypass inundation and abundance of age-0 splittail indicates that the largest year classes are produced when floodplain habitat is available for a month or more. The positive relationship with inundation is likely related to the period needed for successful adult immigration and spawning, egg incubation, and emigration of larvae (Sommer et al. 1997).

In dry years, young splittail have been captured in the Sacramento River (Baxter 2003), indicating that spawning may occur along the river margin. Splittail may also spawn in the Yolo Bypass in dry years, using areas inundated by flow from

Cache and Putah Creeks and flow from the Colusa Basin Drain (Sommer et al. 2002). The response to inundation is highest in wet years.

Striped Bass

Spawning habitat in the Delta may be limiting during drier years (California Department of Fish and Game 1992). Delta outflow maintains the spawning habitat area within the Delta. The extent of salinity intrusion into the Delta (i.e., change in location of X2) will be evaluated to determine the potential effect on spawning habitat area.

The certainty of the assessment relationship is low, primarily because the magnitude of the species response (i.e., spawning success) to reduced freshwater area in the lower Delta is unknown. Spawning is dependent on three factors: temperature, flow, and salinity (Clark and Pearson 1978). During high flow years, spawning takes place in the Sacramento River starting above Colusa and extends to below the mouth of the Feather River. In low-flow years, spawning occurs in the Sacramento River from Isleton to Butte City and the San Joaquin River channel in the Delta from Venice Island to Antioch (Moyle 2002).

Green Sturgeon

No assessment was done comparing spawning habitat availability and flow due to lack of information about flow, velocity, and other spawning criteria for green sturgeon. However, river reaches used by green sturgeon for spawning are known to overlap with those used by spawning Chinook salmon and steelhead. However, unlike salmonids, which use relatively shallow habitats for spawning, green sturgeon spawn in deep pools (Moyle et al. 1992b). The assessment of river flow effects on green sturgeon spawning habitat area is assumed to be encompassed by the assessment applied to Chinook salmon. This assessment approach is reasonable because green sturgeon are known to spawn at much greater water depths than Chinook salmon, and green sturgeon spawning habitat area is less likely to be affected by changes in river flow that affect spawning habitat area for Chinook salmon, which have more narrowly defined hydraulic requirements. The certainty of the assessment relationship is low, primarily because the magnitude of the species response (i.e., spawning success) to reduced flow in the rivers is unknown.

Rearing Habitat Quantity

Chinook Salmon

The assessment of changes in river flow on Chinook salmon rearing habitat is based on the hypotheses that reduction in rearing habitat will result in reduced juvenile production. Change in rearing habitat area is assumed to result in a medium level of response—a change in rearing habitat area results in a proportional change in juvenile abundance.

Rearing habitat area tends to reach maximum abundance at very low flows that inundate most of the river channel area and at very high flows that inundate floodplain. Under low-flow (i.e., in-bank) conditions, rearing habitat area declines in response to increased average velocity as flow increases. The reduction in habitat area with increasing flow results from the preference of low velocity areas by juvenile Chinook salmon fry. The relationship may be misleading because the flow-habitat relationship may not adequately reflect local habitat conditions (i.e., availability of low velocity) or the importance of flow-related habitat quality elements (e.g., water temperature conditions or cover and prey availability). The analysis of potential effects on rearing habitat area relies on the assessment of changes to low-flow conditions (e.g., flows less than the 25^{th} percentile during critical and dry year types). Although an actual 10% change in flow may have measurable effects depending on river form, change in simulated monthly average flow of low magnitude (i.e., a flow that is less than the 25^{th} percentile) that exceeds 10% is assumed to affect rearing habitat area. Average monthly flow is simulated by CALSIM and is used in the assessment of habitat effects. For existing measured flow conditions, daily flows vary by more than 10% from the average monthly flow in the Sacramento, Feather, and American Rivers. Daily variability around the monthly average exceeds 10% even during controlled flow periods (i.e., June–October). During storm events and spring runoff, daily variability around the monthly average has been substantially greater than 10%. The 10% criterion accounts for probable inaccuracies of habitat estimates based on average monthly flow. A change in average monthly flow of less than 10% would likely not result in a measurable change in rearing habitat area.

Increased low magnitude flow is assumed to be beneficial, and reduced low magnitude flow is assumed to be detrimental. The proportional change in flow is assumed to result in the same proportional change in juvenile abundance. The proportion of the rearing period affected and the timing change relative to the rearing period are considered in the assessment of the annual effect. The assumed occurrence of rearing each month is based on Table 6.1-2.

The rearing habitat relationship for floodplain is assumed to be similar to the relationship described for splittail spawning. Rearing habitat availability is dependent on inundation of floodplain and flood bypasses during November through April. The Sutter and Yolo Bypasses are primary rearing areas and are dependent on relatively high flows for inundation. Any reduction in simulated monthly average flows that exceed 14,000 cfs at Colusa and 40,000 cfs at Verona is considered to have an adverse effect. Although change in rearing habitat area would likely result in a low level of response, Sacramento River flows that are reduced below 14,000 cfs at Colusa and 40,000 cfs at Verona are assumed to result in relatively large changes in habitat area and may substantially affect rearing success.

The certainty of the assessment relationship for in-channel habitat is low because the relationship of flow to rearing habitat area and the species response to flow-related changes in rearing habitat area is unknown. The certainty of the assessment relationship for inundated floodplain habitat is low to medium, reflecting the documented potential benefits to rearing juvenile Chinook salmon. Recent studies have shown that juvenile salmon have higher growth rates when using floodplains as rearing habitat. Use of floodplain habitat by juvenile

Chinook salmon has been well documented (Jones & Stokes 1993, 1999; California Department of Water Resources 1999b; Sommer and Nobriga et al. 2001). Sommer and Nobriga et al. 2001 found that floodplain habitat provides better rearing and migration habitat for juvenile Chinook salmon than the main river channel. The apparent growth rate of Chinook salmon in the Yolo Bypass ranged from 0.02 to 0.03 inch (0.55 to 0.80 mm) per day, while growth rates in the main channel of the Sacramento River ranged from 0.19 to 0.02 inch (0.43 to 0.52 mm) per day. The faster growth rate in the Yolo Bypass may be attributed to increased prey consumption associated with greater availability of drift invertebrates and warmer water temperature.

In addition to floodplain availability, other environmental conditions such as flow, depth, velocity, and water temperature affect the growth and survivability of juveniles. In rivers, increases in flow provide edge habitat where terrestrial vegetation on the channel edge increases the diversity of habitat conditions. These areas are more productive and increase growth in juvenile fish. Deeper inundation provides more overhead cover and protection from avian and terrestrial predators than shallow water (Everest and Chapman 1972 in Jackson 1992). In broad, low-gradient rivers, change in flow can greatly increase or decrease the lateral area available to juvenile Chinook salmon, particularly in riffles and shallow glides (Jackson 1992).

The quality of the habitat is more critical to survival than the gross area. Caution should be exercised with the assessment because the effect of the flow on habitat is very site-specific within different reaches of the same river. While flows are important for providing additional habitat, other environmental factors such as depth, velocity, and water temperature affect rearing and growth. Although juvenile Chinook salmon do not appear to prefer a particular depth (Jackson 1992), Brett (1952 in Jackson 1992) reported water depths from 1 to 4 feet (0.3 to 1.2 m) as optimal for rearing. Raleigh et al. (1986) reported preferred water depth ranging from 0.5 to 3.0 feet (0.15 to 0.9 m). Water velocity is a particularly important factor in determining where juvenile salmonids occur because it determines the energy requirements for maintaining position and the amount of food delivered to a particular location. Juvenile salmonids tend to select positions that maximize energy gain, but these positions can be altered by interaction with other fish and the presence of cover (Shirvell 1990). Preferred water velocity used by Chinook salmon varies with size. Larger fish occupy higher velocity and deeper areas than small fish, potentially gaining access to abundant food and avoiding predatory birds (Bjornn and Reiser 1991; Jackson 1992). The mean water column velocity preferred by juvenile Chinook salmon is between 0.3 and 1.5 feet/sec (0.09 and 0.46 m/sec).

Steelhead

The assessment of changes in river flow on steelhead rearing habitat is based on the hypotheses that reduction in rearing habitat will result in reduced juvenile production. Change in rearing habitat area is assumed to result in a medium level of response—a change in rearing habitat area results in a proportional change in juvenile abundance. The assessment of changes in river flow on steelhead rearing habitat is the same as described for Chinook salmon for low-flow conditions. Steelhead have not been observed to substantially use inundated floodplain; therefore, the analysis of floodplain inundation applied to Chinook salmon is not applied to steelhead.

The certainty of the assessment relationship is minimal because of limited information on rearing habitat, growth, and survival. Environmental conditions such as depth, velocity, cover, and water temperature affect the growth and survivability of juveniles. Small juvenile steelhead prefer relatively shallow areas. These include pool tailouts characterized by cobble and boulder bottoms or riffles less than 24 inches (0.6 m) deep (Flosi et al. 1998). Larger juveniles live in higher-velocity water although they may prefer areas with low bottom velocity (Hillman and Chapman 1989). There has been conflicting evidence that shows juvenile steelhead use of instream woody material. Several studies (Hillman and Chapman 1989; Baltz et al. 1999) found that juveniles were rarely associated with woody cover. Shirvell (1990) and Swales et al. (1986) found that instream woody material was an important habitat component. Generally, cover provides protection from predators, rest from high currents, and sources of food.

Change in river flow may decrease the quantity of rearing habitat but may not decrease the quality. Using the same flow model used for Chinook salmon will detect changes in flow, but not the change in habitat quality. Because steelhead rearing habitat is not as well-defined as for Chinook salmon, comparisons may not be appropriate.

Delta Smelt

The assessment is based on the hypothesis that rearing habitat area is a function of Delta outflow and that juvenile production is affected by changes in rearing habitat area. Delta outflow may affect estuarine rearing habitat for delta smelt and other estuarine species (Moyle et al. 1992a). The location of X2 (i.e., the approximate location of the 2 ppt isohaline relative to the Golden Gate Bridge) can be used to estimate the estuarine habitat area within the preferred salinity range for a species (Unger 1994). The estimated salinity preference for delta smelt during estuarine rearing is assumed to range from 0.3 ppt to 1.8 ppt. The range represents the 10^{th} and 90^{th} percentiles of the salinity over which delta smelt are distributed.

The geographic location of the upstream and downstream limits of estuarine rearing habitat for delta smelt is computed from X2 that was calculated from average monthly Delta outflow as simulated by the CALSIM model. Monosmith (1993) showed that when X2 is known, the average position of other salinity gradients can be estimated. The position of the 0.3 ppt isohaline equals 0.35 x X2, and the position of the 1.8 ppt isohaline equals 0.74 x X2. The constants were computed with a nonlinear regression model (Unger 1994).

The estuarine rearing habitat area is the surface area between the location of the upper and lower preferred salinity isohalines (Unger 1994). Surface area was used as an index of habitat because habitat surface area is positively correlated with habitat volume. The shore-to-shore surface area was estimated for each kilometer segment of the estuary from the Golden Gate Bridge to the Delta.

Total surface area between the upper and lower salinity preference is the sum of all segments between the estimated locations of the isohalines.

For Alternative 1 (the No Action Alternative) and the action alternatives, the habitat areas computed for each month were divided by the maximum habitat area for Alternative 1, 1922–1994 simulation. The resulting proportional habitat area for a month under Alternative 1 was subtracted from the proportional habitat area for an action alternative for the same month. The difference is the percent change in estuarine rearing habitat area. The percent change in estuarine rearing habitat area is assumed to represent the expected change in survival.

The certainty of the assessment relationship is low, primarily because the magnitude of species response is weakly supported. Rearing habitat is important in Suisun Bay, and when low salinity water is covering shoal areas, these areas are more productive and favorable than deep channel areas (Moyle et al. 1992a). Delta smelt are more abundant in northern Suisun Bay than in the deeper ship channel to the south. While these studies indicate that shoal areas are better rearing grounds for smelt, more detailed evaluation of the magnitude of effects and other aspects of the relationships is warranted.

Splittail

The assessment is based on the hypothesis that rearing habitat area is a function of inundated floodplain and that juvenile production is dependent on rearing habitat area. The assessment is the same as described for adult splittail under spawning habitat quantity.

The certainty of the assessment relationship is medium to high. Variation in year-class strength appears to be controlled primarily by the extent to which floodplain habitat is available for spawning and early rearing. A positive relationship between days of bypass inundation and abundance of age-0 splittail indicates that the largest year classes are produced when floodplain habitat is available for a month or more (Sommer et al. 1997). Seasonally flooded habitat provides abundant food and minimizes predation losses because of the temporary availability of the habitat, relatively shallow depths, turbid waters, and dense cover provided by flooded vegetation. Juvenile and larvae splittail survival and growth improve with abundant and high quality food sources in the floodplain (Moyle et al. 2001). Floodplains are more productive than the main channel of rivers because these broad and shallow vegetated areas are richer in nutrients than deeper and narrower river channels (Sommer and Harrell et al. 2001).

Striped Bass

The assessment is based on the hypothesis that rearing habitat area is a function of Delta outflow and that juvenile production is affected by changes in rearing habitat area. The assessment is the same as described for delta smelt except that the estimated salinity preference for striped bass during estuarine rearing is assumed to range from 0.1 ppt to 2.5 ppt. The range represents the 10^{th} and 90^{th} percentiles of the salinity over which larval and early juvenile striped bass are distributed. The position of the 0.1 ppt isohaline equals 0.11 x X2 and the position of the 2.5 ppt isohaline equals 0.82 x X2. The constants were computed with a nonlinear regression model (Unger 1994).

The certainty of the assessment is low to medium because of conflicting data on survival of larval striped bass and the importance of estuarine rearing habitat. High flows seem to be key in determining survival of young bass, and higher survival is seen at higher outflow (California Department of Fish and Game 1992). The embryos and larvae of striped bass are planktonic and high flows may facilitate movement to appropriate rearing habitat. Growth and survival of larval fish are highest in brackish water because of reduced energy costs for osmoregulation (Moyle 2002). Existing data are confounded by potential relationships between rearing habitat area, transport flows, SWP and CVP pumping, and other interrelated factors.

Green Sturgeon

The assessment is based on the hypothesis that rearing habitat area is a function of area of inundated benthic habitat and that juvenile production is affected by changes in rearing habitat area. The assessment is assumed to be encompassed by that described for Chinook salmon except that the area of rearing habitat is limited to the channel bottom and does not include floodplain or channel bank areas as it is for Chinook salmon. This assessment approach is reasonable because juvenile green sturgeon in the Delta are benthic feeders (Radtke 1966); therefore, rearing habitat area is primarily a function of inundated channel bottom area, rather than total channel area (i.e., channel bottom, channel bank, and floodplain habitat). The certainty of the assessment is low because little is known about the rearing requirements of juvenile green sturgeon and the relationship between flow and quality of estuarine rearing habitat.

Migration Habitat Conditions

Chinook Salmon

Flows that occur in Central Valley rivers generally support migration of adult and juvenile Chinook salmon. Migration habitat conditions that are related to river flows are not assessed.

The assessment of adult migration in the lower San Joaquin River considers project effects on DO. The hypothesis is that low DO conditions in the San Joaquin River channel near Stockton block migration of fall-run Chinook salmon returning to the San Joaquin River basin. The expected effects of the project on flow and subsequent effects on DO levels are used to determine potential blockage of adult Chinook salmon. DO levels less than 5 mg/l are assumed to block upstream migration of Chinook salmon in the San Joaquin River near Stockton. The effect of blockage on the population is relative to the proportion of the adult migration affected during October through November and the expected delay. San Joaquin River flows between 1,000 cfs and 10,000 cfs appear to provide possibilities for managing DO in the San Joaquin River near Stockton.

DO-level effects on adult Chinook salmon are well established, and delay decreases the spawning success through effects on fecundity and survival. At water temperatures greater than 50°F (10°C), Chinook salmon require levels of DO greater than 5 mg/l. Optimum DO is 12 mg/l (Raleigh et al. 1986). Hallock (1970) observed that Chinook salmon avoided water temperatures greater than 66°F if DO was less than 5 mg/l. The certainty of the assessment relationship is low because water temperature and DO levels are interrelated and it is not clear that DO levels alone have blocked migration of adult Chinook salmon in the San Joaquin River near Stockton.

The assessment of juvenile Chinook salmon migration through the Delta focuses on Delta channel pathways and effects on survival of juvenile Chinook salmon. The hypothesis is that alternative migration pathways have different effects on juvenile Chinook salmon survival from the Sacramento and San Joaquin Rivers. Juvenile Chinook salmon are assumed to move in proportion to flow; therefore, an increase in the proportion of flow diverted off the Sacramento River through the DCC and Georgiana Slough would be expected to increase movement of juvenile Chinook salmon into the DCC and Georgiana Slough. The proportion of Sacramento River flow diverted into the DCC and Georgiana Slough is calculated from the simulated flow for the Sacramento River at Freeport and for the DCC and Georgiana Slough. The simulated proportion of juvenile Chinook salmon that move into the DCC and Georgiana Slough is assumed equal to the simulated proportion of flow diverted into the DCC and Georgiana Slough. Survival is greater for fish that remain in the Sacramento River channel (Newman and Rice 1997; Brandes and McLain 2001).

The certainty of the assessment relationship is medium to high for juvenile Chinook salmon in the Sacramento River. Juvenile Chinook salmon survival is lower for fish migrating through the central Delta (i.e., diverted into the DCC and Georgiana Slough) than for fish continuing down the Sacramento River (Newman and Rice 1997).

An increase in the proportion of flow diverted off the San Joaquin River and into Old River would be expected to increase movement of juvenile Chinook salmon into Old River. The proportion of San Joaquin River flow diverted into Old River is based on the simulated flow for the San Joaquin River at Vernalis and for Old River. The simulated proportion of juvenile Chinook salmon that move into Old River is assumed equal to the simulated proportion of flow diverted into Old River. Survival appears to be greater for juvenile Chinook salmon that remain in the San Joaquin River, although the difference in survival for the pathways has not proved to be statistically different through all years (Brandes and McLain 2001; San Joaquin River Group Authority 2003).

In the San Joaquin River, juvenile Chinook salmon survival appears to be lower for fish migrating into Old River near Mossdale than for fish continuing down the San Joaquin River past Stockton (Brandes and McLain 2001). The certainty of the assessment relationship is low to medium for juvenile Chinook salmon in the San Joaquin River because the survival relationship is not clearly supported in all years by data collected (San Joaquin River Group Authority 2003).

Steelhead

Flows that occur in Central Valley rivers generally support migration of adult and juvenile steelhead. Migration habitat conditions that are related to river flows are not assessed.

The assessment for adult and juvenile steelhead migration through the Delta is similar to the assessment described for adult and juvenile Chinook salmon, taking into account differences in timing and distribution. The certainty of the assessment relationship is low because of lack of information about movement of migrating adult and juvenile steelhead in the Delta. DO levels and migration through the Delta have not been studied specifically for steelhead and may differ from the effect on Chinook salmon.

Delta Smelt

Existing information does not indicate clear relationships between migration habitat conditions and adult, larval, and juvenile survival. Effects of environmental conditions (e.g., net and tidal flow) on adult migration are unknown. The effect of net flow on larval and early juvenile movement and survival is unsupported by available data.

The assessment of larval and juvenile entrainment in CVP and SWP exports is assumed to reflect the potential effect of changes in Delta flow conditions on movement and survival of larvae and early juvenile delta smelt. An additional analysis of flow effects is not applied.

Splittail

Existing information indicates that high flow and the inundation of floodplain initiates upstream adult migration (Garman and Baxter 1999). The assessment of spawning habitat quantity for adult splittail (see Spawning Habitat Quantity) depicts the potential effects on adult, larval, and early juvenile movement onto and off of the floodplain.

Adult migration movements begin sometime between late November and early January and continue into March. Upstream movement is seen when high flow events occur during February–April (Garman and Baxter 1999), but other studies indicate that migration occurs when inundated floodplain habitat is available earlier in the water year. As water levels recede in the floodplain, juvenile splittail return to the main channel and ultimately to tidal areas in response to decreased depth and increasing water temperature (15ºC–18ºC) (Moyle et al. 2001).

Striped Bass

The assessment of larval and juvenile entrainment in CVP and SWP exports is assumed to reflect the potential effect of changes in Delta flow conditions on movement and survival of larvae and early juvenile striped bass. An additional analysis of Delta flow effects is not applied.

Implementation of the SDIP is not expected to substantially affect Sacramento River inflow during striped bass spawning. Sacramento River flow at Freeport will be evaluated to confirm minimal effect on flows less than 11,000 cfs during April and May. The certainty of the assessment relationship is medium because of fairly well–established relationships between flow and movement of eggs and larvae. Available information indicates that low Sacramento River flow (i.e., less than 13,000 cfs at Freeport) may affect survival of striped bass between the egg and 6 mm larvae stage (California Department of Fish and Game 1992). The mechanisms that may reduce survival are: low velocity that results in eggs and larvae settling to the river bottom and ultimately die; delay in reaching higher quality nursery areas; increased exposure to toxic substances; and more exposure to entrainment (CVPIA document).

Green Sturgeon

Flows that occur in the Sacramento River generally support migration of adult and juvenile green sturgeon. Migration habitat conditions that are related to river flows are not assessed.

Water Temperature

Water temperature within the Sacramento–San Joaquin River basin is primarily an issue for coldwater species, including Chinook salmon and steelhead.

Chinook Salmon

The assessment is based on the hypothesis that survival of freshwater life stages (adult migration, spawning and incubation, rearing, and juvenile migration) is dependent on suitable water temperatures in Central Valley rivers. Monthly water temperature effects are estimated for selected locations and all life stages of Chinook salmon. Simulated monthly water temperature indicates the potential direction of effect when considered relative to species water temperature requirements. For the purposes of this impact assessment, survival indices are based on experimental tolerance studies reported in the literature, a use recommended by EPA and Armour (cited in Sullivan et al. 2000; Armour 1991).

Water temperature for the Trinity, Sacramento, Feather, and American Rivers is simulated by Reclamation's temperature model. The model simulates monthly temperature conditions in CVP and SWP reservoirs and at locations downstream from the discharge points, providing estimates of monthly temperature. Model inputs include initial storage and temperature conditions, simulated reservoir storage, simulated model segment inflow, simulated model segment outflow, evaporation, solar radiation, and average air temperature. Release temperatures from reservoirs are computed for each outlet level of the dams. River temperatures are computed for each month at river locations represented by specific model segments. River temperatures are based on the quantity and temperature of the simulated reservoir release, normal climatic conditions, and tributary accretions. During warmer months (March through October), reservoir releases warm with distance downstream.

Temperature survival indices were estimated for Chinook salmon life stages, including adult migration, spawning and incubation, rearing, and smolt migration

(Table 6.1-7). The temperature survival indices are estimated from curves fitted to available survival data. The survival indices applied in this assessment support the comparison of alternatives and should not be considered specific management recommendations or targets for water temperature management in Central Valley rivers.

The certainty of the assessment relationship is high. Water temperature effects on fish are well established and can be used to predict survival. As water temperature increases toward the extremes of the tolerance range of a fish, biological responses, such as impaired growth and risk of disease and predation, are more likely to occur (Myrick and Cech 2001; Sullivan et al. 2000). Acceptable water temperatures identified in the available literature for Chinook salmon and steelhead life stages fall within a relatively broad range. Conclusive studies of the thermal requirements completed for Chinook salmon and steelhead in Central Valley streams are limited (Myrick and Cech 2001). Based on a literature review, conditions supporting adult Chinook salmon migration are assumed to deteriorate as temperature warms between 54ºF and 70ºF (12.2°C and 21.1°C) (Hallock 1970 as cited in McCullough 1999). For Chinook salmon eggs and larvae, survival during incubation is assumed to decline with increasing temperature between 54ºF and 61ºF (12.2°C and 16.1°C) (Myrick and Cech 2001; Seymour 1956 cited in Alderice and Velsen 1978). For juvenile Chinook salmon, survival is assumed to decline as temperature warms from 64ºF to 75ºF (17.8°C to 23.9°C) (Myrick and Cech 2001; Rich 1987). Relative to rearing, Chinook salmon require cooler temperatures to complete the parr-smolt transformation and to maximize their saltwater survival. Successful smolt transformation is assumed to deteriorate at temperatures ranging from 63ºF to 73ºF (17.2°C to 22.8°C) (Marine 1997, cited in Myrick and Cech 2001; Baker et al. 1995). Juveniles are more at risk in the Delta, and water temperatures over the optimal limit increase mortality. Baker et al. (1995) developed a statistical model to estimate the influence of temperature on the survival of Chinook salmon smolts migrating through the Delta. The model estimated that Chinook salmon released at Ryde and migrating to Chipps Island undergo 50% mortality at 71.6ºF-75.2ºF (22ºC to 24ºC).

Table 6.1-7. Monthly Temperature Survival Indices for Chinook Salmon and Steelhead

	Chinook Salmon				Steelhead			
Water Temperature (°F)	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration[1]
50	100%	100%	100%	100%	100%	100%	100%	100%
51	100%	100%	100%	100%	100%	100%	100%	100%
52	100%	100%	100%	100%	100%	100%	100%	100%
53	100%	100%	100%	100%	100%	100%	100%	100%
54	100%	100%	100%	100%	100%	98%	100%	100%
55	100%	99%	100%	100%	100%	91%	100%	100%
56	100%	96%	100%	100%	99%	80%	100%	100%
57	100%	90%	100%	100%	98%	63%	100%	100%
58	99%	82%	100%	100%	96%	37%	100%	100%
59	97%	69%	100%	100%	94%	0%	100%	100%
60	94%	52%	100%	100%	90%	0%	100%	100%
61	91%	29%	100%	100%	87%	0%	100%	100%
62	87%	0%	100%	100%	82%	0%	100%	100%
63	81%	0%	100%	100%	76%	0%	100%	100%
64	74%	0%	100%	100%	69%	0%	100%	100%
65	66%	0%	100%	99%	61%	0%	100%	99%
66	57%	0%	97%	96%	52%	0%	100%	96%
67	46%	0%	93%	92%	42%	0%	98%	92%
68	33%	0%	87%	87%	29%	0%	95%	87%
69	18%	0%	77%	79%	16%	0%	90%	79%
70	0%	0%	65%	69%	0%	0%	83%	69%
71	0%	0%	48%	57%	0%	0%	73%	57%
72	0%	0%	27%	42%	0%	0%	61%	42%
73	0%	0%	0%	23%	0%	0%	45%	23%
74	0%	0%	0%	0%	0%	0%	25%	0%
75	0%	0%	0%	0%	0%	0%	0%	0%

[1] Survival indices for Chinook salmon smolt migration are assumed to apply to steelhead; indices for adult migration, juvenile rearing, and juvenile migration of Chinook salmon are assumed to apply to coho salmon in the Trinity River.

Note: The survival indices in this table support the comparison of alternatives and should not be considered specific management recommendations or targets for water temperature management in Central Valley rivers.

Steelhead

The assessment is based on the hypothesis that survival of freshwater life stages (i.e., adult migration, spawning and incubation, rearing, and juvenile migration) is dependent on suitable water temperatures in Central Valley rivers. The assessment is the same as described for Chinook salmon except that temperature survival indices were estimated for steelhead life stages (Table 6.1-7).

The certainty of the assessment relationship is high. Water temperature effects on fish are well established and can be used to predict survival. For steelhead, successful adult migration and holding are assumed to deteriorate as water temperature warms between 52ºF and 70ºF (11.1°C and 21.1°C). Adult steelhead appear to be much more sensitive to thermal extremes than are juveniles (National Marine Fisheries Service 1996a; McCullough 1999). Conditions supporting steelhead spawning and incubation are assumed to deteriorate as temperature warms between 52ºF and 59ºF (11.1°C and 15°C) (Myrick and Cech 2001). Juvenile rearing success is assumed to deteriorate at water temperatures ranging from 63ºF to 77ºF (17.2°C to 25°C) (Raleigh et al. 1984; Myrick and Cech 2001). Relative to rearing, smolt transformation requires cooler temperatures, and successful transformation occurs at temperatures ranging from 43ºF to 50ºF (6.1°C to 10°C). Juvenile steelhead, however, have been captured at Chipps Island in June and July at water temperatures exceeding 68ºF (Nobriega and Cadrett 2001). Given the movement of steelhead at water temperatures warmer than required for successful smolt transformation, the water temperature criteria applied to migration of steelhead smolt are assumed to be the same as those applied to assess water temperature effects on Chinook salmon smolt migration.

Food

Chinook Salmon

The assessment for Chinook salmon under Rearing Habitat Quantity is assumed to reflect the potential effects on food for juvenile Chinook salmon. The assessment is based on the hypothesis that food production and availability are directly related to inundated channel and floodplain area. The certainty of the assessment relationship is low to medium, primarily because the relationship between river flow and food availability for juvenile Chinook salmon is relatively unknown. Use of floodplain habitat by juvenile Chinook salmon, however, has been well documented (Jones & Stokes 1993, 1999; California Department of Water Resources 1999b; Sommer and Harrell et al. 2001). Sommer and Harrell et al. 2001 found that floodplain habitat provides better rearing and migration habitat for juvenile Chinook salmon than the main river channel. The apparent growth rate of Chinook salmon in the Yolo Bypass ranged from 0.02 to 0.03 inch (0.55 to 0.80 mm) per day, while growth rates in the main channel of the Sacramento River ranged from 0.016 to 0.02 inch (0.43 to 0.52 mm) per day. The faster growth rate in the Yolo Bypass may be attributable to increased prey consumption associated with greater availability of drift invertebrates and warmer water temperature.

Steelhead

The assessment of effects on food for steelhead is the same as described for Chinook salmon for in-channel habitat. Steelhead do not appear to use floodplain habitat as extensively as juvenile Chinook salmon; therefore, assessment of effects on floodplain food sources are not considered. The certainty of the assessment relationship is minimal, primarily because the relationship between river flow and food availability for juvenile steelhead is relatively unknown.

Delta Smelt

The assessment for delta smelt under Rearing Habitat Quantity is assumed to reflect the potential effects on food for juvenile and adult delta smelt in estuarine rearing habitat. The assessment is based on the hypothesis that food production is directly related to the location of X2 in Suisun Bay and that food availability affects smelt survival.

The certainty of the assessment relationship is low to medium, primarily because the magnitude of species response is weakly supported. Rearing habitat in Suisun Bay is assumed to be important to maintaining smelt population abundance. Under similar salinity conditions, shoal areas are more productive and favorable for delta smelt feeding than deep channel areas (Moyle et al. 1992a, 1996). Delta smelt are more abundant in northern Suisun Bay than in the deeper ship channel to the south (Bennett et al. 2002 cited in white paper), and post-larvae are larger and have higher feeding success (Hobbs and Bennett, in preparation cited in white paper). While the studies indicate that shoal areas are better rearing grounds for smelt, more detailed evaluation of the magnitude of effects and other aspects of the relationships is warranted.

Splittail

The assessment for splittail under Spawning Habitat Quantity and Rearing Habitat Quantity is assumed to reflect the potential effects on food for larval, juvenile, and adult splittail. The assessment is based on the hypothesis that effects of food production and availability on splittail abundance are directly related to inundated floodplain area. The certainty of the assessment relationship is medium. Two studies on the Yolo Bypass (Sommer and Harrell et al. 2001) and the Cosumnes River (Moyle, unpublished data) indicate an increase of food resources on floodplain habitat. Also the longer the floodplain is available, the longer juvenile splittail can rear and obtain more food (see Rearing Habitat Quantity).

Striped Bass

The assessment for striped bass under rearing habitat quantity is assumed to reflect the potential effects on food for juvenile bass in estuarine rearing habitat. The assessment is based on the hypothesis that food production is directly related to the location of X2 in Suisun Bay and that food availability affects striped bass survival. The assessment of effects on food for striped bass is the same as described for delta smelt. The certainty of the assessment relationship is medium, primarily because the magnitude of species response is weakly supported.

Green Sturgeon

The assessment for Green Sturgeon under Rearing Habitat Quantity is assumed to reflect the potential effects on food for juvenile green sturgeon. The assessment is based on the hypothesis that food production and availability are directly related to inundated channel bottom area. The certainty of the assessment relationship is low, primarily because the relationship between river flow and food availability for juvenile green sturgeon is relatively unknown.

Entrainment

Entrainment of fish with water diverted from the Delta has been identified as a primary concern for Chinook salmon, delta smelt, and other fish species (U.S. Fish and Wildlife Service 1996). More than 1,800 agricultural, municipal, and industrial diversions have the potential to entrain fish with diverted water. The CVP and SWP pumping plants, the two largest diversions from the Delta, entrain thousands of fish annually. The environmental conditions that influence the number of fish lost to diversions include:

- abundance, distribution, and movement of fish in the Delta;
- diversion location, volume, duration, frequency, and timing (e.g., seasonal, diurnal, tidal phase);
- effects of net and tidal flows on the movement of fish;
- effects of diversions on net and tidal flows;
- direct and indirect (i.e., net and tidal flow) effects of gates on fish movement;
- efficacy of fish salvage (i.e., screening, handling, holding, transport, and release) facilities and procedures; and
- predation vulnerability prior to entrainment and associated with salvage facilities and procedures, including release of salvaged fish near Antioch.

The SDIP includes project actions that potentially affect the number of fish entrained by SWP and CVP pumping and in other diversions. The timing and volume of SWP and CVP pumping is potentially altered with implementation of the SDIP. Construction of gates at the head of Old River and in other south Delta channels potentially blocks fish movement and alters net and tidal flows that could affect the movement and distribution of fish and subsequent entrainment.

Although entrainment is well documented at the SWP and CVP facilities, the relationships between affected environmental conditions, the number of fish entrained, and the potential population effect remain relatively weakly supported. Hypothetical basic relationships for entrainment include:

1. The number of fish entrained is directly related to export volume and an assumed density of fish in the water diverted.

2. The number of fish entrained is related to the interaction between Delta channel hydraulics and fish distribution. Fish are assumed to behave and move as passive particles within the water column.
3. The number of fish entrained is related to the interaction among Delta channel hydraulics, fish distribution, and fish behavior. Fish use hydraulic conditions to expedite movement toward their migration objective.

The three basic hypotheses, potential variability in expected entrainment effects, and the certainty of the assumed entrainment relationships are discussed in detail in Appendix J, "Methods for Assessment of Fish Entrainment in SWP and CVP Exports."

For this impact assessment, entrainment of Delta fishes is based primarily on the first hypothesis that the number of fish entrained is directly related to export volume and an assumed monthly salvage density of fish in the water diverted. Salvage and entrainment loss is assumed to increase linearly with increased exports.

For Chinook salmon, historical loss estimates (i.e., monthly loss per cubic foot per second of pumping) provide the basis for assessing effects of changes in SWP and CVP pumping. DFG has calculated the number of Chinook salmon in each run that are salvaged and lost at the SWP and CVP pumping facilities. The median loss per cubic foot per second for each month, each salmon run, and each facility for 1992–2002 was multiplied by the simulated monthly SWP and CVP pumping rates (cfs) to arrive at total entrainment loss estimates for each year. The total annual entrainment loss for each salmon run for each action alternative was compared to the total annual entrainment loss for the No-Action Alternative.

To provide a context of impact level, entrainment loss was compared to the estimated annual number of juvenile Chinook salmon expected to enter the Delta. Historical juvenile numbers entering the Delta were estimated by the method applied by NOAA Fisheries for winter-run Chinook salmon (Winter-Run JPE [juvenile production estimate] Estimator Program). Juvenile production entering the Delta was estimated for fall-, late fall–, winter-, and spring-run Chinook salmon from the Sacramento and San Joaquin River systems (Appendix J, "Methods for Assessment of Fish Entrainment in SWP and CVP Exports"). The number of juveniles entering the Delta was based on historical escapement (i.e., the estimated number of adult spawners for each run). The number of adult spawners was multiplied times an assumed proportion of females (0.783), number of eggs per female (5,000), survival rate from egg to juvenile (0.1475), and survival of migration to the Delta (0.52).

For all other species (steelhead, delta smelt, splittail, striped bass, and green sturgeon), historical salvage density estimates (i.e., monthly salvage per cfs of pumping) provide the basis for assessing effects of changes in SWP and CVP pumping on entrainment. Annual life-stage production estimates are not available, so the monthly entrainment estimates are not normalized for the relative size and abundance expected in each month. The analysis, therefore, is based on simulated change in salvage that provides an indication of the possible magnitude of change in entrainment loss. The impact on the population is assessed qualitatively based on a range of possible factors (e.g., fish size, fish distribution within and entering the Delta).

DFG has calculated the number of steelhead, delta smelt, splittail, and striped bass that are salvaged at the SWP and CVP pumping facilities. The monthly pattern of salvage numbers and fish size is provided in (Appendix J, "Methods for Assessment of Fish Entrainment in SWP and CVP Exports"). The median salvage density for each month and each facility for 1980–2002 was multiplied by the simulated SWP and CVP monthly pumping rate (cfs) to arrive at total annual salvage values. The total annual salvage for the action alternatives was compared to the total annual salvage for the No-Action Alternative.

Significance Criteria

Assessment species are selected based on listing under the ESA, listing in environmental management plans (e.g., local environmental plans and state resource agency plans), and ecological, economic, or social importance. Under NEPA and CEQA, impacts are considered significant when project actions, viewed with past, current, and reasonably foreseeable future projects, potentially reduce the abundance and distribution of the assessed fish species (Public Resources Code Section 21083; Guidelines Section 15065). Significant impacts may occur through substantial:

- interference with the movement of any resident or migratory fish species;
- long- or short-term loss of habitat quality or quantity;
- adverse effects on rare or endangered species or habitat of the species that affect population abundance or distribution; or
- adverse effects on fish communities or species protected by applicable environmental plans and goals.

Determination of significance requires that the species population abundance and distribution would likely be reduced. Change in survival, growth, reproduction, and movement for any given life stage, however, may not affect the abundance and distribution of a species. Quantifying population level effects is complicated by annual variation in species abundance and distribution in response to variable environmental conditions that may or may not be driven by human activities. In addition, beneficial effects may offset adverse effects for specific aspects of specific life stages, resulting in beneficial or minimal impacts on the overall population.

The significance thresholds under NEPA and CEQA for species population abundance and distribution require maintenance of population resilience and persistence. Resilience is the ability of the species to increase in abundance and distribution in response to improved environmental conditions. Persistence is the ability of the species to sustain itself through periods of adverse environmental conditions. The thresholds include:

- any permanent change in an environmental correlate that would substantially reduce the average abundance of the population over a range of weather-related conditions (e.g., water year types);
- any change in an environmental correlate that would permanently limit the geographic range and the seasonal timing of any life stage; and
- any potential reduction in population abundance, distribution, and production for years with deficient environmental conditions (e.g., water years 1987–1991 or years where weather-related conditions fall below the lowest 20th percentile).

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project-specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Bay-Delta Program.

The discussion of significant impacts and mitigation measures in this section will include one or more of the following programmatic mitigation measures used to build project-specific mitigation measures to offset significant impacts identified from implementation of the SDIP. These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED programmatic mitigation measures, please refer to Appendix E, "Mitigation Measures Adopted in the CALFED Record of Decision."

Fisheries and Aquatic Systems Mitigation Measures

1. Implement BMPs, including a stormwater pollution prevention plan, toxic materials control and spill response plan, and vegetation protection plan.
2. Limit construction activities to windows of minimal species vulnerability.
3. Create additional habitat for desired species, including increased aquatic area and structural diversity through construction of setback levees and channel islands.
5. Operate new and existing diversions to avoid and minimize effects on fish—avoid facility operations during periods of high species vulnerability.
7. Control predators in the diversion facility (screen bays) and modify diversion facility structure and operations to minimize predator habitat.
9. Coordinate and maximize water supply system operations flexibility consistent with seasonal flow and water temperature needs of desired species.

10. Identify and investigate issues regarding beneficial reuse of dredged material, including conducting core sampling and analysis of proposed dredged areas, and implement engineering solutions to avoid or prevent environmental exposure to toxic substances after dredging.
11. Cap exposed toxic sediments with clean clay/silt and protective gravel.
12. Locate constructed shallow-water habitat away from sources of mercury until methods for reducing mercury in water and sediment are implemented.
13. Use cofferdams to construct levees and channel modifications in isolation from existing waterways.
14. Use sediment curtains to contain turbidity plumes during dredging.
15. Schedule ground disturbing construction during the dry season.
16. Follow established and proper procedures and regulations for identifying, removing and disposing of contaminated materials.
17. Utilize the criteria and objectives in the Water Transfer Program, in conjunction with existing legal constraints on water transfers, to protect against adverse effects due to water transfers. The criteria for future water transfer proposals include: Transfers must not harm fish and wildlife resources and their habitats.

Alternative 1 (No Action)

New construction activities would not be implemented under the No Action Alternative. Temporary barriers, however, would continue to be constructed and removed annually in the south Delta channels. The head of Old River fish control barrier and barriers in Middle River, Grant Line Canal, and Old River would be constructed every year as they have been in the past. Construction of the barriers includes grading the channel bank and placement of riprap and other materials on the channel bank and bottom.

Various permit conditions are placed on the Temporary Barriers Program by the USFWS, NOAA Fisheries, and DFG (San Joaquin River Group Authority 2003). The earliest in-water construction activities that can be conducted on the head of Old River, Middle River, and Old River at Tracy barriers during the spring barrier installation period is April 7. Construction of the northern abutment and boat ramps of the Grant Line Canal barrier and construction of out-of-water portions of the head of Old River, Middle River, and Old River at Tracy barriers may not be started before April 1. Full closure of the Grant Line Canal barrier is not required, but construction of the north abutment and boat ramps must be completed to the extent that full barrier closure and operation can be readily achieved in a reasonable time frame when directed by DWR. The permit conditions require that all the above work be completed by April 15, a total of 15 days.

Construction activities remove, disturb, modify, and replace channel bottom and channel bank substrates. Although annual activities are unlikely to remove or disturb substantial aquatic and riparian vegetation, reestablishment of vegetation is prevented within the footprint of the barriers. Organisms on the channel bottom and bank may be removed or crushed during grading and placement of riprap. Local noise, physical movement, and vibration may cause temporary movement of individuals from adjacent habitat.

During barrier construction, there is potential for spill of petroleum products associated with operation of equipment and suspension of sediment. Contaminants, including suspended sediment, may adversely affect organisms within the channel, causing mortality from acute toxicity and suffocation of fish eggs and sessile organisms.

The placement of the barriers on Middle River, Grant Line Canal, and Old River maintains water surface elevation above 1.0 foot msl during May through September. Under current conditions, tides range from about 1.0 foot below mean sea level to 3.0 feet msl two times each day. The placement of the barriers blocks fish access when tidal level is below 1.0 foot msl, although access is maintained when tidal level exceeds 1.0 foot msl (i.e., between 1.0 and 3.0 feet msl). The volume of water exchanged during each tidal cycle (i.e., between the high and the low tidal level) is reduced by about 50% for the channels upstream of the barriers on Middle River, Grant Line Canal, and Old River. Effects on water quality have been monitored but have not been detected. The barriers on Middle River, Grant Line Canal, and Old River may also be in place in April to mid-May and in October and November, although the culverts on the Grant Line Canal barrier are tied open.

The head of Old River fish control barrier minimizes movement of juvenile fall-run Chinook salmon from the San Joaquin River into Old River from about April 14 through June 1. Juvenile Chinook salmon move down the San Joaquin River past Stockton, a pathway believed to enhance survival relative to movement into Old River (Brandes and McLain 2001).

The head of Old River fish control barrier increases flow in the San Joaquin River past Stockton from about September 15 through November 30. The increased flow in the San Joaquin River potentially improves water quality, including increased DO, in the San Joaquin River channel near Stockton (Giulianotti et al. 2003). Improved water quality could benefit upstream migrating adult Chinook salmon.

Alternative 1 does not include any changes to water supply operations. Current reservoir operations, diversions, and SWP and CVP pumping from the Delta would continue. Effects of flow and diversions on fish habitat conditions in the Trinity, Sacramento, Feather, American, and San Joaquin Rivers and the Delta would be the same as under existing water supply operations criteria. Effects of reservoir storage on fish habitat in Trinity, Shasta, Oroville, San Luis, and Folsom Reservoirs would also be the same as under existing water supply operations criteria.

2020 Conditions

Under Future No Action (2020 conditions), the SDIP project components would not be built or operated; diversion and pumping would not increase. SWP and CVP operations would remain the same. It is expected that the temporary barriers program would continue and that other water supply–related projects would be implemented. There would be no impacts on fisheries resources from dredging activities or placement of permanent gates, and existing conditions as described above would continue.

Under 2020 conditions, CALSIM modeling results indicate small changes may occur in the Trinity, American, and Sacramento Rivers. Trinity River flows increase in some months and water temperatures in these months are improved. Upstream Sacramento and American River flows show a tendency to decrease and their temperatures also show a slight increase. The proportion of spawning habitat available under the No Action Alternative for steelhead and Chinook salmon is reduced slightly under 2020 conditions relative to 2001 conditions in the American River (Table 6.1-8 and 6.1-9) and less so in the Sacramento River. Compared to 2001 conditions, base water temperature survival indices for the No Action Alternative under 2020 conditions indicate slightly reduced survival for Chinook salmon (adult migration, juvenile rearing, smolt migration) and steelhead (adult migration, juvenile rearing, smolt migration) in the American River (Table 6.1-23 and 6.1-10). Similarly, base water temperature survival indices for Chinook salmon (spawning/incubation and adult migration) and steelhead (adult migration) in the Sacramento River indicate a slight reduction in survival (Table 6.1-17 and 6.1-11).

Although the CALSIM results for monthly inflows and pumping may be slightly different, the effects of flow and diversions on fish and fish habitat conditions in the Delta would be similar to 2001 conditions. The effects of these simulated 2020 CVP and SWP pumping levels on south Delta tidal hydraulics are similar to the simulated tidal hydraulic conditions for the 2001 conditions. Thus, the effects of the No Action Alternative under 2020 conditions would be similar to the effects described under 2001 conditions, resulting in no significant difference from existing conditions for Chinook salmon, steelhead, delta smelt, splittail, striped bass and green sturgeon in the Delta.

Table 6.1-8. Frequency of Monthly Spawning Habitat Availability for Steelhead and Chinook Salmon in the Sacramento, Feather, and American Rivers for Alternative 1, 1922–1994 Simulation

Proportion of Spawning Habitat Available (%)	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead
Feather River					
<+100%	219			219	365
<+90%	0			0	0
<+80%	0			0	0
<+70%	0			0	0
<+60%	0			0	0
<+50%	0			0	0
<+40%	0			0	0
<+30%	0			0	0
<+20%	0			0	0
<+10%	0			0	0
0%	0			0	0
Sacramento River at Keswick					
<+100%	212	212	290	213	356
<+90%	7	7	2	6	9
<+80%	0	0	0	0	0
<+70%	0	0	0	0	0
<+60%	0	0	0	0	0
<+50%	0	0	0	0	0
<+40%	0	0	0	0	0
<+30%	0	0	0	0	0
<+20%	0	0	0	0	0
<+10%	0	0	0	0	0
0%	0	0	0	0	0
American River at Nimbus					
<+100%	163				292
<+90%	14				32
<+80%	8				8
<+70%	22				23
<+60%	3				4
<+50%	9				3
<+40%	0				0
<+30%	0				3
<+20%	0				0
<+10%	0				0
0%	0				0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-9. Frequency of Monthly Spawning Habitat Availability for Steelhead and Chinook Salmon in the Sacramento, Feather, and American Rivers for Alternative 1, 1922–1994 Simulation (2020 Operations)

Proportion of Spawning Habitat Available (%)	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead
Feather River					
<+100%	219			219	365
<+90%	0			0	0
<+80%	0			0	0
<+70%	0			0	0
<+60%	0			0	0
<+50%	0			0	0
<+40%	0			0	0
<+30%	0			0	0
<+20%	0			0	0
<+10%	0			0	0
0%	0			0	0
Sacramento River at Keswick					
<+100%	208	209	292	214	352
<+90%	11	10	0	5	13
<+80%	0	0	0	0	0
<+70%	0	0	0	0	0
<+60%	0	0	0	0	0
<+50%	0	0	0	0	0
<+40%	0	0	0	0	0
<+30%	0	0	0	0	0
<+20%	0	0	0	0	0
<+10%	0	0	0	0	0
0%	0	0	0	0	0
American River at Nimbus					
<+100%	143				273
<+90%	17				26
<+80%	11				11
<+70%	27				30
<+60%	8				10
<+50%	12				11
<+40%	1				1
<+30%	0				3
<+20%	0				0
<+10%	0				0
0%	0				0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-10. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the American River at Sunrise for Alternative 1, 1922–1993 Simulation (2020 Operations)

	Fall-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	169	303	406	174	360	278	732	390
0.9	34	34	22	26	54	28	119	26
0.8	3	27	4	11	8	8	9	11
0.7	28	14	0	5	6	8	0	5
0.6	52	7	0	0	40	7	2	0
0.5	35	9	0	0	14	5	1	0
0.4	30	5	0	0	10	4	0	0
0.3	33	4	0	0	7	4	1	0
0.2	17	7	0	0	1	4	0	0
0.1	13	0	0	0	2	4	0	0
0.0	18	22	0	0	2	154	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Alternative 2A

Stage 1 (Physical/Structural Component)

Construction of the gates under Alternative 2A potentially affects environmental conditions in the south Delta (Table 6.1-12). Permanent gates would be constructed at the head of Old River and in Middle River, Grant Line Canal, and Old River at DMC. Construction of the gates includes grading the channel bank, dredging the channel bottom, constructing sheet-pile cofferdams or an in–the-wet construction method, and placing riprap, concrete, and other materials on the channel bank and bottom.

Dredging for all of the permanent gates would occur between August and November (Chapter 2, “Project Description”). Cofferdams would also be placed in the channel during the August through November timeframe. Work outside of the channel and within the cofferdams, if used, is assumed to occur during any month.

The construction activities would remove, disturb, modify, and replace channel bottom and channel bank substrates. Aquatic and riparian vegetation would be removed within the footprint of the gate and the footprint of riprap along the contiguous levee face and channel bottom. Organisms on the channel bottom and bank would be removed or crushed during grading, dredging, and placement of riprap and other materials. The cofferdams, if used, would isolate the work area for gate construction from the channel. Water and associated fish and other aquatic organisms would be pumped out of the isolated area and into the Delta channel. Local noise, physical movement, and vibration generated during construction may temporarily cause individuals to move out of adjacent habitat.

During gate construction, there is potential for spill of petroleum products and suspension of sediments associated with operation of equipment (Table 6.1-12). Using a cofferdam to isolate work on the gate structure would minimize suspended sediment and the potential introduction of contaminants into the channel. If cofferdams are not used, other methods, such as sediment curtains, would be implemented to minimize suspension of fine sediment. Contaminants introduced into the channel, including suspended sediment, may adversely affect organisms, causing mortality from acute toxicity and suffocation of fish eggs and sessile organisms.

In addition to the dredging associated with gate construction, conveyance dredging is proposed in West Canal, Old River, Middle River, and Grant Line Canal (Table 6.1-12). Dredging may also be required to accommodate operation of the intakes for some existing agricultural diversions that would be extended to a greater water depth. Maintenance dredging may be required at an unspecified interval to maintain channel capacity and the function of the gates. Some level of maintenance dredging could occur every year, and approximately 25% of the area initially dredged would be dredged every 5 years. Dredging would remove and disturb the channel bottom. Aquatic vegetation would be removed within the footprint of the dredging. Organisms on the channel bottom would be removed. Local noise, physical movement, and vibration generated by the dredge may temporarily cause individuals to move out of adjacent habitat. Spill of petroleum products and suspension of sediment may occur during dredge operation. Contaminants introduced into the channel, including suspended sediment, may adversely affect organisms, causing mortality from acute toxicity and suffocation of fish eggs and sessile organisms.

Dredging would increase the conveyance capacity of the channel. Tidal flow velocity may be slightly reduced in West Canal and, depending on existing channel constrictions, circulation may be increased in Middle River, Old River, and Grant Line Canal (Section 5.2, Delta Tidal Hydraulics).

Extending the 24 agricultural intakes is not expected to increase the exposure of fish to entrainment. The environmental effects of extending the intakes were summarized in the BO issued by NOAA Fisheries on dredging around or extending the intakes (National Marine Fisheries Service, Southwest Region 2003). The BO concluded that modifying the diversions would not allow for any additional water to be diverted that would exceed that which has been historically diverted through the current diversions. The conservation measures described in the BO will ensure that adverse impacts to fish are avoided.

The operation of the permanent flow control gates on Middle River, Grant Line Canal, and Old River would maintain water surface elevation above 0.0 feet msl during April 15 through November or other periods as determined by USFWS, NOAA Fisheries, and DFG (Table 6.1-12; Section 5.2, Delta Tidal Hydraulics). Under current conditions, tides range from about 1.0 foot below mean sea level

Table 6.1-11. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Red Bluff for Alternative 1, 1922–1993 Simulation (2020 Operations)

	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	388	397	432	216	532	486	859	648	573	146	715	504	469	211	859	576	468	328	859	432
0.9	23	18	0	0	23	67	5	0	3	170	5	0	15	73	5	0	21	74	5	0
0.8	7	2	0	0	7	6	0	0	0	52	0	0	6	23	0	0	7	34	0	0
0.7	1	1	0	0	1	1	0	0	0	19	0	0	1	8	0	0	0	30	0	0
0.6	5	2	0	0	5	2	0	0	0	10	0	0	5	8	0	0	3	15	0	0
0.5	1	3	0	0	1	4	0	0	0	8	0	0	1	8	0	0	3	5	0	0
0.4	3	1	0	0	3	2	0	0	0	2	0	0	3	2	0	0	1	8	0	0
0.3	2	1	0	0	2	1	0	0	0	3	0	0	2	2	0	0	0	3	0	0
0.2	2	1	0	0	2	1	0	0	0	0	0	0	2	1	0	0	1	2	0	0
0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.0	0	6	0	0	0	6	0	0	0	22	0	0	0	24	0	0	0	5	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-12. Potential Actions, Impact Mechanisms, and Affected Environmental Conditions with Implementation of the South Delta Improvements Project

Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
Construct operable gates on Middle River, Grant Line Canal, and Old River and a fish control structure at the head of Old River	Grade channel bank and dredge channel bottom: ▪ Head of Old River—500 feet ▪ Old River—540 feet ▪ Middle River—200 feet ▪ Grant Line Canal—600 feet Construct bottom-hinged gates, boat locks, and supporting structures across the channel. Place rip rap on channel bank and bottom: ▪ Head of Old River—11,000 square feet ▪ Old River—49,000 square feet ▪ Middle River—11,000 square feet ▪ Grant Line Canal—15,400 square feet Construct 1,000 feet of new setback levee on Old River, leave part of existing levee as channel island. Construct sheet-pile coffer dams to isolate construction areas; pump water from inside of coffer dams. Potential accidental spill of petroleum products. Traffic noise and footprint disturbance.	Substrate: remove, disturb, modify, and replace channel bottom and channel bank substrates. Cover: Remove and disturb aquatic and riparian vegetation; add hard structure to the channel cross section. Contaminants: potential spill of petroleum products and concrete; suspend sediment during dredging, grading, and other construction activities. Channel dimensions: change channel depth and width. Non-native predator species: change in cover, depth, and velocity associated with the gate structure may alter habitat for non-native species. Physical contact: remove or crush organisms during dredging, grading, placement of rip rap; entrain organisms with water pumped during evacuation of construction areas within coffer dams. Disturbance: noise, physical movement, or vibration sufficient to cause movement of individuals from local habitat.

Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
Operate gates on Middle River, Grant Line Canal, and Old River and a fish control structure at the head of Old River	Operate the gates (i.e., Middle River, Grant Line Canal, and Old River) to maintain a minimum level above 0.0 feet mean sea level during May through September. Operate the head of Old River gate to minimize movement of juvenile fall-run Chinook salmon from the San Joaquin River into Old River from April 1 to May 31. Operate the head of Old River gate to increase flow in the San Joaquin River past Stockton during September 15–November 30.	Gate: the closure of the bottom-hinged gates at the head of Old River will block flow and fish movement; closure of the bottom-hinged gates at other gates will block flow and fish movement during levels less than 0.0 feet mean sea level. Level: operation of the gate will maintain level at 0.0 feet mean sea level in the channels on the upstream side of the gates and potentially reduce inter-tidal area. Flow velocity: operation of the gate will affect circulation in the channels on the upstream and downstream side of the gates. Net flow direction: depending on interaction between inflow and diversions, net flow direction may change in some channels. Soil moisture: higher level could increase soil moisture elevation on lands adjacent to the affected channels. Cover: change in level could affect maintenance and establishment of riparian and aquatic vegetation, affecting the availability of cover. Contaminants: change circulation may change residence time and volume and the concentration of salts, pesticides, nutrients, and other materials from agricultural return flows. Water temperature: change in circulation could change water temperature. Dissolved oxygen: change in circulation could change dissolved oxygen levels. Predator effectiveness: the operation of the gates could potentially create feeding areas for predator species and hydraulic conditions that disorient prey. Non-native predator species: change in cover, depth, and velocity may alter habitat to favor non-native species in the channels between gates. Food: change in residence time, in combination with change in contaminants, may affect food production.

Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
Dredge West Canal, Old River, Middle River, and Grant Line Canal	Grade and remove vegetation to create staging area for dredge machinery and operation. Remove and disturb channel bottom and channel bank substrate and vegetation (i.e., aquatic and riparian) along: ▪ West Canal—Clifton Court Forebay intake to Victoria Canal ▪ Middle River—MR 49 to MR 12 ▪ Old River—spot dredging at specific siphons Divert water for conveyance of dredged sediments (i.e., depends on dredge type). Potential for accidental spill of petroleum products into the channel. Change channel conveyance capacity. Disturb and bury terrestrial or aquatic communities at dredge disposal sites and along routes to disposal sites. Discharge of dredge conveyance water. Traffic noise and footprint disturbance.	Channel dimensions: increase channel depth and width; potential for ongoing changes to channel dimensions and potential loss of existing shallow area. Substrate: remove, disturb, and mobilize channel bottom and channel bank substrates; potential for ongoing erosion of shallow areas from changes in channel dimensions. Cover: remove or disturb aquatic and riparian vegetation; potential for ongoing loss of riparian and aquatic vegetation from channel bank erosion. Contaminants: petroleum products from construction equipment; suspended sediment from construction activities; mobilized contaminants from channel sediments. Level: change in channel dimensions may affect level. Flow velocity: change in velocity from the change in channel dimensions. Non-native predator species: change in cover, depth, and velocity may alter species habitat. Physical contact: removal or crushing of organisms during dredging and disposal of dredge spoils.

Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
Maintenance dredging in and around gates and agricultural pumps and siphons	Remove and disturb channel bottom and channel bank substrate and vegetation (i.e., aquatic and riparian) at gates, siphons, and pumps in Old River, Middle River, and Grant Line Canal. Divert water for conveyance of dredged sediments (i.e., depends on dredge type). Potential for accidental spill of petroleum products into the channel. Maintain channel conveyance capacity. Disturb and bury terrestrial or aquatic communities at dredge disposal sites and along routes to disposal sites. Discharge of dredge conveyance water. Traffic noise and footprint disturbance.	Channel dimensions: maintain channel depth and width; potential loss of shallow area. Substrate: remove, disturb, and mobilize channel bottom and channel bank substrates; potential for ongoing erosion of shallow areas from changes in channel dimensions. Cover: remove or disturb aquatic and riparian vegetation; potential for ongoing loss of riparian and aquatic vegetation from channel bank erosion. Contaminants: petroleum products from construction equipment; suspended sediment from construction activities; mobilized contaminants from channel sediments. Flow velocity: change in velocity from the change in channel dimensions. Non-native predator species: change in cover, depth, and velocity may alter species habitat. Physical contact: removal or crushing of organisms during dredging and disposal of dredge spoils.
Extend agricultural diversions on Middle River, Grant Line Canal, and Old River	Potential for increased duration and depth of diversion. Disturb channel bottom and bank substrate. Potential accidental spill of petroleum products during construction activities.	Substrate: disturb channel substrates. Cover: remove or disturb aquatic and riparian vegetation at siphon or pump. Contaminants: petroleum products from construction equipment; suspended sediment from construction activities. Physical contact: entrainment of fish and other aquatic organisms in deeper diversion.

Project Actions	Impact Mechanisms Associated with Implementing Project Actions	Affected Environmental Conditions
Increase State Water Project Delta diversions	Change in upstream reservoir operations. Change in Delta exports. Change in the use of exported water (i.e., effects on agricultural practices, wildlife refuge operations, etc.).	Reservoir shallow water area: operations may change the seasonal level of reservoirs. Flow level: river level could change in response to changes in reservoir releases. Depth: river depth would change with level. Flow velocity: river velocity would change with river level; net Delta channel velocity could respond to river inflow changes and export changes. Net flow direction: change in net Delta channel flow direction would respond to river inflow changes and export changes. Floodplain inundation: dependent on change in river level. Soil moisture: dependent on change in river level. Diversion: Delta exports would increase in response to changes in Delta operations criteria and upstream reservoir operations; upstream diversions may also change. Substrate: could be affected depending on the magnitude of river flow change related to spill. Cover: could be affected depending on the magnitude, duration, timing, and frequency of change in level and effects on riparian vegetation. Water temperature: operations may affect reservoir storage volume and river flow, subsequently affecting river water temperature Salinity: dependent on changes in Delta outflow in response to Delta inflow and exports. Turbidity: could be affected by river inflow, Delta exports, changes in nutrient input and production. Predator effectiveness: could be affected by change in turbidity. Outside food input: could be affected depending on the magnitude of river flow change. Food production: dependent on change in residence time and losses to diversion.

to 3.0 feet msl two times each day. The maximum change in SWP pumping (and CCF operations) could reduce the daily higher high tide from about 2.6 to 2.4 feet msl near the CCF gates (Section 5.2, Delta Tidal Hydraulics; Figures 5.2-60 through 5.2-62). The reduction in higher high tide attributable to change in SWP pumping is less with distance from the CCF gates. When closed during tide levels below 0.0 feet msl, the flow control gates block fish passage. When opened during tide levels greater than 0.0 feet msl, fish passage is restored. The volume of water exchanged during each tidal cycle is reduced by about 20% for the channels upstream of the gates on Middle River, Grant Line Canal, and Old River.

During the spring, the head of Old River fish control gate would be operated to block flow and movement of juvenile fall-run Chinook salmon and other fishes from the San Joaquin River into Old River from about April 1 through June 1, or other periods as recommended by USFWS, NOAA Fisheries, and DFG (Table 6.1-12). Juvenile Chinook salmon move down the San Joaquin River past Stockton, a pathway believed to enhance survival relative to movement into Old River (Brandes and McLain 2001).

During fall, the head of Old River fish control gate would be operated to increase flow in the San Joaquin River past Stockton from about September 15 through November 30 or other periods as recommended by USFWS, NOAA Fisheries, and DFG. The increased flow in the San Joaquin River potentially improves water quality, including increased DO, in the San Joaquin River channel near Stockton (Giulianotti et al. 2003). Improved water quality could benefit upstream migrating adult Chinook salmon.

Chinook Salmon

The following assessment identifies potential construction-related impacts of implementing Alternative 2A on winter-, spring-, and fall-/late fall–run Chinook salmon in Central Valley rivers and the Delta. The assessment also identifies the impacts on Chinook salmon as a result of operating the gates. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages for each run.

Impact Fish-1: Construction-Related Loss of Rearing Habitat Area for Chinook Salmon. Chinook salmon rear in the Delta. Construction of the gates in the south Delta and maintenance activities have the potential to permanently modify shallow vegetated areas that may provide rearing habitat for Chinook salmon. The area of shallow vegetated habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport).

The permanent gates constructed under Alternative 2A would have minimal effect on habitat within the construction footprint at the head of Old River, Middle River, and Old River at DMC. Construction of the temporary barriers has previously modified shallow water habitat. These permanent gates would be constructed in the same location as the temporary barriers and would result in little change in habitat quality and quantity relative to Alternative 1.

Construction of a new gate on Grant Line Canal, which would be located in a different location than the temporary barrier, and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow vegetated habitat. Although the loss of shallow vegetated habitat in the Delta has not been explicitly identified as a factor contributing to the decline of Chinook salmon (U.S. Fish and Wildlife Service 1996), juvenile Chinook salmon are known to rear in the south Delta and use shallow vegetated areas (Feyrer 2001; Grimaldo et al. 2000).

Relative to historical extent, existing availability of shallow vegetated areas is limited. Therefore loss of additional shallow vegetated area that may represent rearing habitat for Chinook salmon could contribute to the historical loss and to an ongoing adverse impact.

The relative importance of specific areas and habitat types to growth and survival of juvenile Chinook salmon is currently unknown. Areas colonized by nonnative aquatic vegetation (e.g., *Egeria densa)* may not provide habitat for juvenile Chinook salmon (Grimaldo et al. 2000). Nonnative species currently dominate the fish community in shallow vegetated areas of the south Delta (Feyrer 2001), and many of the species prey on juvenile Chinook salmon. In addition, current efforts such as the temporary barrier at the head of Old River, focus on routing juvenile Chinook salmon down the San Joaquin River past Stockton and away from the south Delta channels. Available data indicate that survival is lower for juvenile Chinook salmon that are drawn off the San Joaquin River into Old River, although statistical differences between the survival relationships are not always significant (San Joaquin River Group Authority 2003). Low survival is attributable to entrainment in diversions, especially CVP and SWP pumping.

Rearing habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant. The determination is based on:

- the area disturbed by construction of gates on Middle River, Old River at DMC, and the head of Old River would be similar to the existing footprint of the temporary barriers;
- the footprint of the gate on Grant Line Canal would be in a new location, but the absence of the temporary barrier footprint would reestablish a similar area of rearing habitat;
- dredging would increase channel depth, but habitat area would remain unchanged and habitat quality would be similar (i.e., shallow water [the resulting bottom elevation is less than 3 m below mean lower low water (MLLW)]) following recolonization of the temporarily disturbed substrate by the affected benthic organisms (see Impact Fish-2); and
- implementation of a dredge monitoring program to confirm minimal effects of dredging on rearing habitat (see Chapter 2, “Project Description”).

No mitigation is required.

Impact Fish-2: Construction-Related Reduction in Food Availability for Chinook Salmon. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for juvenile Chinook salmon. Construction of the gates in the south Delta and maintenance activities have the potential to permanently modify shallow vegetated areas and remove bottom substrates that may produce food for Chinook salmon. The area of prey habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport).

The permanent gates constructed under Alternative 2A would have minimal effect on prey habitat within the construction footprint at the head of Old River, Middle River, and Old River at DMC. Construction of the temporary barriers has previously modified shallow water areas and channel bottom substrates. The permanent gates would be constructed in the same location as the temporary barriers and would result in little change in prey habitat quality and quantity relative to Alternative 1.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow vegetated areas and channel bottom substrate. Prey habitat loss associated with gate construction, riprap, maintenance activities, and dredging is determined to be less than significant. The determination is based on the small area affected by gate construction and riprap placement relative to availability of similar vegetated areas and bottom substrates in adjacent channel reaches. Also, benthic invertebrates are expected, based on changes in benthic invertebrate abundance observed in response to changes in salinity (Markham 1986; Vayssieres and Peterson 2003), to recolonize bottom substrates disturbed by dredging relatively quickly. For reasons similar to those discussed for Impact Fish-1, construction would have a minimal effect on prey availability, especially over the long term. No mitigation is required.

Impact Fish-3: Construction-Related Loss of Chinook Salmon to Accidental Spill of Contaminants. Contaminants associated with construction activities, including gate construction, placement of riprap, dredging, and maintenance dredging, could be accidentally introduced into the south Delta channels and could adversely affect Chinook salmon and their habitat. Environmental commitments, including an erosion and sediment control plan, SWPPP, hazardous materials management plan, spoils disposal plan, and environmental training, will be developed and implemented before and during construction activities (Chapter 2, "Project Description"). The environmental commitments would eliminate the likelihood of any substantial contaminant input. Contaminants would have a less-than-significant impact on Chinook salmon and their habitat in the south Delta because the potential for increased contaminant input following implementation of environmental commitments is small. No mitigation is required.

Impact Fish-4: Construction-Related Loss of Chinook Salmon to Direct Injury. Construction of the gates would include placement of sheetpiles and riprap and could directly injure fish present during the time of construction. Dredging could entrain and injure juvenile Chinook salmon. Cofferdams, if used, would be installed to isolate gate construction areas from the channel. Placement of cofferdams in the channels could trap juvenile Chinook salmon. Fish that become trapped inside the cofferdams could be killed during desiccation of the construction area and construction activities. Direct injury associated with construction and maintenance activities, including dredging, would have a less-than-significant impact on Chinook salmon because the number of fish injured is likely small given that:

- in-water construction, including the construction of a cofferdam, would occur between August and November;
- the area of construction activity is small relative to the channel area providing similar habitat quality in the south Delta;
- in-water construction and dredging would occur over a relatively short period (i.e., about 3 years); and
- most juvenile and adult Chinook salmon would move away from construction activities and into adjacent habitat of similar quality.

No mitigation is required.

Impact Fish-5: Construction-Related Loss of Chinook Salmon to Predation. Construction of gates and extension of agricultural intakes would add permanent structure and cover to the south Delta channels. The presence of natural or artificial cover (e.g., pilings, piers, trees, or aquatic plants) in rivers is known to attract relatively higher concentrations of fish than are present in areas without cover (Johnson and Stein 1979). Cover can disrupt flow patterns and provide fish with refuge from elevated water velocity (Shirvell 1990). Food may also be more abundant in areas with cover (Johnson et al. 1988). The addition of structure has the potential to increase the density of predator species and predation on fish moving around and past the structure.

Juvenile Chinook salmon and other fish species are known to be vulnerable to predators at locations such as RBDD, CCF, and release sites for fish salvaged from the SWP and CVP facilities (Hall 1980; Pickard et al. 1982; Bureau of Reclamation 1983). These facilities and release sites create relatively high concentrations of juvenile salmonids and other fish species that may be substantially disoriented by turbulence and handling associated with diversion, flow constriction, bypasses, and salvage. Concentrations of disoriented fish increase prey availability and create predator habitat.

Predation associated with the addition of the operable gates and the agricultural intake extensions to the south Delta channels could cause a small and likely negligible (i.e., less-than-significant impact) increase in mortality of the juvenile Chinook salmon moving past the structures. The determination is based on several factors. Design elements will minimize turbulence that could disorient fish and increase vulnerability to predation. The structures would not create conditions that could concentrate juvenile Chinook salmon. Flow velocity would be similar to velocities within the channel upstream and downstream of the gates and agricultural intake extensions.

The transition zones between various elements of the gates (e.g., sheetpiles and riprap) could provide low-velocity holding areas for predatory fish. Predatory fish holding near the gates and agricultural intakes could prey on vulnerable species. The additional predator habitat created by the gates and intake extensions would have a less-than-significant impact on juvenile Chinook salmon because the increase in potential predator habitat is small relative to habitat in adjacent areas, including the habitat currently created by the temporary barriers and habitat at the existing agricultural intakes. Disorientation and concentration of juvenile fish would be minimal given the size and design of the gates. This impact is less than significant. No mitigation is required.

Impact Fish-6: Effects of Gate Operation on Juvenile and Adult Chinook Salmon Migration. The head of Old River fish control gate could be closed from April 14 to May 15 under Alternative 1 and closed from April 1 to May 31 under Alternative 2A (i.e., when San Joaquin River flow is less than 10,000 cfs) (Table 6.1-12). Under Alternative 1 (No Action), a temporary fixed barrier is constructed each year. Under Alternative 2A, a gate would be constructed with operable gates that would allow a range of operations. Gate closure would minimize the movement of juvenile Chinook salmon into Old River. Although the effects of gate closure are similar for both Alternatives 1 and 2A, the operable gate constructed under Alternative 2A would provide increased opportunities (i.e., longer closure) for fish protection. The increased flexibility to operate the fish control gate is also considered a beneficial impact.

The head of Old River fish control gate may also provide benefits to adult Chinook salmon during upstream migration in September, October, November, and other months (Table 6.1-12). Hallock (1970) observed that adult Chinook salmon avoided water temperatures greater than 66°F if DO was less than 5 mg/l. Low DO in the San Joaquin River channel near Stockton may delay migration of fall-run Chinook salmon. High San Joaquin River flows past Stockton maintain higher DO levels (Hayes and Lee 2000). Closure of the head of Old River fish control gate increases the San Joaquin River flow past Stockton, but the increase in flow during years with low-to-average flow (less than 1,000 cfs) appears to have minimal effect on DO levels. Available data indicate that the operation of flow control gates could reduce DO in the San Joaquin River near Stockton during the summer, but closure of the head of Old River fish control gate September 15 through November 30 would result in DO levels that are the same for Alternatives 1 and 2A (Section 5.3, Water Quality; Figure 5.3-44). Migration of adult Chinook salmon would be protected. Although the benefit of closing the head of Old River fish control gate to upstream movement of adult fall-run Chinook salmon is uncertain for all flow conditions, an operable gate constructed under Alternative 2A would provide increased opportunities to evaluate the potential effects of increased flow under a wide range of San Joaquin River flow conditions (Table 6.1-12). The increased flexibility of an operable gate is a beneficial impact.

Gates in Middle River, Grant Line Canal, and Old River near Byron could affect access to rearing habitat in the south Delta channels and passage through the channels by adult and juvenile Chinook salmon during operation from April 15 through November and other months as needed (Table 6.1-12). Operation of the gates, however, generally avoids the period of adult and juvenile Chinook salmon movement through the Delta, except during May and June when juvenile Chinook salmon could be affected. During May, the proposed closure of the head of Old River Gate would transcend the effects of the gates on Middle River, Grant Line Canal, and Old River near Byron. In addition, the gate operations would have a beneficial effect relative to the existing temporary barriers. The existing temporary barriers are in place from mid-May through September and may also be in place in April to mid-May and in October and November, although the culverts on the Grant Line Canal barrier are tied open. Tidal flow overtops the barriers twice each day during the portion of tide that exceeds 1 foot msl. High tide approaches 3 feet msl, and total tidal volume in the channels upstream of the barriers is reduced by about 50% (Section 5.2, Delta Tidal Hydraulics). The gates constructed under Alternative 2A would operate from May through September. The gates would be open at tide elevations between 0.0 feet msl and about 3 feet msl, an increase in the tidal period currently allowed by the temporary barriers. Total tidal volume would approach 80% of the tidal volume without gates in place. Operable gates would have a beneficial impact on movement of adult and juvenile Chinook salmon because of the potential management flexibility and increased period of access to Middle River, Grant Line Canal, and Old River (i.e., passage conditions are provided at water surface elevations exceeding 0 feet msl under Alternatives 2A–2C versus passage provided at elevations exceeding 1 foot msl under Alternative 1). The increased flexibility of an operable gate is a beneficial impact.

Impact Fish-7: Effects of Head of Old River Gate Operation on Juvenile Chinook Salmon Entrainment. Closure of the head of Old River fish control gate during April–May under Alternative 2A would direct juvenile Chinook salmon down the San Joaquin River during most of the peak out-migration period. Installation of the temporary barrier reduces the number of juvenile Chinook salmon salvaged compared to years when the temporary barrier was not installed (San Joaquin River Group Authority 2003). Although the difference in the estimated survival with and without the gate is not statistically significant, relative survival for juvenile Chinook salmon migrating down the San Joaquin River has been about twice the survival for Chinook salmon migrating down Old River (Brandes and McLain 2001; Baker and Morhardt 2001).

Whether or not the gate alone would substantially minimize entrainment-related losses of juvenile fall-run Chinook salmon from the San Joaquin River, however, is currently not well supported. The gate closure results in additional flow from the San Joaquin River channel into Turner Cut, Middle River, and Old River channels to supply the CVP and SWP pumps. There is currently no clear correlation between SWP and CVP pumping and survival of juvenile Chinook salmon moving through the Delta in the lower San Joaquin River (Baker and Morhardt 2001).

Steelhead

The following assessment identifies potential construction-related impacts of implementing Alternative 2A on Central Valley steelhead. The assessment also identifies the impacts on steelhead as a result of operating the gates. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages.

Impact Fish-8: Construction-Related Loss of Rearing Habitat Area for Steelhead. Steelhead rear primarily in natal reaches upstream of the Delta; therefore, construction activities in the Delta would not affect steelhead rearing. This potential impact is less than significant. No mitigation is required.

Impact Fish-9: Construction-Related Reduction in Food Availability for Steelhead. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for steelhead. Steelhead are not expected to rear for substantial periods in the Delta. Construction activities in the Delta would, therefore, not be expected to affect food resources for steelhead. This potential impact is less than significant. No mitigation is required.

Impact Fish-10: Construction-Related Loss of Steelhead to Accidental Spill of Contaminants. Contaminants associated with construction activities, including gate construction, placement of riprap, dredging, and maintenance dredging, could be introduced into the south Delta channels and could adversely affect steelhead during migration. Environmental commitments, including an erosion and sediment control plan, SWPPP, hazardous materials management plan, spoils disposal plan, and environmental training, will be developed and implemented before and during construction activities (Chapter 2, "Project Description"). The environmental commitments would substantially reduce the likelihood of any considerable contaminant input. Contaminants would have a less-than-significant impact on steelhead moving through the south Delta because the potential for increased contaminant input following implementation of environmental commitments is small. No mitigation is required.

Impact Fish-11: Construction-Related Loss of Steelhead to Direct Injury. Construction of the gates would include placement of sheetpiles and riprap and could directly injure fish present during the time of construction. Dredging could entrain and injure juvenile steelhead. Cofferdams, if used, would be installed to isolate gate construction areas from the channel. Placement of cofferdams in the channels could trap juvenile steelhead. Fish that become trapped inside the cofferdams could be killed during desiccation of the construction area and other construction activities. Direct injury associated with construction and maintenance activities, including dredging, would have a less-than-significant impact on steelhead because the number of fish injured is likely small given that:

- in-water construction, including the construction of a cofferdam, would occur between August and November;
- the area of construction activity is small relative to the channel area providing passage through the south Delta;
- in-water construction and dredging would occur over a relatively short period (i.e., about 3 years); and
- most juvenile and adult steelhead would move away from construction activities and into adjacent habitat of similar quality.

No mitigation is required.

Impact Fish-12: Construction-Related Loss of Steelhead to Predation. Construction of gates and extension of agricultural intakes would add permanent structure and cover to the south Delta channels. The addition of structure has the potential to increase the density of predator species and predation on fish moving around and past the structure. Similar to Chinook salmon, predation associated with the addition of the operable gates and the agricultural intake extensions to the south Delta channels could cause a small and likely negligible (i.e., less-than-significant impact) increase in mortality of the juvenile steelhead moving past the structures. The determination is based on the same factors described for juvenile Chinook salmon (Impact Fish-7). No mitigation is required.

Impact Fish-13: Effects of Head of Old River Gate Operation on Juvenile Steelhead Migration. Closure of the head of Old River fish control gate would minimize the movement of juvenile steelhead into Old River. Although the effects of gate closure are similar for both Alternatives 1 and 2A, an operable gate constructed under Alternative 2A would provide increased opportunities for fish protection in response to new information on fish survival for variable flows and migration pathways. The increased flexibility is a beneficial impact.

The head of Old River fish control gate may also provide benefits to adult steelhead during upstream migration in September through March. The benefits would be similar to those described above for adult Chinook salmon relative to movement in the San Joaquin River past Stockton (Impact Fish-7). An operable gate constructed under Alternative 2A would provide increased opportunities to evaluate the potential effects of increased flow and effects on DO levels under a wide range of San Joaquin River flow conditions. The increased flexibility of an operable gate is a beneficial impact.

Delta Smelt

The following assessment identifies potential construction-related impacts of implementing Alternative 2A on delta smelt. The assessment also identifies the impacts on delta smelt as a result of operating the gates. Delta smelt occur primarily within the Delta and Suisun Bay. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages.

Impact Fish-14: Construction-Related Loss of Spawning Habitat Area for Delta Smelt. Delta smelt spawn in the Delta. As indicated in the methods description, existing information does not indicate that spawning habitat is limiting population abundance and production (U.S. Fish and Wildlife Service 1996).

Shallow areas that may provide spawning habitat for delta smelt could be permanently modified by construction of the gates in the south Delta and subsequent maintenance activities. The area of shallow habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport). The permanent gates constructed under Alternative 2A would have minimal effect on habitat within the construction footprint at the head of Old River, Middle River, and Old River at DMC. Construction of the temporary barriers has previously modified shallow water habitat. These permanent gates would be constructed in the same location as the temporary barriers and would result in little change in habitat quality and quantity relative.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow habitat. The loss of spawning habitat in the Delta has not been explicitly identified as a factor contributing to the decline of delta smelt, and the south Delta channels have not been identified as important spawning habitat (U.S. Fish and Wildlife Service 1996). The relative importance of spawning habitat in the south Delta in contributing to population abundance is likely low. Nonnative species currently dominate the fish community in shallow areas of the south Delta (Feyrer 2001), and many of the species prey on delta smelt and their eggs. In addition, entrainment of larvae in diversions, especially CVP and SWP pumping, would minimize the importance of spawning habitat in the south Delta.

Spawning habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant. The determination is based on:

- the area disturbed by construction of gates on Middle River, Old River at DMC, and the head of Old River would be similar to the existing footprint of the temporary barriers;
- the footprint of the gate on Grant Line Canal would be in a new location, but the absence of the temporary barrier footprint would reestablish a similar area of potential spawning habitat;
- dredging would increase channel depth, but habitat area would remain unchanged and habitat quality would be similar (i.e., shallow water [the resulting bottom elevation is less than 3 m below MLLW]) following the temporary disturbance of substrate; and

- implementation of a dredge monitoring program to confirm minimal effects of dredging on spawning habitat (see Chapter 2, "Project Description").

No mitigation is required.

Impact Fish-15: Construction-Related Loss of Rearing Habitat Area for Delta Smelt. Delta smelt larvae, juveniles, and adults rear in the Delta and Suisun Bay. The importance of rearing habitat in the south Delta, however, appears to be relatively low. Nonnative species currently dominate the fish community in the south Delta (Feyrer 2001), and many of the species prey on delta smelt larvae and juveniles. In addition, entrainment of larvae and juveniles in diversions, especially CVP and SWP pumping, would minimize the importance of rearing habitat in the south Delta.

Rearing habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant. The determination is based on:

- the area disturbed by construction of gates on Middle River, Old River at DMC, and the head of Old River would be similar to the existing footprint of the temporary barriers;
- the footprint of the gate on Grant Line Canal would be in a new location, but the absence of the temporary barrier footprint would reestablish a similar area of rearing habitat;
- dredging would increase channel depth, but habitat area would remain unchanged and habitat quality would be similar (i.e., shallow water; [the resulting bottom elevation is less than 3 m below MLLW]) following the temporary disturbance of substrate; and
- implementation of a dredge monitoring program to confirm minimal effects of dredging on rearing habitat (see Chapter 2, "Project Description").

No mitigation is required.

Impact Fish-16: Construction-Related Reduction in Food Availability for Delta Smelt. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for delta smelt. Construction of the gates in the south Delta and maintenance activities have the potential to permanently modify channel form and remove bottom substrates. Delta smelt, however, feed on zooplankton and effects on benthic invertebrate habitat may not affect food for delta smelt. This potential impact is less than significant for the same reasons discussed for effects on rearing habitat (see Impact Fish-15). No mitigation is required.

Impact Fish-17: Construction-Related Loss of Delta Smelt to Accidental Spill of Contaminants. Contaminants associated with construction activities, including gate construction, placement of riprap, dredging, and maintenance dredging, could be introduced into the south Delta channels and could adversely affect delta smelt and their habitat. Environmental commitments, including an erosion and sediment control plan, SWPPP, hazardous materials management plan, spoils disposal plan, and environmental training, will be developed and implemented before and during construction activities (Chapter 2, "Project Description"). The environmental commitments would substantially reduce the likelihood of any considerable contaminant input. Contaminants would have a less-than-significant impact on delta smelt and their habitat in the south Delta because the potential for increased contaminant input following implementation of environmental commitments is small. No mitigation is required.

Impact Fish-18: Construction-Related Loss of Delta Smelt to Direct Injury. Construction of the gates would include placement of sheetpiles and riprap and could directly injure fish present during the time of construction. Dredging could entrain and injure delta smelt. Cofferdams, if used, would be installed to isolate gate construction areas from the channel. Placement of cofferdams in the channels could trap larval, juvenile, and adult delta smelt. Fish that become trapped inside the cofferdams could be killed during desiccation of the construction area and construction activities. Direct injury associated with construction and maintenance activities, including dredging, would have a less-than-significant impact on delta smelt because the number of fish injured is likely small given that:

- in-water construction, including the construction of a cofferdam, would occur between August and November;
- the area of construction activity is small relative to the channel area providing similar habitat quality in the south Delta; and
- most juvenile and adult delta smelt would move away from construction activities and into adjacent habitat of similar quality.

No mitigation is required.

Impact Fish-19: Construction-Related Loss of Delta Smelt to Predation. Construction of gates and extension of agricultural intakes would add permanent structure and cover to the south Delta channels. As indicated for Chinook salmon (Impact Fish-5), the addition of structure has the potential to increase the density of predator species and predation on fish moving around and past the structure. Concentrations of disoriented fish increase prey availability and create predator habitat.

Predation associated with the addition of the operable gates and the agricultural intake extensions to the south Delta channels could cause a small and likely negligible (i.e., less-than-significant impact) increase in mortality of the delta smelt moving past the structures. The determination is based on several factors. Design elements will minimize turbulence that could disorient fish and increase vulnerability to predation. The structures would not create conditions that could concentrate delta smelt. Flow velocity would be similar to velocities within the channel upstream and downstream of the gates and the agricultural intake extensions.

The transition zones between various elements of the gates (e.g., sheetpiles and riprap) could provide low-velocity holding areas for predatory fish. Predatory fish holding near the gates and agricultural intakes could prey on vulnerable species. The additional predator habitat created by the gates and intake extensions would have a less-than-significant impact on delta smelt because the increase in potential predator habitat is small relative to habitat in adjacent areas, including the habitat currently created by the temporary barriers and habitat at the existing agricultural intakes. Disorientation and concentration of juvenile and adult fish would be minimal given the size and design of the gates. No mitigation is required.

Impact Fish-20: Effects of Gate Operation on Delta Smelt Spawning and Rearing Habitat, and Entrainment. Under constant SWP and CVP pumping, gate closure causes additional net flow to be drawn from the San Joaquin River and south through Old River, Middle River, and Turner Cut (Section 5.2, Delta Tidal Hydraulics). The increased net flow toward the south may increase entrainment of larval and juvenile delta smelt (see the following section on Entrainment). The effects of gate closure are similar for Alternatives 1 and 2A, however the fish control gate constructed under Alternative 2A would be operated for all of April and May.

Flow control gates in Middle River, Grant Line Canal, and Old River at DMC could affect access to spawning and rearing habitat for delta smelt in the south Delta channels. The gates constructed under Alternative 2A would be open at tide elevations between 0.0 feet msl and about 3 feet msl, an increase in the tidal range currently allowed by the temporary barriers. Total tidal volume would approach 80% of the tidal volume that would occur without gates in place. The flow control gates could have a beneficial impact on movement of delta smelt by enhancing access to Middle River, Grant Line Canal, and Old River. Measurable benefits to delta smelt, however, are likely small considering the assumed high probability that larval and juvenile delta smelt spawned in the south Delta would be entrained in diversions (see the following section on Entrainment).

Splittail

The following assessment identifies potential construction-related impacts of implementing Alternative 2A on splittail. The assessment also identifies the impacts on splittail as a result of operating the gates. Adult and juvenile splittail spend most of their lives in the Delta and Suisun Bay. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages.

Impact Fish-21: Construction-Related Loss of Spawning Habitat Area for Splittail. Some splittail spawn within and downstream of the Delta (U.S. Fish and Wildlife Service 1996), where adults deposit eggs on vegetation along the edges of tidal channels. Gate construction and dredging activities in the Delta could affect spawning habitat.

Shallow areas that may provide spawning habitat for splittail could be permanently modified by construction of the gates in the south Delta and subsequent maintenance activities. The area of shallow habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport). The permanent gates constructed under Alternative 2A would have minimal effect on habitat within the construction footprint at the head of Old River, Middle River, and Old River at DMC. Construction of the temporary barriers has previously modified shallow water habitat. These permanent gates would be constructed in the same location as the temporary barriers and would result in little change in habitat quality and quantity relative to existing conditions.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow habitat. Relative to spawning on inundated floodplain (Sommer et al. 1997), spawning habitat along the south Delta channels is likely of minor importance to maintaining population abundance. Nonnative species currently dominate the fish community in shallow areas of the south Delta (Feyrer 2001), and many of the species prey on splittail eggs, larvae, and juveniles.

Spawning habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant for the same reasons discussed for spawning habitat for delta smelt (Impact Fish-14). In addition, the determination is based on the small area of habitat relative to inundated floodplain and upstream areas. No mitigation is required.

Impact Fish-22: Construction-Related Loss of Rearing Habitat Area for Splittail. Splittail rear in the Delta, and construction of the gates in the south Delta and maintenance activities have the potential to permanently modify shallow vegetated areas that may provide rearing habitat. The area of shallow vegetated habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport).

As discussed under spawning habitat area, the permanent gates constructed under Alternative 2A would have minimal effect on habitat within the construction footprint at the head of Old River, Middle River, and Old River at DMC. Construction of the temporary barriers has previously modified shallow water habitat. These permanent gates would be constructed in the same location as the temporary barriers and would result in little change in habitat quality and quantity relative to existing conditions.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow habitat. Although the loss of shallow habitat in the Delta has not been explicitly identified as a factor contributing to the decline of splittail (U.S. Fish and Wildlife Service 1996), splittail are known to rear in the south Delta and use shallow vegetated areas (Feyrer 2001; Grimaldo et al. 2000).

Relative to historical extent, existing availability of shallow areas is limited. Therefore, loss of additional shallow area that may represent rearing habitat for splittail could contribute to the historical loss and to an ongoing adverse impact.

The relative importance of specific areas within the Delta and habitat types to growth and survival of splittail is currently unknown. Areas colonized by nonnative aquatic vegetation (e.g., *Egeria densa)* may not provide habitat for splittail (Grimaldo et al. 2000). Nonnative species currently dominate the fish community in shallow vegetated areas of the south Delta (Feyrer 2001) and many of the species prey on larval and juvenile splittail.

Rearing habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant for the same reasons discussed under spawning habitat (Impact Fish-21). No mitigation is required.

Impact Fish-23: Construction-Related Reduction in Food Availability for Splittail. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for adult, larval, and juvenile splittail. Construction of the gates in the south Delta and maintenance activities have the potential to permanently modify shallow vegetated areas and remove bottom substrates that may produce food for splittail. The area of prey habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport).

The construction footprints of the head of Old River, Middle River, and Old River near DMC gates, would have a minimal effect on prey habitat. Construction of the temporary barriers has previously modified shallow water areas and channel bottom substrates. The permanent gates would be constructed in the same location as the temporary barriers and would result in little change in prey habitat quality and quantity relative to existing conditions.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow vegetated areas and channel bottom substrate. Prey habitat loss associated with gate construction, riprap, maintenance activities, and dredging is determined to be less than significant. The determination is the same as discussed for Chinook salmon (Impact Fish-2). The area affected by gate construction and riprap placement is small relative to availability of similar vegetated areas and bottom substrates in adjacent channel reaches. Also, benthic invertebrates are expected, based on changes in benthic invertebrate abundance observed in response to changes in salinity (Markham 1986; Vayssieres and Peterson 2003), to recolonize bottom substrates disturbed by dredging relatively quickly. Construction would have a minimal effect on prey availability, especially over the long term. This impact is less than significant. No mitigation is required.

Impact Fish-24: Construction-Related Loss of Splittail to Accidental Spill of Contaminants. Potential contaminant impacts on splittail attributable to construction activities in the south Delta, including gate construction, placement of riprap, dredging, and maintenance dredging, are the same as described previously for Chinook salmon (Impact Fish-3). The impact on splttial is considered less than significant because environmental commitments would substantially reduce the likelihood of any considerable contaminant input. No mitigation is required.

Impact Fish-25: Construction-Related Loss of Splittail to Direct Injury. The potential for direct injury impacts attributable to construction activities in the south Delta is less than significant, the same as described previously for Chinook salmon (Impact Fish-4). The number of fish injured during construction is likely small given that:

- in-water construction, including the construction of a cofferdam, would occur between August and November;
- the area of construction activity is small relative to the channel area providing similar habitat quality in the south Delta;
- in-water construction and dredging would occur over a relatively short period (i.e., about 3 years); and
- most juvenile and adult splittail would move away from construction activities and into adjacent habitat of similar quality.

No mitigation is required.

Impact Fish-26: Construction-Related Loss of Splittail to Predation. Predation impacts attributable to construction activities in the south Delta are less than significant, the same as described previously for Chinook salmon (Impact "Fish-5"). Increased predation could be associated with the addition of the operable gates and the agricultural intake extensions to the south Delta channels. Design elements, however, will minimize turbulence that could disorient fish and increase vulnerability to predation. The structures would not create conditions that could concentrate splittail. The increase in potential predator habitat is small relative to habitat in adjacent areas, including the habitat currently created by the temporary barriers and habitat at the existing agricultural diversion intakes. Disorientation and concentration of juvenile fish would be minimal given the size and design of the gates. This impact is less than significant. No mitigation is required.

Impact Fish-27: Effects of Gate Operation on Splittail Migration. Under the No Action Alternative, the head of Old River temporary barrier is in place from April 14 through June 1. Under Alternative 2A, the head of Old River fish control gate could be closed from April 1 to May 31. During high flow years when splittail spawn in the San Joaquin River, gate closure would minimize the movement of juvenile splittail into Old River. Although the effects of gate closure on splittail are unknown, the operable gates constructed under Alternative 2A would provide increased opportunities for fish protection in response to new information on splittail survival for variable flows and migration pathways. The increased flexibility in operation provided by the gates is a beneficial impact.

Gates in Middle River, Grant Line Canal, and Old River near Byron could affect access to rearing habitat in the south Delta channels and passage through the channels by juvenile splittail during operation from April through September. Operable gates could have a beneficial impact on movement of adult and juvenile splittail because of increased circulation and the potential management flexibility to provide access to Middle River, Grant Line Canal, and Old River.

Striped Bass

The following assessment identifies potential construction-related impacts of implementing Alternative 2A on striped bass. The assessment also identifies the impacts on striped bass as a result of operating the gates. Striped bass occur within the Delta, Suisun Bay, San Francisco Bay, and in the coastal waters near San Francisco Bay. Adult striped bass migrate upstream in the Sacramento River to spawn. Some juvenile and adult striped bass occur in rivers upstream of the Delta throughout the year. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages.

Impact Fish-28: Construction-Related Loss of Spawning Habitat Area for Striped Bass. Striped bass spawning in the Delta usually occurs within the San Joaquin River channel between Antioch and upstream to Venice Island (California Department of Fish and Game 1987). This spawning habitat area would not be affected by construction activities in the south Delta. This impact is less than significant. No mitigation is required.

Impact Fish-29: Construction-Related Loss of Rearing Habitat Area for Striped Bass. Striped bass larvae, juveniles, and adults rear in the Delta and Suisun Bay. Construction of the gates in the south Delta and maintenance activities have the potential to permanently modify channel areas that may provide rearing habitat for striped bass. The area of habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport).

The construction footprint of the head of Old River, Middle River, and Old River near DMC gates would have a mimimal effect on striped bass rearing habitat. Construction of the temporary barriers has previously modified channel habitat. The permanent gates would be constructed in the same location as the temporary barriers and would result in little change in habitat quality and quantity relative to existing conditions.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing channel habitat. Rearing habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant.

The determination is the same as discussed for delta smelt rearing habitat (Impact Fish-15). No mitigation is required.

Impact Fish-30: Construction-Related Reduction in Food Availability for Striped Bass. The construction-related effects on the availability of food for striped bass would be the same as described for delta smelt (Impact Fish-16). This impact is considered less than significant and no mitigation is required.

Impact Fish-31: Construction-Related Loss of Striped Bass to Accidental Spill of Contaminants. The construction-related effects on striped bass as a result of accidental spill of contaminants would be the same a described for delta smelt (Impact Fish-17). The impact on striped bass is considered less than significant and no mitigation is required.

Impact Fish-32: Construction-Related Loss of Striped Bass to Direct Injury. Construction of the gates would include placement of sheetpiles and riprap and could directly injure fish present during the time of construction. Dredging could entrain and injure striped bass. Cofferdams, if used, would be installed to isolate gate construction areas from the channel. Placement of cofferdams in the channels could trap larval, juvenile, and adult striped bass. Fish that become trapped inside the cofferdams could be killed during desiccation of the construction area and construction activities. Direct injury associated with construction and maintenance activities, including dredging, would have a less-than-significant impact on striped bass because the number of fish injured is likely small given that:

- in-water construction, including the construction of a cofferdam, would occur between August and November;
- the area of construction activity is small relative to the channel area providing similar habitat quality throughout the Delta; and
- most juvenile and adult striped bass would move away from construction activities and into adjacent habitat of similar quality.

No mitigation is required.

Impact Fish-33: Construction-Related Loss of Striped Bass to Predation. Construction of gates and extension of agricultural intakes would add permanent structure and cover to the south Delta channels. As indicated for Chinook salmon (Impact Fish-5), the addition of structure has the potential to increase the density of predator species and predation on fish moving around and past the structure. Concentrations of disoriented fish increase prey availability and create predator habitat.

Predation associated with the addition of the gates and the agricultural intake extensions to the south Delta channels could cause a small and likely negligible (i.e., less-than-significant impact) increase in mortality of the larval and juvenile striped bass moving past the structures. The determination is based on several factors. Design elements will minimize turbulence that could disorient fish and increase vulnerability to predation. The structures would not create conditions that could concentrate striped bass. Flow velocity would be similar to velocities within the channel upstream and downstream of the gates and agricultural intake extensions.

The transition zones between various elements of the gates (e.g., sheetpiles and riprap) could provide low-velocity holding areas for predatory fish, including juvenile and adult striped bass. Predatory fish holding near the gates and agricultural intakes could prey on larvae and smaller juvenile striped bass. The additional predator habitat created by the gates and intake extensions would have a less-than-significant impact on striped bass because the increase in potential predator habitat is small relative to habitat in adjacent areas, including the habitat currently provided by the temporary barriers and habitat at the existing agricultural intakes. Disorientation and concentration of juvenile and adult fish would be minimal given the size and design of the gates. This impact is less than significant. No mitigation is required.

Impact Fish-34: Effects of Gate Operation on Striped Bass Migration. As discussed for delta smelt, the effects of gate closure are similar for Alternatives 1 and 2A. The operable gate constructed under Alternative 2A, however, would provide increased opportunities for fish protection in response to new information on fish survival for variable flows and migration pathways. The increased flexibility is a beneficial impact. Gates in Middle River, Grant Line Canal, and Old River would have the same effect on striped bass as described for delta smelt. Operation of the permanent flow control gates on Middle River, Grant Line Canal, and Old River under Alternative 2A could have a beneficial effect relative to the existing temporary barriers (i.e., Alternative 1).

Green Sturgeon

The following assessment identifies potential construction-related impacts of implementing Alternative 2A on green sturgeon. Green sturgeon occur within the Delta, Suisun Bay, San Francisco Bay, and in the coastal waters near San Francisco Bay. Adult green sturgeon migrate upstream in the Sacramento River to spawn. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages.

Impact Fish-35: Construction-Related Loss of Spawning Habitat Area for Green Sturgeon. Green sturgeon spawning usually occurs in the upper reach of the Sacramento River (Moyle 2002). Spawning habitat area would not be affected by construction activities in the south Delta. This impact is less than significant. No mitigation is required.

Impact Fish-36: Construction-Related Loss of Rearing Habitat Area for Green Sturgeon. Green sturgeon juveniles may rear in the Delta and Suisun Bay, but there is no data indicating which areas are used by juvenile green sturgeon. The area of habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, "Project Description," and Section 5.6, Sediment Transport).

The permanent gates constructed under Alternative 2A would have minimal effect on habitat within the construction footprint at the head of Old River, Middle River, and Old River near Byron. Construction of the temporary barriers has previously modified channel habitat. The permanent gates would be constructed in the same location as the temporary barriers and would result in little change in habitat quality and quantity relative to existing conditions.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing channel habitat. Rearing habitat loss associated with gate construction, maintenance activities, and dredging is determined to be less than significant. The determination is based on:

- the area disturbed by construction of gates on Middle River, Old River at DMC, and the head of Old River would be similar to the existing footprint of the temporary barriers;
- the footprint of the gate on Grant Line Canal would be in a new location, but the absence of the temporary barrier footprint would reestablish a similar area of rearing habitat;
- dredging would increase channel depth, but habitat area would remain unchanged and habitat quality would be similar (i.e., shallow water; [the resulting bottom elevation is less than 3 m below MLLW]) following the temporary disturbance of substrate; and
- implementation of a dredge monitoring program to confirm minimal effects of dredging on rearing habitat (see Chapter 2, “Project Description”).

No mitigation is required.

Impact Fish-37: Construction-Related Reduction in Food Availability for Green Sturgeon. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for adult and juvenile green sturgeon. Construction of the gates in the south Delta and maintenance activities have the potential to permanently modify shallow vegetated areas and remove bottom substrates that may produce food for green sturgeon. The area of prey habitat affected by the gate footprints, riprapped levee, and dredging may total several acres (Table 6.1-12; Chapter 2, “Project Description,” and Section 5.6, Sediment Transport).

The permanent gates constructed under Alternative 2A would have minimal effect on prey habitat within the construction footprint at the head of Old River, Middle River, and Old River near Byron. Construction of the temporary barriers has previously modified shallow water areas and channel bottom substrates. The permanent gates would be constructed in the same location as the temporary barriers and would result in little change in prey habitat quality and quantity relative to existing conditions.

Construction of a new gate on Grant Line Canal and the proposed dredging in West Canal, Middle River, and Old River potentially would remove and modify existing shallow vegetated areas and channel bottom substrate.

The area affected by gate construction and riprap placement is small relative to availability of similar vegetated areas and bottom substrates in adjacent channel reaches. Also, benthic invertebrates are expected, based on changes in benthic invertebrate abundance observed in response to changes in salinity (Markham 1986; Vayssieres and Peterson 2003) and dredging (Wilson 1998), to recolonize bottom substrates disturbed by dredging relatively quickly. Construction would have a minimal effect on prey availability, especially over the long term. Prey habitat loss associated with gate construction, riprap, maintenance activities, and dredging is determined to be less than significant. No mitigation is required.

Impact Fish-38: Construction-Related Loss of Green Sturgeon to Accidental Spill of Contaminants. Contaminants associated with construction activities, including gate construction, placement of riprap, dredging, and maintenance dredging, could be introduced into the south Delta channels and could adversely affect adult green sturgeon during migration and juveniles rearing in the Delta. Environmental commitments, including an erosion and sediment control plan, SWPPP, hazardous materials management plan, spoils disposal plan, and environmental training, will be developed and implemented before and during construction activities (Chapter 2, "Project Description"). The environmental commitments would substantially reduce the likelihood of any considerable contaminant input. Contaminants would have a less-than-significant impact on green sturgeon moving through, and rearing in, the south Delta because the potential for increased contaminant input following implementation of environmental commitments is small. No mitigation is required.

Impact Fish-39: Construction-Related Loss of Green Sturgeon to Direct Injury. Construction of the gates would include placement of sheetpiles and riprap and could directly injure fish present during the time of construction. Dredging could entrain and injure green sturgeon. Cofferdams, if used, would be installed to isolate gate construction areas from the channel. Placement of cofferdams in the channels could trapjuvenile and adult green sturgeon. Fish that become trapped inside the cofferdams could be killed during desiccation of the construction area and construction activities. Direct injury associated with construction and maintenance activities, including dredging, would have a less-than-significant impact on green sturgeon. This determination is based on the fact that:

- the area of construction activity is small relative to the channel area providing similar habitat quality in the south Delta;
- in-water construction and dredging would occur over a relatively short period (i.e., about 3 years) and be limited to the August to November timeframe; and
- most juvenile and adult green sturgeon would move away from construction activities and into adjacent habitat of similar quality.

No mitigation is required.

Impact Fish-40: Construction-Related Loss of Green Sturgeon to Predation. Increased predation could be associated with the addition of the operable gates and the agricultural intake extensions to the south Delta channels. Design elements, however, will minimize turbulence that could disorient fish and increase vulnerability to predation. The structures would not create conditions that could concentrate green sturgeon. The increase in potential predator habitat is small relative to habitat in adjacent areas, including the habitat currently created by the temporary barriers and habitat at the existing agricultural diversion intakes. Disorientation and concentration of juvenile fish would be minimal given the size and design of the gates. This impact is less than significant. No mitigation is required.

Impact Fish-41: Effects of Gate Operation on Green Sturgeon Migration. The head of Old River fish control gate could be closed from April 14 to June 1 under both Alternatives 1 and 2A. Under Alternative 1, a temporary fixed barrier is constructed each year. Under Alternative 2A, an operable gate would be constructed with bottom-hinged gates that would allow a range of operations. Currently, there is no available data about the migratory paths of adult or juvenile green sturgeon. If green sturgeon migrate through the South Delta, the gate closure could minimize the movement of green sturgeon into the Sacramento River and out to the Pacific ocean. The effects of gate closure on sturgeon that may use the South Delta as a migratory path are unknown. However, closure of the Old River fish control gate would not preclude juvenile and adult sturgeon movement between the San Joaquin River upstream of Old River and the Sacramento River or Pacific Ocean. Closure of the head of Old River fish control gate increases the San Joaquin River flow past Stockton and green sturgeon that may migrate through the South Delta would presumably use the route past Stockton to migrate into the Saramento River and out to the Pacific Ocean. This impact is less than significant. No mitigation is required. Other gate operations would have the same effect on sturgeon.

2020 Conditions

The impacts associated with Stage 1 of Alternative 2A under 2020 conditions would be the same as those described above under 2001 conditions (see Alternative 2A under 2001 conditions above). Permanent gates constructed and operated at the head of Old River and in Middle River, Grant Line Canal, and Old River would potentially affect environmental conditions in the south Delta and are expected to be the same as those described for 2001. Fish, surface water, hydrology, and water quality impacts associated with construction under 2020 conditions would be the same as described above for Alternative 2A under 2001 conditions. Impacts from construction of the physical/structural component of Alternative 2A under 2020 conditions would be the same as those under 2001 conditions. Therefore, construction-related impacts on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are identical to the physical/structural impacts described for Alternative 2A under 2001 conditions (Impact Fish-1 through Impact Fish-41).

Stage 2 (Operational Component)

Relative to existing conditions, water supply operations with implementation of SDIP Alternative 2A would increase Delta pumping, changing CVP and SWP diversions and operation of CVP and SWP reservoirs (Section 5.1, Water Supply). Maximum CCF and SWP Banks diversion and pumping in any month would not exceed 8,500 cfs on an average monthly basis (Chapter 2, “Project Description”). Changes in flow and diversions may affect fish and fish habitat in reaches of the Trinity, Sacramento, Feather, American, and San Joaquin Rivers and in the Delta and Suisun Bay. Simulated flow, SWP and CVP pumping, and water temperature conditions are evaluated. Environmental conditions potentially affected with implementation of the SDIP under Alternative 2A are summarized in Table 6.1-12.

Water temperature conditions in the south Delta appear to be unaffected by changes in SWP and CVP pumping and gate operation. For all months of the year, measured water temperature at Mossdale during 2000 and 2001 is similar to the measured water temperature in Old River, Middle River, and the San Joaquin River near Stockton (Section 5.3, Water Quality; Figure 5.3-1). Water temperature conditions are determined by weather conditions; therefore, temperature effects on fish species in the Delta are not discussed further.

Alternative 2A would result in little to no change in reservoir storage patterns (see Section 5.1, Water Supply). Effects of reservoir storage on fish habitat (i.e., shallow water area) in Trinity, Shasta, Oroville, San Luis, and Folsom Reservoirs would be similar to existing water supply operations criteria.

The simulated flow volume for 1922–1994 for the San Joaquin River and its tributaries under Alternative 2A is similar to the simulated flow under Alternative 1 (Figure 6.1-4). Therefore, effects of flow and water temperature conditions on fish and fish habitat in the San Joaquin River are not considered further. Similarly, flow in the Trinity River under Alternative 2A is nearly the same as flow under Alternative 1, with increased flow in a few months (Figure 6.1-4). Although changes in flow conditions on fish habitat are not considered further, changes in water temperature could occur and are assessed in detail (see discussion of water temperature that follows).

Flows under Alternative 2A for the Sacramento, Feather, and American Rivers frequently vary from monthly flows under Alternative 1 (Figure 6.1-5). A consistent pattern of higher or lower flows, however, is not apparent. Specific effects on spawning and rearing habitat for Chinook salmon, steelhead, and splittail are discussed in following sections.

Changes in Delta inflow from the Sacramento River reflect the cumulative effects of flow changes upstream on the Sacramento, Feather, and American Rivers (Figure 6.1-6). Changes in Sacramento River inflow potentially affect the proportion of flow drawn into the DCC and Georgiana Slough, although the effects appear to be relatively small (Figure 6.1-7). Changes in Delta outflow are similarly small relative to the outflow volume under Alternative 1, although slightly lower outflow results in some months (Figure 6.1-6).

Delta outflow affects the downstream extent of fresh water and the estuarine salinity distribution. The parameter X2 (the distance in kilometers of the 2-ppt isohaline from the Golden Gate Bridge) is an indicator of potential effects of Delta outflow changes on salinity distribution in Suisun Bay and the western Delta. Comparison of X2 for Alternative 1 and Alternative 2A indicates that for most months salinity distribution is similar (Figure 6.1-8). However, an upstream shift is relatively frequent during September, October, and November.

Monthly SWP and CVP pumping for Alternative 2A varies from pumping that was simulated for Alternative 1 (Figure 6.1-9). On average, CVP pumping is similar for Alternatives 1 and 2A, but SWP pumping, averaged over the 73-year simulation, increases for every month. Although changes in exports are generally small, SWP pumping increases by at least 10% of the baseline pumping in every month during at least 10% of the simulated years (1922–1994).

Chinook Salmon

The following assessment identifies potential operations-related impacts of implementing Alternative 2A on winter-, spring-, and fall-/late fall–run Chinook salmon in Central Valley rivers and the Delta. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages for each run. Environmental correlates addressed for Chinook salmon include spawning habitat quantity, rearing habitat quantity, migration habitat condition, water temperature, food, and entrainment in diversions.

Impact Fish-42: Operations-Related Loss of Spawning Habitat Area for Chinook Salmon. Fall-/late fall–run Chinook salmon spawn in the cool reaches of the Sacramento, Feather, and American Rivers downstream of Shasta, Oroville, and Folsom Reservoirs. Changes in water supply operations potentially affect spawning habitat area for Chinook salmon in the Sacramento, Feather, and American Rivers. The spawning and egg incubation period for fall-/late fall–run Chinook salmon extends from October through May in the Sacramento River and October through February in the Feather and American Rivers. Winter-run Chinook salmon spawn in the Sacramento River, generally above RBDD, and spring-run Chinook salmon spawn in the cool reaches of the Sacramento and Feather Rivers. The spawning and egg incubation period for winter-run Chinook salmon extends from April through September. The spawning and egg incubation period for spring-run Chinook salmon extends from August through December.

Flows simulated for Alternative 1 provide near the maximum spawning habitat area during the months of spawning for winter-, spring-, fall-, and late fall–run Chinook salmon in the Sacramento River (Table 6.1-8). Change in Sacramento River flow attributable to water supply operations under Alternative 2A would not affect spawning habitat area for any run (Table 6.1-13). Similarly, change in

Feather River flow attributable to water supply operations under Alternative 2A would not affect spawning habitat area for spring- and fall-run Chinook salmon. In the American River, spawning habitat area for fall-run Chinook salmon is not affected during most months (Table 6.1-13), and varies between less and more abundant in a few months. The reduction in area is generally less than 10% and does not affect spawning for all months in any year. Given the few spawning months affected and the relatively small change in spawning habitat area, the effect on adult spawning success and survival of fall-run Chinook salmon eggs and larvae through incubation in the American River would be less than significant. No mitigation is required.

Impact Fish-43: Operations-Related Loss of Rearing Habitat Area for Chinook Salmon. Changes in water supply operations potentially affect rearing habitat area for Chinook salmon in the Sacramento, Feather, and American Rivers. Fall-run Chinook salmon rear in the Sacramento, Feather, and American Rivers from January through May. Winter-run Chinook salmon rear in the Sacramento River upstream and downstream of RBDD, and spring-run Chinook salmon rear in the cool reaches of the Sacramento and Feather Rivers. The rearing period for winter-run Chinook salmon can extend from July through April. The rearing period for spring-run Chinook salmon extends through all months of the year, although most rearing occurs from November through May. Some late fall–run Chinook salmon rear in the Sacramento River from March through November, with most rearing from April through November.

The flow simulated for 1922–1994 in the Sacramento, Feather, and American Rivers for Alternative 2A varies relative to flow under Alternative 1 (Figure 6.1-5). The reduction in flow in some months and increases for other months and years have minimal effect on the range of flows that could affect rearing habitat area (Table 6.1-14). The impact on Chinook salmon of any run would be less than significant.

Inundated floodplain in the Yolo and Sutter Bypasses provides important rearing habitat for juvenile Chinook salmon (Sommer and Harrell et al. 2001). Changes in water supply operations affect reservoir storage and may affect the frequency of floodplain inundation. Inundation of the Yolo Bypass has occurred in approximately 60% of the historical water years (Sommer and Harrell et al. 2001), and inundation of the Sutter Bypass occurs in at least 80%. Monthly average flows provide an indicator of inundation, although weekly and shorter storm events that inundate floodplain are not captured by the monthly average. The frequency of floodplain inundation in the Yolo and Sutter Bypasses was estimated under Alternative 1 for the 1922–1994 water years (Figure 6.1-10). Most flooding occurs from December though April, coinciding with downstream movement and rearing by juvenile Chinook salmon in all runs (Table 6.1-2). Changes in water supply operations under Alternative 2A could reduce flooding in November of one year for the Sutter Bypass and in December of two years for the Yolo Bypass. The reduced bypass flooding in November and December would have a less-than-significant impact on the expected growth and survival of juvenile Chinook salmon for any run. No mitigation is required. The determination is based on several factors. Few months are affected, with

Table 6.1-13. Frequency of Change (Relative to Alternative 1) in Monthly Spawning Habitat Availability for Steelhead and Chinook Salmon in the Feather, Sacramento, and American Rivers for Alternative 2A, 1922–1994 Simulation (2001 Operations)

	Sacramento River					Feather River			American River	
Change in Percentage Area	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	0	0	0	0	0	0	0	0	0	0
<+90%	0	0	0	0	0	0	0	0	0	0
<+80%	0	0	0	0	0	0	0	0	0	0
<+70%	0	0	0	0	0	0	0	0	0	0
<+60%	0	0	0	0	0	0	0	0	0	0
<+50%	0	0	0	0	0	0	0	0	0	0
<+40%	0	0	0	0	0	0	0	0	2	1
<+30%	0	0	0	0	0	0	0	0	2	0
<+20%	0	0	0	0	0	0	0	0	4	3
<+10%	0	0	0	0	0	0	0	0	6	5
0%	219	219	292	219	365	219	219	365	183	342
>-10%	0	0	0	0	0	0	0	0	17	10
>-20%	0	0	0	0	0	0	0	0	1	3
>-30%	0	0	0	0	0	0	0	0	1	1
>-40%	0	0	0	0	0	0	0	0	3	0
>-50%	0	0	0	0	0	0	0	0	0	0
>-60%	0	0	0	0	0	0	0	0	0	0
>-70%	0	0	0	0	0	0	0	0	0	0
>-80%	0	0	0	0	0	0	0	0	0	0
>-90%	0	0	0	0	0	0	0	0	0	0
>=-100%	0	0	0	0	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-14. Frequency of Occurrence of the Percentage Change in Monthly Flow from Alternative 1 that Could Affect Rearing Habitat Area for Steelhead and Chinook Salmon in the Sacramento, Feather, and American Rivers for Alternative 2A, 1922–1994 Simulation

	Sacramento River					Feather River			American River	
Percentage Change in Flow	Fall-Run Chinook Salmon	Late Fall–Run Chinook Salmon	Winter-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Spring-Run Chinook Salmon	Steelhead	Fall-Run Chinook Salmon	Steelhead
<+100%	0	0	0	0	0	0	0	0	0	2
<+90%	0	0	0	0	0	0	0	1	0	0
<+80%	0	0	0	0	0	0	1	3	0	0
<+70%	0	0	0	0	0	0	0	0	1	3
<+60%	0	0	0	0	0	0	0	2	0	1
<+50%	1	1	2	1	2	0	0	2	0	2
<+40%	0	1	1	1	1	1	1	4	3	5
<+30%	2	0	3	3	3	0	0	2	2	4
<+20%	3	3	6	5	6	1	2	2	2	11
<+10%	0	0	0	0	0	0	0	0	0	0
0%	429	572	702	486	848	430	499	830	417	802
>-10%	0	0	0	0	0	0	0	0	0	0
>-20%	2	2	8	7	8	0	2	7	7	22
>-30%	0	5	6	6	6	3	3	5	1	8
>-40%	1	0	2	2	2	0	0	1	1	6
>-50%	0	0	0	0	0	0	0	1	1	1
>-60%	0	0	0	0	0	2	2	4	1	3
>-70%	0	0	0	0	0	0	0	0	0	4
>-80%	0	0	0	0	0	0	0	0	0	0
>-90%	0	0	0	0	0	0	0	1	0	0
>=-100%	0	0	0	0	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

inundation predicted in 143 months for the Sutter Bypass and 100 months for the Yolo Bypass (1922–1994 simulation). The affected months are early in the period of downstream migration of juvenile Chinook salmon. In addition, the probability of flooding in months subsequent to the 3 affected months, and the subsequent availability of floodplain rearing habitat, is higher for January, February, and March. Therefore, access to floodplain habitat may be delayed but habitat would likely be available in a subsequent month.

Impact Fish-44: Operations-Related Decline in Migration Habitat Conditions for Chinook Salmon. The Sacramento, Feather, and American Rivers provide a migration pathway between freshwater and estuarine habitats for Chinook salmon. Flows that occur in Central Valley rivers support migration of adult and juvenile Chinook salmon and steelhead. Relative to Alternative 1, the change in flows under Alternative 2A would not be expected to affect migration of adult and juvenile Chinook salmon in Central Valley rivers (Figures 6.1-4 and 6.1-5). Flows under Alternative 2A are within the range of flows that are simulated under Alternative 1.

In the Delta, juvenile Chinook salmon survival is lower for fish migrating through the central Delta than for fish continuing down the Sacramento River channel (Brandes and McLain 2001; Newman and Rice 1997). Juvenile spring-, winter-, and late fall–run Chinook salmon begin entering the Delta from upstream habitat in the Sacramento River and its tributaries during late October and November. Downstream movement and migration continue through April or May, joined by fall-run juveniles from February through June. Few juvenile Chinook salmon move through the Delta from July through September.

Juvenile Chinook salmon are assumed to move along Delta channel pathways in proportion to flow; therefore, an increase in the proportion of flow diverted off the Sacramento River through the DCC and Georgiana Slough would be expected to increase mortality of migrating juvenile Chinook salmon. The proportion of Sacramento River flow diverted into the DCC and Georgiana Slough under Alternative 2A is generally the same as the proportion diverted under Alternative 1 (Figure 6.1-7), especially during the primary period of juvenile Chinook salmon migration from November through May (Table 6.1-2). For the primary migration period, the change in flow is usually less than 1% (Figure 6.1-7). The frequency of change in the proportion of flow diverted under Alternative 2A is higher from June through October, but most of the time the change is small (less than 2%) relative to the proportion under Alternative 1. Operations under Alternative 2A would have a less-than-significant impact on survival of juvenile Chinook salmon migrating from the Sacramento River because the proportion of flow diverted off the Sacramento River at the DCC and Georgiana Slough is similar to the proportion of flow diverted under Alternative 1.

For the San Joaquin River, the flow split at the head of Old River determines the pathway of juvenile fall-run Chinook salmon through the south Delta. Available data indicate that survival of fish continuing down the San Joaquin River past Stockton is higher than survival of fish that move into Old River (San Joaquin

River Group Authority 2003; Brandes and McLain 2001). The relationships, however, have not proved to be statistically different over multiple years and variable hydrologic conditions. Flow in the San Joaquin River is the same under Alternatives 1 and 2A (Figure 6.1-4) and would not affect the proportion of flow drawn into Old River.

SWP and CVP pumping, also a factor in the proportion of flow diverted off the San Joaquin River at the head of Old River, would increase under Alternative 2A Figure 6.1-9 shows the monthly range of combined CVP and SWP pumping for the 2001 baseline (Alternative 1) and operations scenario A (Alternative 2A), as well as the average monthly change in combined pumping. The range of pumping simulated by the CALSIM model is shown as the minimum, maximum, and 10^{th} percentile values from the 73-year simulation of 1922–1994. The average pumping is also shown for each month.

An increase in CVP and SWP pumping of approximately 2,000 cfs could increase the proportion of flow drawn into Old River by about 10% (Section 5.2, Delta Tidal Hydraulics). During the primary period of juvenile fall-run movement in April and May, the maximum monthly increase in simulated export was less than 500 cfs and would result in less than 2.5% change in the proportion of San Joaquin River flow drawn into Old River. Flow and pumping changes under Alternative 2A would have minimal effect on movement and survival of juvenile Chinook salmon.

Impact Fish-45: Operations-Related Reduction in Survival of Chinook Salmon in Response to Changes in Water Temperature.

Change in reservoir storage and river flow potentially affects water temperature in the Sacramento, Feather, and American Rivers. Water temperature in river reaches immediately downstream of the primary reservoirs, including Shasta, Oroville, and Folsom, are the most sensitive to effects of operations. These reaches support Chinook salmon life stages that can be adversely affected by temperature conditions in Central Valley rivers.

Water temperatures in the Sacramento, Feather, and American Rivers are similar under Alternative 1 and Alternative 2A (Figures 6.1-11 and 6.1-12). The change in monthly water temperatures attributable to Alternative 2A is almost always less than 1°F (0.56°C), although larger changes occur in some simulated months. The magnitude and frequency of changes are too small and too infrequent to attribute to any specific SDIP action. The potential effect of water temperature on steelhead and Chinook salmon life stages warrants further consideration of the range of water temperatures affecting survival. Survival indices were assigned to the water temperatures for each month of occurrence of each life stage for Chinook salmon (winter-, spring-, and fall-/late fall–run) in the Sacramento, Feather, and American Rivers.

For all life stages of all runs in the Sacramento River near Keswick, the water temperature survival indices are near optimal in most months under Alternative 1 (Table 6.1-15). The indices are similarly high at Bend Bridge and RBDD (Tables 6.1-16 and 6.1-17), although less than optimal indices are more frequent

Table 6.1-15. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Keswick for Alternative 1, 1922–1993 Simulation (2001 Operations)

Base Index	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	410	410	432	216	554	554	864	648	576	411	720	504	491	322	864	576	485	498	864	432
0.9	9	9	0	0	9	9	0	0	0	1	0	0	2	8	0	0	8	5	0	0
0.8	2	3	0	0	2	3	0	0	0	3	0	0	0	5	0	0	3	0	0	0
0.7	3	0	0	0	3	0	0	0	0	1	0	0	3	0	0	0	2	1	0	0
0.6	5	1	0	0	5	1	0	0	0	3	0	0	5	3	0	0	5	0	0	0
0.5	3	1	0	0	3	1	0	0	0	0	0	0	3	1	0	0	1	0	0	0
0.4	0	2	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0
0.3	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
0.0	0	4	0	0	0	4	0	0	0	13	0	0	0	17	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-16. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Bend Bridge for Alternative 1, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	401	409	432	216	545	535	859	648	576	304	715	504	482	277	859	576	480	380	858	432
0.9	15	10	0	0	15	26	5	0	0	86	5	0	7	42	5	0	11	93	6	0
0.8	3	1	0	0	3	1	0	0	0	14	0	0	2	9	0	0	5	18	0	0
0.7	2	3	0	0	2	5	0	0	0	6	0	0	2	5	0	0	1	8	0	0
0.6	5	0	0	0	5	0	0	0	0	0	0	0	5	0	0	0	4	2	0	0
0.5	0	2	0	0	0	2	0	0	0	0	0	0	0	2	0	0	1	0	0	0
0.4	3	1	0	0	3	1	0	0	0	1	0	0	3	1	0	0	2	1	0	0
0.3	2	1	0	0	2	1	0	0	0	0	0	0	2	1	0	0	0	1	0	0
0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0.1	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
0.0	0	5	0	0	0	5	0	0	0	21	0	0	0	23	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-17. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Red Bluff for Alternative 1, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	397	406	432	216	541	497	858	648	573	153	714	504	475	225	858	576	473	331	858	432
0.9	14	13	0	0	14	59	5	0	3	169	5	0	9	66	5	0	16	70	6	0
0.8	7	1	0	0	7	6	1	0	0	49	1	0	6	20	1	0	6	40	0	0
0.7	2	1	0	0	2	1	0	0	0	20	0	0	2	12	0	0	2	33	0	0
0.6	4	2	0	0	4	2	0	0	0	12	0	0	4	8	0	0	3	8	0	0
0.5	2	2	0	0	2	4	0	0	0	4	0	0	2	3	0	0	2	9	0	0
0.4	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0
0.3	2	2	0	0	2	2	0	0	0	3	0	0	2	3	0	0	2	4	0	0
0.2	2	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0
0.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
0.0	1	5	0	0	1	5	0	0	0	22	0	0	1	23	0	0	0	4	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-18. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Keswick for Alternative 2A, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration
<+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.1	5	6	0	0	5	6	0	0	0	3	0	0	4	7	0	0	6	3	0	0
0.0	418	409	432	216	562	553	862	648	576	417	718	504	497	328	862	576	482	500	863	432
>-0.1	9	15	0	0	9	15	2	0	0	10	2	0	3	21	2	0	16	1	1	0
>-0.2	0	1	0	0	0	1	0	0	0	2	0	0	0	3	0	0	0	0	0	0
>-0.30	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-19. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Bend Bridge for Alternative 2A, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning /Incubation	Juvenile Rearing	Smolt Migration
<+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.1	10	6	0	0	10	8	1	0	1	40	1	0	9	27	1	0	1	8	1	0
0.0	402	415	432	216	546	555	861	648	572	369	717	504	485	307	861	576	487	487	860	432
>-0.1	19	10	0	0	19	12	2	0	3	22	2	0	9	24	2	0	16	9	3	0
>-0.2	1	0	0	0	1	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0
>-0.30	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-20. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Sacramento River at Red Bluff for Alternative 2A, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Fall-/Late Fall–Run Chinook Salmon				Winter-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<+0.2	0	0	0	0	0	0	0	0	0	5	0	0	0	3	0	0	0	3	0	0
<+0.1	8	6	0	0	8	7	1	0	2	72	1	0	7	35	1	0	1	12	1	0
0.0	405	413	432	216	549	549	859	647	571	311	715	503	487	280	859	575	492	473	859	432
>-0.1	18	12	0	0	18	19	4	1	3	41	4	1	9	38	4	1	11	15	4	0
>-0.2	1	0	0	0	1	0	0	0	0	2	0	0	1	2	0	0	0	1	0	0
>-0.30	0	1	0	0	0	1	0	0	0	1	0	0	0	2	0	0	0	0	0	0
>-0.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

for spawning and incubation at RBDD, especially for spring- and winter-run Chinook salmon. The occurrence of lower indices reflects warming of water temperatures downstream from Keswick Dam and Bend Bridge.

The few months of change in survival indices at Keswick Dam under Alternative 2A illustrate the similarity to indices under Alternative 1 (Table 6.1-18). Water temperature conditions supporting spawning and incubation for fall-/late fall–run Chinook salmon and spring-run Chinook salmon decline during a few months. The infrequent change in the indices would have a less-than-significant impact on survival, especially given that water temperature conditions are near optimal most of the time.

At Bend Bridge and RBDD, change in the survival indices under Alternative 2A is more frequent than occurred at Keswick, especially for winter- and spring-run spawning and incubation (Tables 6.1-19 and 6.1-20). Water temperature conditions supporting spawning and incubation of winter-run Chinook salmon improve in some months. Survival indices for spring-run spawning and incubation do not show a clear pattern of increase or decrease.

Other than the benefit to spawning and incubation for winter-run Chinook salmon at Bend Bridge and RBDD, water temperature survival indices for all runs and life stages of Chinook salmon in the Sacramento River are nearly the same for Alternative 1 and Alternative 2A. The impact on Chinook survival is considered less than significant.

In the Feather River, suboptimal conditions occur during many months for most life stages of spring- and fall-run Chinook salmon under Alternative 1, especially adult migration (Table 6.1-21). Water supply operations under Alternative 2A would slightly improve survival indices for adult migration and juvenile rearing life stages of fall- and spring-run Chinook salmon (Table 6.1-22). Although indices are reduced in some months, increased indices are more prevalent. For spawning and incubation, reduction in the survival indices occurs more frequently than increases. For spring-run Chinook salmon, the effect of reduced indices for spawning and incubation does not accurately reflect the conditions experienced within the spawning habitat. Most spring-run Chinook salmon spawn in the low-flow section of the Feather River upstream of Thermalito. Water temperatures in the low-flow section are cooler, and changes in operations under Alternative 2A would not be expected to alter water temperature or adversely affect spawning success of spring run. Given the relatively few months affected and small change, the reduction in the spawning and incubation indices for fall-run is likely to have a less-than-significant impact on survival. Improved conditions for adult migration and juvenile rearing may also ameliorate the slight effects on spawning and incubation.

Similar to the Feather River, suboptimal conditions occur in the American River during many months for life stages of fall-run Chinook salmon under Alternative 1 (Table 6.1-23). Water supply operations under Alternative 2A would slightly improve survival indices for adult migration, juvenile rearing, and smolt migration life stages of fall-run Chinook salmon (Table 6.1-24). Water supply operations under Alternative 2A would have a slight beneficial impact on water temperature conditions supporting fall-run Chinook salmon.

Table 6.1-21. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Feather River at Thermalito for Alternative 1, 1922–1994 Simulation

	Fall-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	176	345	418	175	143	140	742	573	371	271	736	391
0.9	45	16	10	32	48	9	59	2	56	26	77	32
0.8	19	11	3	5	45	8	29	0	19	14	26	5
0.7	24	7	1	2	49	7	9	1	18	11	12	2
0.6	27	13	0	2	47	12	10	0	28	6	5	2
0.5	26	7	0	0	40	7	3	0	8	9	5	0
0.4	16	5	0	0	22	6	3	0	2	3	2	0
0.3	18	9	0	0	22	9	2	0	0	2	0	0
0.2	14	3	0	0	15	4	4	0	1	6	0	0
0.1	11	0	0	0	13	0	1	0	0	4	0	0
0.0	56	16	0	0	60	158	2	0	1	152	1	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-22. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the Feather River below Thermalito for Alternative 2A, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Spring-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+0.4	1	0	0	0	1	0	1	0	0	0	0	0
<+0.3	4	0	0	0	4	0	0	0	0	0	2	0
<+0.2	7	2	1	1	9	2	5	0	3	0	2	1
<+0.1	51	10	3	6	57	10	41	1	12	6	36	6
0.0	306	405	427	201	359	334	781	574	458	493	795	417
>-0.1	54	10	1	8	64	9	28	1	28	5	24	8
>-0.2	7	1	0	0	8	1	3	0	3	0	4	0
>-0.30	0	2	0	0	0	2	2	0	0	0	1	0
>-0.4	1	1	0	0	1	1	2	0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-23. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the American River at Sunrise for Alternative 1, 1922–1993 Simulation (2001 Operations)

	Fall-Run Chinook Salmon				Steelhead			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	189	307	420	184	377	276	793	400
0.9	15	50	12	23	40	31	64	23
0.8	7	26	0	9	5	9	5	9
0.7	52	11	0	0	35	8	0	0
0.6	70	11	0	0	28	5	0	0
0.5	39	3	0	0	6	9	1	0
0.4	21	3	0	0	7	3	1	0
0.3	17	3	0	0	0	4	0	0
0.2	11	3	0	0	3	4	0	0
0.1	1	0	0	0	1	4	0	0
0.0	10	15	0	0	2	151	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-24. Frequency of Monthly Water Temperature Survival Indices for Chinook Salmon and Steelhead Life Stages in the American River at Sunrise for Alternative 2A, 1922–1993 Simulation

	Fall-Run Chinook Salmon				Steelhead			
Change in the Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+0.4	0	0	0	0	0	0	0	0
<+0.3	2	2	0	0	0	1	0	0
<+0.2	10	2	0	1	0	0	0	1
<+0.1	64	21	2	6	22	5	21	6
0.0	297	368	428	203	443	490	829	419
>-0.1	48	34	1	5	33	6	14	5
>-0.2	7	4	1	1	4	1	0	1
>-0.30	4	0	0	0	2	0	0	0
>-0.4	0	0	0	0	0	1	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Impact Fish-46: Operations-Related Increases in Entrainment-Related Losses of Fall-/Late Fall–Run Chinook Salmon from the San Joaquin River Basin. SWP and CVP pumping for Alternative 2A varies from pumping that was simulated for Alternative 1 (Figure 6.1-9). Increased pumping potentially increases entrainment-related losses of juvenile Chinook salmon from the San Joaquin River.

Under Alternative 1, annual losses of fall-run Chinook salmon vary from about 10,000 juveniles to 55,000 juveniles for the 73-year CALSIM simulated monthly CVP and SWP pumping (Figure 6.1-13). The simulated losses are based on the assumption that historical salvage densities and estimated losses are representative of losses that would occur in the future (Appendix J, "Methods for Assessment of Fish Entrainment in SWP and CVP Exports"). Most fall-run Chinook salmon entrainment losses historically have occurred during May. More than 90% of the fall-run Chinook salmon historically entrained by SWP and CVP pumping are believed to have originated from the San Joaquin River basin (California Department of Water Resources and Bureau of Reclamation 2001). Salvage of fall-run Chinook salmon at the CVP is more than twice the salvage at the SWP (Appendix J). Calculated loss of fall-run Chinook salmon at the SWP, however, is several times greater than the calculated loss for the CVP (San Joaquin River Group Authority 2003). The difference in loss is attributable to assumed high predation that occurs in CCF prior to salvage.

Entrainment losses generally increase under Alternative 2A, approaching a 20% increase in some years (i.e., total entrainment exceeding 60,000 juveniles) (Figure 6.1-13). To provide context for juvenile entrainment loss relative to the potential population abundance of juveniles, historical juvenile fall-run production from the San Joaquin River basin was estimated by the method applied by NOAA Fisheries for winter-run Chinook salmon (i.e., Winter Run JPE Estimator Program). Based on the method, production of juveniles from the San Joaquin River is estimated to range from about 180 thousand to more than 21 million fall-run juveniles (Appendix J). If an annual entrainment loss approaching 60,000 fish occurred during a year when production of juveniles is low (i.e., 180 thousand fish), the loss would represent as much as 33% of the annual production. The loss contributed by additional SWP pumping under Alternative 2A for such a year could approach 6% of the juvenile population. This would be the potential maximum impact from Alternative 2A. Because there is a potential for a substantial impact on the San Joaquin River juvenile Chinook production, this impact is considered to be significant.

The increased entrainment of juvenile Chinook salmon is attributable mostly to increased SWP pumping in May. Increased simulated pumping in May can occur in response to an increase in the permitted pumping criteria (i.e., from 6,680 cfs to 8,500 cfs) or in response to assumptions incorporated in CALSIM relative to the application of the EWA. The SDIP allows SWP pumping to increase from 6,680 cfs to 8,500 cfs when water is available or other criteria are not limiting in the second half of May. In the simulation of EWA by CALSIM, the EWA is assumed to be used to reduce pumping to protect fish during December through May. The EWA has a fixed water volume; therefore, when the available EWA water is used in the early months (beginning with December) and during VAMP, EWA water is no longer available to reduce SWP pumping in later months (e.g., May 16 through May 31). SWP pumping from May 16 through May 31 under Alternatives 2A increases relative to SWP pumping under

Alternative 1 (i.e., substantial increases in about 18% of the years—13 of the 73 years).

The impact of increased entrainment-related mortality (i.e., juvenile abundance would be reduced to a level that would affect population resilience and persistence) is assumed significant, even with the head of Old River gate closed in April and May. Increased entrainment-related losses may occur in response to increased pumping from May 16 through May 31. (The studies implemented as part of the VAMP are attempting to better understand potential relationships between salmon survival and streamflow, gate closure, and SWP and CVP pumping [San Joaquin River Group Authority 2003].) A substantial proportion of the annual juvenile production from the San Joaquin River may be affected during years with relatively low production. Also, a greater fraction of juvenile production may be entrained in years with relatively low San Joaquin River flow. Implementing Mitigation Measure Fish-MM-1 would reduce the significance of this impact to a less-than-significant level.

Mitigation Measure Fish-MM-1: Minimize Entrainment-Related Losses of Juvenile Fall-/Late Fall–Run Chinook Salmon from the San Joaquin River Basin That May Be Caused by Increased SWP Pumping from May 16 through May 31. The significant impact of increased entrainment-related mortality of juvenile Chinook salmon from the San Joaquin River is attributable to a simulated increase in SWP pumping from May 16 through May 31. This mitigation measure ensures that impacts on fall-run Chinook salmon from the San Joaquin River would be less than significant.

SWP pumping capacity in excess of 6,680 cfs will not be allowed from May 16 through May 31 if EWA actions are taken to reduce entrainment. The reduction in allowable SWP pumping above 6,680 cfs provided by DWR as mitigation will not exceed the reduction in pumping for fish protection provided by EWA. The reduction from 8,500 cfs to 6,680 cfs will not be charged to the EWA as long as the EWA action reduces export pumping by at least 1,820 cfs.

Substantial uncertainty surrounds the assessment and the significance determination for entrainment-related impacts on fall-run Chinook salmon from the San Joaquin River. Uncertainty is associated with the following assessment assumptions:

- Entrainment-related loss increases linearly with increased SWP and CVP pumping. (Alternative assumptions: Entrainment-related loss is asymptotic, and increased SWP pumping beyond the asymptote results in minimal additional loss, or entrainment losses increase at higher pumping.)
- Most of the entrainment-related losses attributable to the SWP pumping are related to predation on juvenile Chinook salmon in CCF. (Alternative assumptions: Predation in CCF is not a major contributor to entrainment-related losses; and the level of predation in CCF is similar to predation in Delta channels.)
- Although the head of Old River fish control gate prevents fish from moving into Old River and increases survival, additional net movement of San

Joaquin River flow into Turner Cut in response to increased SWP pumping increases entrainment-related mortality of juvenile Chinook salmon. (Alternative assumption: Net channel flow in Turner Cut, Old River, and Middle River does not affect survival of juvenile Chinook salmon in the San Joaquin River channel downstream of Stockton.)

- Entrainment-related mortality, including predation at the SWP and CVP pumping facilities, losses through the fish protection facilities, trucking and handling losses, and mortality attributable to SWP and CVP operations effects on channel flow conditions in the Delta, is sufficient to reduce juvenile abundance to a level that would affect population resilience and persistence. (Alternative assumption: Entrainment-related mortality and subsequent reduction in juvenile abundance would not affect population resilience and persistence.)

To help address these uncertainties, DWR and Reclamation will continue to support IEP and CALFED Science Program initiatives to better understand and quantify the actual entrainment-related losses at the CVP and SWP salvage facilities, and the efficacy of the head of Old River fish-control gate. This mitigation measure could be modified, as described under the adaptive management framework that is summarized at the end of the impact assessment section. This mitigation measure may be replaced by the long-term EWA if it is sufficient to operate from the Stage 2 permited SWP pumping basline.

Impact Fish-47: Operations-Related Increases in Entrainment-Related Losses of Chinook Salmon from the Sacramento River Basin. SWP and CVP pumping for Alternative 2A varies from pumping that was simulated for Alternative 1 (Figure 6.1-9). Change in pumping potentially alters entrainment and losses of juvenile Chinook salmon from the Sacramento River basin and the Mokelumne River.

Under Alternative 1, calculated annual losses of fall-run Chinook salmon vary from about 10,000 juveniles to 55,000 juveniles for the 73-year CALSIM simulated monthly CVP and SWP pumping (Figure 6.1-13). The simulated losses are based on the assumption that historical mean monthly salvage densities and estimated losses are representative of losses that would occur in the future (Appendix J, “Methods for Assessment of Fish Entrainment in SWP and CVP Exports”). Most fall-run Chinook salmon entrainment losses historically have occurred during May. More than 90% of the fall-run Chinook salmon historically entrained by SWP and CVP pumping are believed to have originated from the San Joaquin River basin (California Department of Water Resources and Bureau of Reclamation 2001); therefore, only about 10% of the historical entrainment losses would include fall-run Chinook salmon from the Sacramento River basin and the Mokelumne River.

Entrainment losses generally increase under Alternative 2A, approaching a 20% increase in some years (i.e., a total entrainment of Sacramento/Mokelumne fall-run Chinook salmon exceeding about 6,000 juveniles or about 10% of the 60,000 fish that includes fall-run juveniles from the San Joaquin River) (Figure 6.1-13). To provide context for juvenile entrainment loss relative to the potential population abundance of juveniles, historical juvenile fall-run production from the Sacramento River basin was estimated by the method applied by NOAA Fisheries for winter-run Chinook salmon (i.e., Winter Run JPE Estimator Program). Based on the method, production of juveniles from the Sacramento River is estimated to range between about 18 million to more than 208 million fall-run juveniles (Appendix J). If an annual entrainment loss approaching 6,000 fish occurred during a year when production of juveniles is low (i.e., 18 million fish), the loss would represent about 0.03% of the annual production. The loss contributed by additional SWP pumping under Alternative 2A for such a year could approach just 0.006% of the juvenile population. The simulated increase in entrainment-related losses would be small, and the proportion of annual fall-run production from the Sacramento River basin and the Mokelumne River lost to entrainment would be inconsequential, having a less-than-significant impact on the population.

Although late fall–run Chinook salmon from the Sacramento River basin are considered to be part of the fall-run Chinook salmon population, entrainment-related losses were assessed separately. Simulated annual losses of late fall–run Chinook salmon vary from about 400 juveniles to almost 1,600 juveniles (Figure 6.1-13). Similar to entrainment losses for fall run, entrainment losses generally increase under Alternative 2A, approaching or exceeding a 15% increase in some years. To provide context for juvenile entrainment loss relative to the potential population abundance of juveniles, production of juvenile late fall–run Chinook salmon is estimated to range between about 120 thousand to more than 8.8 million juveniles (Appendix J). If an annual entrainment loss approaching 1,600 fish occurred during a year when production of juveniles is low (e.g., 120 thousand fish), the loss would represent about 1% of the annual production. The loss contributed by additional SWP pumping under Alternative 2A for such a year could approach 0.2% of the juvenile population. As for fall run, the simulated increase in entrainment-related losses is relatively small, and the proportion of annual late fall–run production lost to entrainment would likely be inconsequential, having a less-than-significant impact on the population.

Simulated annual entrainment losses of winter-run Chinook salmon vary from about 1,000 juveniles to 5,000 juveniles (Figure 6.1-13). Entrainment losses generally increase under Alternative 2A, approaching or exceeding a 15% increase in some years (i.e., total entrainment exceeding 5,500 juveniles). An estimated 30 thousand to 5.5 million winter-run juveniles have possibly passed through the Delta in past years (Appendix J). Entrainment losses of 5,500 juveniles could exceed an estimated 18% of the total annual winter-run production. The loss contributed by additional SWP pumping under Alternative 2A for such a year could approach 3% of the juvenile population. Based on the observed proportion of the juvenile production for winter-run Chinook salmon that has been salvaged and lost to entrainment-related factors, it is unlikely that the actual proportion lost would exceed 2–5%, especially considering that entrainment losses to CVP and SWP pumping that likely exceed 2% of the annual production would result in reinitiation of consultation with NOAA Fisheries and implementation of measures to minimize losses (National Marine Fisheries Service 1995).

Additional SWP pumping, however, could increase entrainment-related losses of winter-run Chinook salmon and increase the frequency of reconsultation under existing biological opinions for operation of the SWP and CVP. The impact, therefore, is considered significant.

Simulated annual losses of spring-run Chinook salmon vary from about 6,000 juveniles to 35,000 juveniles (Figure 6.1-13). Entrainment losses generally increase under Alternative 2A, approaching or exceeding a 10% increase in some years (i.e., total entrainment exceeding 38,000 juveniles). Natural production of spring-run Chinook salmon entrained by SWP and CVP pumping includes fish from small tributary populations (e.g., Mill, Deer, and Butte Creeks) and populations in the Feather and Sacramento Rivers that may be genetically compromised by spawning with fall-run Chinook salmon. Consequently, the potential effect on the population of juveniles representing true spring-run Chinook salmon cannot be determined with available information. Considering that the natural production from tributary populations is relatively small (Appendix J), the impact of a 10% increase in entrainment loss is considered significant. Implementing Mitigation Measure Fish-MM-2 would reduce the significance of this impact to a less-than-significant level.

Mitigation Measure Fish-MM-2: Minimize Entrainment-Related Losses of Juvenile Winter- and Spring-Run Chinook Salmon That May Be Caused by Increased SWP Pumping from March 1 through April 14 and May 16 through May 31. The significant impact of increased entrainment-related mortality of juvenile winter- and spring-run Chinook salmon is attributable to a simulated increase in SWP pumping during March (winter run) and April–May (spring run). This mitigation measure ensures that impacts on winter- and spring-run Chinook salmon would be less than significant and includes the following components that build upon and integrate with Mitigation Measure Fish-MM-1:

SWP pumping capacity in excess of 6,680 cfs will not be allowed from March 1 through April 14 if EWA actions are taken to reduce entrainment. The reduction in allowable SWP pumping above 6,680 cfs provided by DWR as mitigation will not exceed the reduction in pumping for fish protection provided by EWA. The reduction from 8,500 cfs to 6,680 cfs will not be charged to the EWA as long as the EWA action reduces pumping by at least 1,820 cfs.

DWR and Reclamation will continue to support IEP and CALFED Science Program initiatives to better understand and quantify the actual entrainment-related losses at the CVP and SWP salvage facilities, and the efficacy of the DCC closure that is assumed to protect these Sacramento River fish. This mitigation measure could be modified, as described under the adaptive management framework that is summarized at the beginning of the impact assessment section above. This mitigation measure may be replaced by the long-term EWA if it is sufficient to operate from the Stage 2 permited SWP pumping basline.

Impact Fish-48: Operations-Related Reduction in Food Availability for Chinook Salmon. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for juvenile

Chinook salmon. Changes in water supply operations potentially affect prey habitat in the Sacramento, Feather, and American Rivers. The flow simulated for 1922–1994 in the Sacramento, Feather, and American Rivers for Alternative 2A varies relative to flow under Alternative 1 (Figure 6.1-5). The reduction in flow in some months and increases for other months and years has minimal effect on the range of flows that could affect rearing habitat area for juvenile Chinook salmon (Table 6.1-14) and would likely have minimal effect on habitat supporting prey organisms. The impact on food for Chinook salmon would be less than significant.

Inundated floodplain in the Yolo and Sutter Bypasses provides important access by fish to prey organisms and input of nutrients to the rivers and Delta (Sommer and Harrell et al. 2001). As previously discussed for juvenile Chinook salmon rearing habitat, the frequency of floodplain inundation in the Yolo and Sutter Bypasses was estimated under Alternative 1 for the 1922–1994 water years (Figure 6.1-10). Most flooding occurs from December though April, coinciding with downstream movement and rearing by juvenile Chinook salmon in all runs (Table 6.1-2). Changes in water supply operations under Alternative 2A could reduce flooding in November of one year for the Sutter Bypass and in December of two years for the Yolo Bypass. The reduced bypass flooding in November and December would have a less-than-significant impact on the expected access by juvenile Chinook salmon to prey organisms and input of nutrients to the rivers and Delta. The determination is based on several factors. Few months are affected, with inundation predicted in 143 months for the Sutter Bypass and 100 months for the Yolo Bypass (i.e., 1922–1994 simulation). In addition, the probability of flooding in months subsequent to the three affected months, and the subsequent availability of floodplain rearing habitat, is higher for January, February, and March. Therefore, access to the floodplain may be delayed but access to prey organisms and input of nutrients would likely be available in a subsequent month. No mitigation is required.

Coho Salmon

Effects of implementing Alternative 2A on coho salmon are discussed for the Trinity River (southern Oregon/northern California coasts' ESU). Gate construction and dredging activities occur in the Delta and would, therefore, not affect environmental conditions in the Trinity River or any life stages of anadromous fish species that occur in the Trinity River. Changes in water supply operations, however, may affect Trinity Reservoir storage and Trinity River flow. The following assessment identifies potential impacts of implementing the water supply operations under Alternative 2A. The environmental correlates addressed for coho salmon include spawning habitat quantity, rearing habitat quantity, migration habitat condition, water temperature, and food.

Effects on Chinook salmon, steelhead, and other species are not discussed for the Trinity River. The effects on coho salmon are representative of the potential effects on Chinook salmon and steelhead.

Impact Fish-49: Operations-Related Loss of Spawning Habitat Area for Coho Salmon in the Trinity River. Flow in the Trinity River under

Alternative 2A is nearly the same as flow under Alternative 1, with increased flow in a few months (Figure 6.1-4). The changes in flow would not adversely affect spawning habitat area in the Trinity River. This potential impact is considered less than significant. No mitigation is required.

Impact Fish-50: Operations-Related Loss of Rearing Habitat Area for Coho Salmon in the Trinity River. Flow in the Trinity River under Alternative 2A is nearly the same as flow under Alternative 1, with increased flow in a few months (Figure 6.1-4). The changes in flow would not adversely affect rearing habitat area in the Trinity River. This potential impact is considered less than significant. No mitigation is required.

Impact Fish-51: Operations-Related Decline in Migration Habitat Conditions for Coho Salmon in the Trinity River. Flow in the Trinity River under Alternative 2A is nearly the same as flow under Alternative 1, with increased flow in a few months (Figure 6.1-4). The changes in flow would not adversely affect migration habitat conditions in the Trinity River. This potential impact is considered less than significant. No mitigation is required.

Impact Fish-52: Operations-Related Reduction in Survival of Coho Salmon in Response to Changes in Water Temperature in the Trinity River. Simulated water temperature for the Trinity River is nearly the same for Alternative 1 and Alternative 2A (Figure 6.1-14), although warmer and cooler water temperatures occur in some months. (Note: Points that fall off of the 45º line in the figures for water temperature indicate warming [above the line] or cooling [below the line] relative to the No Action Alternative.) As indicated previously, changes in Trinity River flow are minimal and would not affect water temperature. The simulated changes in water temperature under Alternative 2A are caused by simulated changes in export of Trinity River water to the Sacramento River (Figure 6.1-15). Although the annual water volume exported to the Sacramento River is nearly the same under Alternative 1 and Alternative 2A, the monthly volume of Trinity River exports under Alternative 2A varies from the volume exported under Alternative 1.

Water exported to the Sacramento River is released from Trinity Reservoir to Lewiston Reservoir. Water in Lewiston Reservoir is either released to the Trinity River or exported to the Sacramento River. When Trinity Reservoir releases are low during warmer months, water traversing Lewiston Reservoir warms considerably prior to release to the Trinity River. Under Alternative 2A, the warming of water temperature in some months coincides with reduced export of Trinity River water and the cooling coincides with increased export.

Increased water temperature in the Trinity River during the fall months could have an adverse effect on coho salmon and other salmonids. Survival indices were assigned to the water temperature simulated for each month of occurrence for adult migration, spawning, juvenile rearing, and smolt migration life stages of coho salmon in the Trinity River. Water temperature conditions under Alternative 1 are optimal (an index of 1) for most months (Table 6.1-25). For all life stages, the water temperature survival indices are nearly the same for

Alternatives 1 and 2A (Table 6.1-26). The frequency of change in indices for adult migration show the most change, but only 8 months out of 288 simulated months of migration are affected, and the number of declines in the survival indices is similar to the number of increases. The shift in water temperature survival indices would not affect adult migration or other life stages. The change in water supply operations under Alternative 2A would not affect survival of coho salmon in the Trinity River. This potential impact is less than significant. No mitigation is required.

Table 6.1-25. Frequency of Monthly Water Temperature Survival Indices for Coho Salmon (i.e., Based on Criteria for Chinook Salmon) in the Trinity River at Lewiston for Alternative 1, 1922–1994 Simulation

	Coho Salmon			
Base Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
1.0	277	288	862	288
0.9	6	0	2	0
0.8	3	0	0	0
0.7	0	0	0	0
0.6	0	0	0	0
0.5	0	0	0	0
0.4	1	0	0	0
0.3	0	0	0	0
0.2	0	0	0	0
0.1	1	0	0	0
0.0	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Table 6.1-26. Frequency of Monthly Water Temperature Survival Indices for Coho Salmon Life Stages in the Trinity River at Lewiston for Alternative 2A, 1922–1993 Simulation (2001 Operations)

	Coho Salmon			
Change in the Index	Adult Migration	Spawning/ Incubation	Juvenile Rearing	Smolt Migration
<+0.4	0	0	0	0
<+0.3	0	0	0	0
<+0.2	0	0	0	0
<+0.1	4	0	1	0
0.0	280	288	860	288
>-0.1	3	0	3	0
>-0.2	1	0	0	0
>-0.30	0	0	0	0
>-0.4	0	0	0	0

Note: See Table 6.1-2 to identify months for each life stage.

Impact Fish-53: Operations-Related Reduction in Food Availability for Coho Salmon in the Trinity River. Flow in the Trinity River under Alternative 2A is nearly the same as flow under Alternative 1, with increased flow in a few months (Figure 6.1-4). The changes in flow would not adversely affect food abundance or availability for coho salmon in the Trinity River.

Steelhead

The following assessment identifies potential impacts of operating Alternative 2A on Central Valley steelhead. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages. Environmental correlates addressed for steelhead include spawning habitat quantity, rearing habitat quantity, migration habitat condition, water temperature, food, and entrainment in diversions.

Impact Fish-54: Operations-Related Loss of Spawning Habitat Area for Steelhead. Steelhead spawn in the cool reaches of the Sacramento, Feather, and American Rivers downstream of the terminal reservoirs. Changes in water supply operations potentially affect spawning habitat area for steelhead. The spawning and egg incubation period for steelhead extends from December through June.

Flows simulated for Alternative 1 provide near the maximum spawning habitat area during the months of spawning in the Sacramento and Feather Rivers (Table 6.1-8). Change in Sacramento and Feather River flows attributable to water supply operations under Alternative 2A would not affect spawning habitat area (Table 6.1-13). In the American River, spawning habitat area for steelhead is not affected during most months (Table 6.1-13) but is less abundant in a few months. The reduction in area is generally less than 10% and does not affect spawning for all months in any year. Given the few spawning months affected and the relatively small change in spawning habitat area, the effect on adult spawning success and survival of steelhead eggs and larvae through incubation in the American River would be less than significant. No mitigation is required.

Impact Fish-55: Operations-Related Loss of Rearing Habitat Area for Steelhead. Changes in water supply operations potentially affect rearing habitat area for steelhead in the Sacramento, Feather, and American Rivers. Rearing occurs year round in the cool reaches below the terminal reservoirs. The flow simulated for 1922–1994 in the Sacramento, Feather, and American Rivers for Alternative 2A varies relative to flow under Alternative 1 (Figure 6.1-5). The reduction in flow in some months and increases for other months and years has minimal effect on the range of flows that could affect rearing habitat area (Table 6.1-14). The impact on steelhead would be less than significant because rearing habitat in most months of most years is unaffected. No mitigation is required.

Impact Fish-56: Operations-Related Decline in Migration Habitat Conditions for Steelhead. The Sacramento, Feather, and American Rivers provide a migration pathway between freshwater and marine habitats for steelhead. Flows that occur in Central Valley rivers generally support migration of adult and juvenile steelhead. Relative to Alternative 1, flows under Alternative 2A are within the range of flows under Alternative 1 and would not affect migration of adult and juvenile steelhead in Central Valley rivers (Figures 6.1-4 and 6.1-5).

In the Delta, juvenile Chinook salmon survival is lower for fish migrating through the central Delta than for fish continuing down the Sacramento River channel (Brandes and McLain 2001; Newman and Rice 1997). A similar relationship is assumed for juvenile steelhead. Juvenile steelhead begin entering the Delta from upstream habitat in the Sacramento River and its tributaries during December. Downstream movement and migration continues through May or June. Few juvenile steelhead move through the Delta from July through November.

Juvenile steelhead are assumed to move along Delta channel pathways in proportion to flow; therefore, an increase in the proportion of flow diverted off the Sacramento River through the DCC and Georgiana Slough would be expected to increase mortality of migrating juvenile steelhead. The proportion of Sacramento River flow diverted into the DCC and Georgiana Slough under Alternative 2A is generally the same as the proportion diverted for Alternative 1 (Figure 6.1-7), especially during the primary period of juvenile steelhead migration (Table 6.1-2). For the primary migration period, the change in flow is usually less than 1% (Figure 6.1-7). Operations under Alternative 2A would have a less-than-significant impact on survival of juvenile steelhead migrating from the Sacramento River because the proportion of flow diverted off the Sacramento River at the DCC and Georgiana Slough is similar to the proportion of flow diverted under Alternative 1.

For the San Joaquin River, the flow split at the head of Old River determines the pathway of juvenile fall-run Chinook salmon through the south Delta. Available data indicate that survival for fish continuing down the San Joaquin River past Stockton is higher than survival of fish that move into Old River (San Joaquin River Group Authority 2003; Brandes and McLain 2001). Effects on steelhead are assumed to be similar to effects on juvenile Chinook salmon. As described for Chinook salmon, flow and pumping changes under Alternative 2A would have minimal effect on survival of juvenile steelhead.

Impact Fish-57: Operations-Related Reduction in Survival of Steelhead in Response to Changes in Water Temperature. Change in reservoir storage and river flow potentially affects water temperature in the Sacramento, Feather, and American Rivers. Water temperature in river reaches immediately downstream of the primary reservoirs, including Shasta, Oroville, and Folsom, are the most sensitive to effects of operations. These reaches support steelhead life stages that can be adversely affected by temperature conditions in Central Valley rivers.

Water temperatures in the Sacramento, Feather, and American Rivers are similar under Alternative 1 and Alternative 2A (Figures 6.1-11 and 6.1-12). The change in water temperature attributable to Alternative 2A is almost always less than 1°F (0.56°C), although larger changes occur in some simulated months. The magnitude and frequency of changes are too small and too infrequent to attribute to any specific SDIP action. The potential effect of water temperature on steelhead life stages warrants further consideration of the range of water temperatures affecting survival. Survival indices were assigned to the water temperatures for each month of occurrence of each life stage for steelhead in the Sacramento, Feather, and American Rivers.

For all life stages in the Sacramento River near Keswick, the water temperature survival indices are near optimal in most months under Alternative 1 (Table 6.1-15). The indices are similarly high at Bend Bridge and RBDD (Tables 6.1-16 and 6.1-17), although less than optimal indices for spawning and incubation are more frequent for spawning and incubation at RBDD. The occurrence of lower indices reflects warming of water temperatures downstream from Keswick and Bend Bridge.

The few months of change in survival indices at Keswick under Alternative 2A illustrate the similarity to indices under Alternative 1 (Table 6.1-18). The infrequent change in the indices would have a less-than-significant impact on survival. At Bend Bridge and RBDD, change in the survival indices under Alternative 2A is slightly more frequent than occurred at Keswick (Tables 6.1-19 and 6.1-21). Water temperature conditions supporting spawning and incubation improve in some months. Other than the benefit to spawning and incubation at Bend Bridge and RBDD, water temperature survival indices for steelhead life stages in the Sacramento River are nearly the same under Alternative 1 and Alternative 2A.

In the Feather River, suboptimal conditions occur during many months for most life stages under Alternative 1, especially adult migration and juvenile rearing (Table 6.1-21). Water supply operations under Alternative 2A would slightly improve survival indices for juvenile rearing (Table 6.1-22). Although indices are reduced in some months, increased indices are more prevalent. For other life stages, relatively few months are affected and changes are small. Change in water temperature would have a less-than-significant impact on survival. No mitigation is required.

Similar to the Feather River, suboptimal conditions occur in the American River during many months for adult migration and juvenile rearing under Alternative 1 (Table 6.1-23). Water supply operations under Alternative 2A would slightly improve survival indices for juvenile rearing (Table 6.1-24). Water supply operations under Alternative 2A would have minimal effects on water temperature conditions supporting steelhead.

Impact Fish-58: Operations-Related Increases in Entrainment Losses of Steelhead. Under Alternative 1, simulated SWP and CVP pumping would result in an estimated annual salvage of approximately 1,000 to 4,500 juvenile steelhead (Figure 6.1-16). Salvage, and hence entrainment losses, generally increase under Alternative 2A, approaching a 15–20% increase in some years (i.e., total salvage exceeding 4,900 juveniles). The proportion of annual steelhead production entrained is currently unknown, but the effect on steelhead from the Sacramento River basin would likely be similar to effects described for spring-run Chinook salmon. Effects of increased SWP pumping on steelhead from the San Joaquin River basin would likely be similar to effects on fall-run Chinook salmon from the San Joaquin River basin. Juvenile steelhead are larger than juvenile Chinook salmon; therefore, entrainment-related losses of juvenile steelhead may be less than the effects described for juvenile Chinook salmon. The larger size results in higher screening efficiency and may increase the ability of individuals to avoid predators. However, considering that the natural production of steelhead appears to be relatively low, the potential impact of a 15–20% increase in entrainment loss in some years is considered significant. Mitigation measures Fish-MM-1 and Fish-MM-2, already described for reducing Chinook entrainment, would reduce the impact to less than significant.

Impact Fish-59: Operations-Related Reduction in Food Availability for Steelhead. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for steelhead. Changes in water supply operations potentially affect prey habitat in the Sacramento, Feather, and American Rivers. The flow simulated for 1922–1994 in the Sacramento, Feather, and American Rivers for Alternative 2A varies relative to flow under Alternative 1 (Figure 6.1-5). The reduction in flow in some months and increases for other months have minimal effect on the range of flows that could affect rearing habitat area for steelhead (Table 6.1-14) and would likely have minimal effect on habitat supporting prey organisms. The impact on food for steelhead would be less than significant. No mitigation is required.

Delta Smelt

The following assessment identifies potential impacts of implementing Alternative 2A on delta smelt. Delta smelt occur primarily within the Delta and Suisun Bay, with sporadic occurrence in San Pablo Bay and frequent occurrence in the Napa River estuary. Delta smelt do not occur in the rivers upstream of the Delta. The environmental conditions within the Delta and Suisun Bay that could be affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages. Environmental correlates addressed for delta smelt include spawning habitat quantity, rearing habitat quantity, migration habitat condition, food, and entrainment in diversions.

Impact Fish-60: Operations-Related Loss of Spawning Habitat Area for Delta Smelt. Delta smelt spawn in the Delta, upstream of the 2 ppt isohaline (X2). As indicated in the methods description, existing information does not indicate that spawning habitat is limiting population abundance and production (U.S. Fish and Wildlife Service 1996). The extent of salinity intrusion into the Delta, as represented by the change in location of X2, provides an index of potential effects of water supply operations on spawning habitat availability throughout the Delta. Delta smelt spawn primarily from January through May. Water supply operations under Alternative 2A would affect the location of X2 (Figure 6.1-8). The location of X2 during the spawning period for delta smelt is nearly the same under both Alternative 1 and 2A. The change in location of X2 during the spawning period is less than 1 kilometer in most months, indicating relatively minor salinity intrusion into Delta spawning areas. Operations under Alternative 2A would have a less than significant impact on spawning habitat in the Delta.

Impact Fish-61: Operations-Related Loss of Rearing Habitat Area for Delta Smelt. Delta smelt larvae, juveniles, and adults rear in the Delta and Suisun Bay where changes in water supply operations potentially affect estuarine rearing habitat area. The location of the preferred salinity range for delta smelt rearing is assumed to determine estuarine rearing habitat area in the Delta and Suisun Bay. The range of salinity preferred by delta smelt (0.3 ppt to 1.8 ppt) was used to calculate the estuarine rearing habitat area for each month under Alternative 1 (proportion of the maximum area available for any month of the 1922–1994 simulation) (Figure 6.1-17). High Delta outflows move X2 downstream and increase the available rearing habitat for Delta smelt. The proportion of the maximum rearing habitat area available ranged from about 25% to 100% depending on the month and simulated hydrologic conditions. The primary months that estuarine rearing habitat is important to survival of a year class are not precisely known, but it appears to be most important from March through July (Unger 1994). During most simulated years, the proportion of maximum habitat area available exceeded 60% during the important months for rearing in most years. Habitat availability is generally lowest from September through December (Figure 6.1-17).

Compared to Alternative 1, the change in estuarine rearing habitat area attributable to water supply operations under Alternative 2A is small (generally less than 5%) and infrequent for most years during all months. Most of the time, rearing habitat area is the same for Alternative 1 and Alternative 2A. Given the few rearing months affected and the relatively small change in estuarine rearing habitat area, effects on survival of delta smelt would be less than significant. No mitigation is required.

Impact Fish-62: Operations-Related Decline in Migration Habitat Conditions for Delta Smelt. Water supply operations under Alternative 2A would change SWP and CVP pumping and Delta inflow and outflow (Figures 6.1-6 and 6.1-9). Net flow in the Delta channels could be affected (Section 5.2, Delta Tidal Hydraulics). Although net channel flows have been identified as important because they move fish downstream (U.S. Fish and Wildlife Service 1996), actual effects of net flow changes on the movement of adult, larvae, and juvenile delta smelt have not been demonstrated. Given that net flow changes attributable to water supply operations are small relative to tidal flows, effects on delta smelt migration habitat are considered less than significant.

Impact Fish-63: Operations-Related Increases in SWP Pumping and Resulting Entrainment Losses of Delta Smelt. Under Alternative 1, simulated SWP and CVP pumping results in annual estimated salvage ranging from about 7,000 to 35,000 delta smelt (Figure 6.1-19). Most delta smelt (about 90%) are salvaged during May–June (Appendix J). However, adult delta smelt are entrained in small numbers through the winter and early spring months of November through March. Salvage generally increases under Alternative 2A, approaching a 15–40% increase in some years (Figure 6.1-19). The increased salvage is primarily attributable to increased SWP pumping in June (Figure 6.1-20), although increased pumping also contributes to increased entrainment in May and July. The increased pumping under Alternative 2A in the winter and early spring months of November–March has a potentially large impact on the population because these delta smelt are adults moving into spawning habitat.

Gate closure causes additional net flow to be drawn from the San Joaquin River and south through Old River, Middle River, and Turner Cut (Section 5.2, Delta Tidal Hydraulics). The increased net flow toward the south may increase entrainment of larval and juvenile delta smelt (Appendix J). The effects of gate closure are similar for Alternatives 1 and 2A, but the fish control gate constructed under Alternative 2A would be closed from April 1 through May 31. During the May–July period, salvage consists mostly of 0.79–1.18-inch (20–30-mm) juveniles (Figure 6.1-21). Based on the 20-mm survey data, most juvenile smelt occur in Suisun Bay and near the confluence of the Sacramento and San Joaquin Rivers during April–July. However, a substantial proportion of the population may occur within the central and south Delta. Delta smelt larvae and juveniles within the central and south Delta are vulnerable to entrainment by SWP and CVP pumping. An increase in salvage ranging from 15% to 35% may represent substantial but unknown proportions of the annual larval and juvenile production. Given the limited understanding of smelt abundance and distribution and of factors affecting the population abundance, the impact of increased SWP pumping in the winter and early spring months of November–March when adult delta smelt are in relatively high densities, as well in as May and June, when the delta smelt salvage density is highest, is considered significant. Implementing Mitigation Measure Fish-MM-3 would reduce this impact to a less-than-significant level.

Mitigation Measure Fish-MM-3: Minimize Entrainment Losses of Delta Smelt Associated with Increased SWP Pumping. The significant impact of increased entrainment-related mortality of delta smelt is attributable primarily to a potential increase in SWP pumping during May and June. Entrainment of adult delta smelt in the winter may also be significant. This mitigation measure ensures that the impact of increased SWP pumping on delta smelt would be reduced to a less than significant level and includes the following components that build upon and integrate with Mitigation Measures Fish-MM-1, and Fish-MM-2:

1. SWP pumping capacity in excess of 6,680 cfs will not be allowed from November 1 through June 30 if EWA actions are taken to reduce entrainment. Fish-MM-1 already provides mitigation for the May 16–May 31 period and Fish-MM-2 provides mitigation for the March 1–April 14 period. The reduction in allowable SWP pumping above 6,680 cfs provided by DWR as mitigation will not exceed the reduction in pumping for fish protection provided by EWA. The reduction from 8,500 cfs to 6,680 cfs (or the existing pumping limit in the December 15–March 15 period) will not be charged to the EWA, as long as the EWA reduction is at least as large.
2. From November 1 through March 31, pumping-reduction credits will be given to the EWA (ranging from 10% to up to 30%) for all non-EWA pumping that is above the existing permitted capacity. Under this mitigation component, for each 100 taf of non-EWA pumping above the existing permitted capacity, a pumping reduction credit, ranging from 10 taf to 30 taf, could be used by EWA to reduce pumping during periods of high fish density.

This relatively simple avoidance of impacts during periods of EWA actions, in addition to an EWA credit for mitigation of periods with remaining pumping above the existing permitted capacity, will reduce the delta smelt entrainment impacts to less than significant. DWR and Reclamation will coordinate with DFG, NOAA Fisheries, and USFWS to determine the appropriate credit percentage.

When an expanded EWA (i.e., greater than CALFED ROD EWA) is implemented by CALFED, as assumed in the 2004 OCAP documents, this SDIP mitigation measure would no longer be required because the expanded EWA is assumed to be sufficient to mitigate any entrainment impacts from the incremental pumping above the existing permitted capacity. The SWP has proposed increased funding through an amended Four-Pumps Agreement to support SDIP mitigation measures, including an expanded EWA. In the absence of the EWA, that increased funding would continue to be available to DFG to mitigate impacts of the SDIP through purchases of water to reduce pumping during critical periods for fish or other mitigation strategies developed through the adaptive management process.

DWR and Reclamation will continue to support IEP and CALFED Science Program initiatives to better understand and quantify the actual entrainment-related losses at the CVP and SWP salvage facilities, improved salvage techniques for delta smelt, and the effects of the head of Old River fish control gate on the movement of relatively high densities of delta smelt from the vicinity of Franks Tract. This mitigation measure could be modified, as described under the adaptive management framework that is summarized at the beginning of the impact assessment section above, utilizing in whole or in part, increased funds available through the Four-Pumps Agreement.

Impact Fish-64: Operations-Related Reduction in Food Availability for Delta Smelt. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for delta smelt. As discussed above for rearing habitat area, changes in water supply operations potentially affect estuarine rearing habitat area for delta smelt in the Delta and Suisun Bay. Location of rearing habitat area downstream of the Delta is believed to increase food availability for delta smelt (U.S. Fish and Wildlife Service 1996). The broad and shallow areas of Suisun Bay allow algae to grow and reproduce rapidly, providing food for zooplankton, which are food for delta smelt. Greater rearing habitat area for delta smelt coincides with location downstream of the Delta and within the areas of higher zooplankton production. The change in estuarine rearing habitat area under Alternative 2A is small (generally less than 5%) and infrequent for most years during all months (Figure 6.1-18). Given the few rearing months affected, especially during April through August, and the relatively small change in estuarine rearing habitat area, the impact on food availability for delta smelt would be less than significant.

Delta smelt feed on zooplankton; consequently prey organisms may be subject to entrainment effects similar to those described above for larval and juvenile delta smelt within the central and south Delta. Entrainment loss of food organisms and its effect on delta smelt productivity is currently unknown. The effect, however, is not clearly separable from entrainment loss of delta smelt. The impact of entrainment on food is assumed to be encompassed by the impact described for delta smelt (Impact Fish-63). Mitigation Measure Fish-MM-3 would reduce the entrainment impacts on food organisms for delta smelt to less than significant.

Splittail

The following assessment identifies potential impacts of operating Alternative 2A on splittail. Splittail are dependent on conditions upstream of the Delta for rearing and spawning, especially inundated floodplain in the Yolo and Sutter Bypasses. Adult and juvenile splittail spend most of their lives in the Delta and Suisun Bay. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages. Environmental correlates addressed for splittail include spawning habitat quantity, rearing habitat quantity, migration habitat condition, food, and entrainment in diversions.

Impact Fish-65: Operations-Related Loss of Spawning Habitat Area for Splittail. The extent of salinity intrusion into the Delta, as represented by the change in location of X2, provides an index of potential effects of water supply operations on spawning habitat availability throughout the Delta. Splittail spawn primarily from February through May. Water supply operations under Alternative 2A would affect the location of X2 (Figure 6.1-8). The location of X2 during the spawning period for splittail is nearly the same under Alternative 1. The change in location of X2 during the spawning period is generally less than 1 kilometer, indicating relatively minor intrusion into Delta spawning areas. Operations under Alternative 2A would result in a less than significant impact on spawning habitat in the Delta.

Splittail spawn primarily upstream of the Delta and use vegetated areas on inundated floodplain or along the edge of the river channel (Sommer and Harrell et al. 2001). Inundated floodplain in the Yolo and Sutter Bypasses provides important spawning habitat for splittail. Changes in water supply operations affect reservoir storage and may affect the frequency of floodplain inundation. Inundation of the Yolo Bypass has occurred in one or more months of approximately 60% of the historical water years (Sommer and Harrell et al. 2001) and inundation of the Sutter Bypass occurs in at least 80% of historical water years. Monthly average flows provide an indicator of inundation, although weekly and shorter storm events that inundate floodplain are not captured by the simulated monthly average. The frequency of floodplain inundation in the Yolo and Sutter Bypasses was estimated under Alternative 1 for the 1922–1994 water years (Figure 6.1-10). Most flooding occurs from December though April, coinciding with the spawning period for splittail (Table 6.1-2). Changes in water supply operations under Alternative 2A could reduce flooding in November of one year for the Sutter Bypass and in December of two years for the Yolo Bypass. The reduced bypass flooding in November and December precedes the spawning period for splittail and would not affect spawning. Few months are affected, with inundation predicted in 143 months (i.e., 39% of the simulated months from December through April) for the Sutter Bypass and 100 months (i.e., 27% of the simulated months from December through April) for the Yolo Bypass (1922–1994 simulation). The probability of flooding in months subsequent to the three affected months, and the availability of floodplain spawning habitat in January, February, and March would not be affected. No mitigation is required.

Impact Fish-66: Operations-Related Loss of Rearing Habitat Area for Splittail. Inundated floodplain in the Yolo and Sutter Bypasses provides important rearing habitat for larval and juvenile splittail (Sommer et al. 1997). As discussed above for spawning habitat area, changes in water supply operations under Alternative 2A could reduce flooding in November of one year for the Sutter Bypass and in December of two years for the Yolo Bypass. The affected months precede the rearing habitat need for larval and juvenile splittail, although less floodplain inundation in December could affect rearing of adult splittail. The impact on splittail rearing, however, would be less than significant. The determination is based on several factors. Few months are affected, with inundation predicted in 143 months for the Sutter Bypass and 100 months for the

Yolo Bypass (1922–1994 simulation). The affected months are early in the period of upstream migration for adults. In addition, floodplain rearing habitat is not affected in the primary period of observed adult migration in January through March. Access to floodplain habitat may be delayed, but habitat would not be affected in the primary months.

Impact Fish-67: Operations-Related Decline in Migration Habitat Conditions for Splittail. The Sacramento River provides a migration pathway between freshwater and estuarine habitats for splittail. Flows that occur in the Sacramento River generally support migration of adult splittail. As indicated above for spawning and rearing habitat area, change in floodflows attributable to water supply operations under Alternative 2A would be early in the period of adult migration and affect few months. Relative to Alternative 1, the change in flows under Alternative 2A would not be expected to affect migration of adult and juvenile splittail. This impact is less than significant. No mitigation is required.

Impact Fish-68: Operations-Related Increases in Entrainment Losses of Splittail. Under Alternative 1, simulated CVP and SWP pumping results in annual salvage of splittail ranging from about 15,000 to 75,000 individuals (Figure 6.1-22). Highest salvage densities occur during May and June (Appendix J, “Methods for Assessment of Fish Entrainment in SWP and CVP Exports”). The median length of splittail salvaged during May and June is 1.97 inches (50 mm) or less (Figure 6.1-23), indicating entrainment of juveniles originating from spawning during the current year. High salvage coincides with high juvenile abundance during wet years (U.S. Fish and Wildlife Service 1995).

Salvage generally increases under Alternative 2A, approaching a 40% increase in one year and 10–20% increases in other years (Figure 6.1-22). Total salvage under Alternative 2A exceeds 70,000 juveniles for some wetter years. The increased salvage is attributable to increased SWP pumping. However, the largest percentage increase is associated with low pumping and low salvage (e.g., about 20,000 individuals).

Although entrainment may increase under Alternative 2A, the impact of entrainment on splittail abundance is determined to be less than significant. The conclusion is based on two factors. The largest percentage increase in simulated salvage occurs in dry and critically dry years, resulting in an overestimate of the potential increase given that the actual density of juvenile splittail would be less than the median value applied in the assessment method for entrainment. Also, most splittail spawn and rear over floodplain inundated by the Sacramento River, including the Yolo and Sutter Bypasses (Sommer et al. 1997). Substantial spawning in the San Joaquin River basin has appeared to coincide with high spawning success in the Sacramento River basin. Given that most splittail enter the Delta from the Sacramento River system and move into Suisun Bay and Marsh, the exposure to entrainment by SWP and CVP pumping would be relatively low relative to the total production of splittail. Information to determine the population level impact is not available. No mitigation is required.

Impact Fish-69: Operations-Related Reduction in Food Availability for Splittail. Inundated floodplain in the Yolo and Sutter Bypasses provides important access by fish to prey organisms and input of nutrients to the rivers and Delta (Sommer and Harrell et al. 2001). As previously discussed for splittail rearing habitat, changes in water supply operations under Alternative 2A would have little effect on access to floodplain rearing habitat during the primary period of splittail occurrence or on input of nutrients with runoff from floodplain habitat. This impact is considered less than significant. No mitigation is required.

Striped Bass

The following assessment identifies potential impacts of operating Alternative 2A on striped bass. Striped bass occur within the Delta, Suisun Bay, San Francisco Bay, and in the coastal waters near the San Francisco Bay. Adult striped bass migrate upstream in the Sacramento River to spawn. Some juvenile and adult striped bass occur in rivers upstream of the Delta throughout the year. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages. Environmental correlates addressed for striped bass include spawning habitat quantity, rearing habitat quantity, migration habitat condition, food, and entrainment in diversions.

Impact Fish-70: Operations-Related Loss of Spawning Habitat Area for Striped Bass. Striped bass spawn in the Delta and in the Sacramento River upstream of the Delta (California Department of Fish and Game 1987). Eggs are released into the water column. They are semibuoyant and drift with the currents. Eggs spawned in the Sacramento River drift downstream to the Delta. Larvae and early juveniles rear near the 2 ppt isohaline in the lower Delta and, depending on salinity conditions, Suisun Bay. Spawning in the Sacramento River upstream of the Delta occurs during May and June. Spawning in the Delta occurs during April and May, usually within the San Joaquin River channel between Antioch and Venice Island (California Department of Fish and Game 1987).

The extent of salinity intrusion into the Delta, as represented by the change in location of X2 (Figure 6.1-8), provides an index of potential effects of water supply operations on spawning habitat availability in the San Joaquin River. The location of X2 during the spawning period for striped bass is nearly the same under Alternatives 1 and 2A. The change in location of X2 is less than 1 kilometer, indicating relatively little intrusion into Delta spawning habitat under Alternative 2A. Water supply operations under Alternative 2A would have a less-than-significant impact on spawning habitat in the Delta. No mitigation is required.

Impact Fish-71: Operations-Related Loss of Rearing Habitat Area for Striped Bass. Striped bass larvae, juveniles, and adults rear in the Delta and Suisun Bay. Changes in water supply operations potentially affect estuarine rearing habitat area for striped bass in the Delta and Suisun Bay. The location of the preferred salinity range for striped bass is assumed to determine estuarine rearing habitat area in the Delta and Suisun Bay. The range of salinity preferred by striped bass larvae and early juveniles (i.e., 0.1 ppt to 2.5 ppt) was used to calculate the estuarine rearing habitat area for each month under Alternative 1 (i.e., proportion of the maximum area available for any month of the 1922–1994 simulation) (Figure 6.1-24). Proportional rearing habitat area ranged from about 40% to 100% depending on the month. The primary months that estuarine rearing habitat is important to survival of a year class are not precisely known, but it appears to be most important from April through June (Unger 1994). During most simulated years, the proportional habitat area exceeded 80% during April–June (Figure 6.1-24).

The change in estuarine rearing habitat area under Alternative 2A is small (generally less than 5%) relative to area under Alternative 1 (Figure 6.1-25). Given the few rearing months affected during April–June, and the relatively small change in estuarine rearing habitat area, effects on survival of striped bass would be less than significant. No mitigation is required.

Impact Fish-72: Operations-Related Decline in Migration Habitat Conditions for Striped Bass. Water supply operations could affect Sacramento River flow and survival of striped bass eggs and larvae (California Department of Fish and Game 1992). Higher flows (greater than 17,000 cfs) appear to result in higher egg survival. The mechanism for higher survival could be related to duration of transport, larval food availability, suspension of eggs within the water column, or other factors. Simulated Sacramento River flow under Alternative 2A for May and June would be similar to flow under Alternative 1. Notable reductions in flow occur in three months of the 1922–1994 May–June simulation (i.e., flow is reduced by more than 1,000 cfs). Affected flows under Alternative 1 range from 11,779 cfs to 14,264 cfs. The reduction in Sacramento River flow would have a less-than-significant impact on egg movement and survival in the Sacramento River because few years are affected and the flow changes are within the range of flows that do not clearly support higher egg survival. No mitigation is required.

Impact Fish-73: Operations-Related Increases in SWP Pumping and Resulting Entrainment Losses of Striped Bass. Under Alternative 1, simulated CVP and SWP pumping result in an estimated annual salvage of striped bass ranging from about 1 million to 7 million individuals (Figure 6.1-26). Salvage generally increases under Alternative 2A, approaching a 10–20% increase or more in some years (Figure 6.1-26). The increased salvage is attributable to increased simulated SWP pumping during June and July. Salvage in June and July, however, consists primarily of juveniles 20–30 mm in length (Figure 6.1-27), indicating that substantial entrainment of eggs and larvae could also occur in April and May.

Recent analysis of striped bass data sets indicates that entrainment of striped bass by SWP and CVP pumping is unrelated to total mortality rates and probably did not contribute to the observed decline in adult abundance (Kimmerer et al. 2001). However, the proportion of annual striped bass production lost to entrainment could be substantial and effects on future population abundance are currently unknown. The impact of increased SWP pumping in April, May, and June, therefore, is considered significant. Implementation of Mitigation Measures Fish-MM-1, Fish-MM-2, and Fish-MM-3 would reduce this impact to a less-than-significant level.

Impact Fish-74: Operations-Related Reduction in Food Availability for Striped Bass. Effects on food are the same as described for delta smelt. This impact is significant and would be reduced to a less-than-significant level by implementing Fish-MM-3 for delta Smelt, as discussed above.

Green Sturgeon

The following assessment identifies potential operations-related impacts of implementing Alternative 2A on green sturgeon in the Sacramento River and the Delta. The environmental conditions affected under Alternative 2A were briefly discussed above. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages. Environmental correlates addressed for green sturgeon include spawning habitat quantity, rearing habitat quantity, migration habitat condition, water temperature, food, and entrainment in diversions.

Impact Fish-75: Operations-Related Loss of Spawning Habitat Area for Green Sturgeon. Green sturgeon spawn in the cool, upper reaches of the Sacramento River, and possibly in the Feather River downstream of Oroville Dam. Changes in water supply operations potentially affect spawning habitat area for green sturgeon in the Sacramento and Feather Rivers. The spawning and egg incubation period for green sturgeon extends from late spring to early summer.

Change in Sacramento River flow attributable to water supply operations under Alternative 2A would not affect spawning habitat area for green sturgeon because the change in flow would not affect the existing area of deep pool habitat in the Sacramento River. This determination is based on the results of simulations of effects on spawning habitat area for Chinook salmon. Because Chinook salmon spawning habitat (which occurs in shallower habitats than green sturgeon spawning habitat) would not be reduced under Alternative 2A, it is reasonable to conclude that spawning habitat area for green sturgeon (which spawn in deep pools with fast water), also would not be affected. Similarly, change in Feather River flow attributable to water supply operations under Alternative 2A would not affect spawning habitat area for green sturgeon in the Feather River for the same reasons. This impact is less than significant. No mitigation is required.

Impact Fish-76: Operations-Related Loss of Rearing Habitat Area for Green Sturgeon. Changes in water supply operations potentially affect rearing habitat area for green sturgeon in the Sacramento and possibly the Feather Rivers, and move down into the Delta and San Pablo Bay during summer.

The flow simulated for 1922–1994 in the Sacramento and Feather Rivers for Alternative 2A varies relative to flow under Alternative 1 (Figure 6.1-5). The reduction in flow in some months and increases for other months and years have minimal effect on the range of flows that could affect rearing habitat area (Table 6.1-14). The impact on green sturgeon of any run would be less than significant.

Impact Fish-77: Operations-Related Decline in Migration Habitat Conditions for Green Sturgeon. The Sacramento River provides a migration pathway between freshwater and estuarine habitats for green sturgeon. Flows that occur in the Sacramento River generally support migration of adult sturgeon. Flows under Alternative 2A are within the range of flows that are simulated under Alternative 1. Flow changes under Alternative 2A would have minimal effect on movement and survival of juvenile green sturgeon. No mitigation is required.

Impact Fish-78: Operations-Related Increases in SWP Pumping and Resulting Entrainment Losses of Green Sturgeon. SWP and CVP pumping for Alternative 2A varies from pumping that was simulated for Alternative 1 (Figure 6.1-9). Change in pumping potentially alters entrainment and losses of juvenile green sturgeon from the Sacramento River basin and the South Delta. However, increases in pumping under Alternative 2A would have a minimal effect on green sturgeon entrainment. This determination is based on the fact that:

- In the past 12 years, only 99 juvenile green sturgeon have been entrained in the pumping facilities (IEP 2005), indicating that they rarely use the South Delta as rearing habitat and/or they are not subject to entrainment, relative to other species; and
- Implementation of Mitigation Measure Fish-MM-1 would reduce the potential for entrainment of green sturgeon.

This impact is less than significant. No mitigation is required.

Impact Fish-79: Operations-Related Reduction in Food Availability for Green Sturgeon. Many of the same factors affecting rearing habitat area would be expected to affect food production and availability for juvenile green sturgeon. Changes in water supply operations potentially affect prey habitat in the Sacramento and Feather Rivers. The flow simulated for 1922–1994 in the Sacramento and Feather Rivers for Alternative 2A varies relative to flow under Alternative 1 (Figure 6.1-5). The reduction in flow in some months and increases for other months and years has minimal effect on the range of flows that could affect rearing habitat area for juvenile green sturgeon (Table 6.1-14) and would likely have minimal effect on habitat supporting prey organisms. The impact on food for green sturgeon would be less than significant. No mitigation is required.

2020 Conditions

SWP and CVP pumping under 2020 conditions would be similar to operational conditions simulated under 2001 conditions (see Alternative 2A under 2001 conditions).

Changes in flow and diversions may affect fish and fish habitat in reaches of the Trinity, Sacramento, Feather, American, and San Joaquin Rivers and in the Delta and Suisun Bay. The simulated flow volume for the San Joaquin River and its tributaries for Alternative 2A under 2020 conditions is similar to the simulated flow for Alternative 1 under 2020 conditions (Figure 6.1-33). Similarly, flow in the Trinity River under Alternative 2A is nearly the same as flow under Alternative 1, with decreased flow in a few months (Figure 6.1-33). Flows for Alternative 2A under 2020 conditions for the Sacramento, Feather, and American Rivers frequently vary from flows for Alternative 1 under 2020 conditions (Figure 6.1-34). A consistent pattern of higher or lower flows, however, is not apparent. Specific effects on spawning and rearing habitat for Chinook salmon, steelhead, splittail, and green sturgeon are discussed in the following sections. These results are similar to those identified under 2001 conditions (see Alternative 2A under 2001 conditions, above).

Changes in Delta inflow from the Sacramento River reflect the cumulative effects of flow changes upstream on the Sacramento, Feather, and American Rivers (Figure 6.1-35). Changes in Sacramento River inflow between Alternative 2A and Alternative 1 under 2020 conditions potentially affect the proportion of flow drawn into the DCC and Georgiana Slough, although the effects appear to be relatively small (Figure 6.1-36). Changes in Delta outflow are similarly small relative to the outflow volume under Alternative 1, although slightly lower outflow results in some months (Figure 6.1-35). These results are similar to those identified under 2001 conditions (see Alternative 2A under 2001 conditions, above).

Delta outflow affects the downstream extent of fresh water and the estuarine salinity distribution. The parameter X2 (the distance in kilometers of the 2-ppt isohaline from the Golden Gate Bridge) is an indicator of potential effects of Delta outflow changes on salinity distribution. The simulated tidal hydraulic impacts for Alternative 2A under 2020 conditions would be similar to those simulated for Alternative 2A under 2001 baseline conditions because the simulated pumping patterns are similar (See Figure 5.2-28). Comparison of X2 for Alternative 1 and Alternative 2A under 2020 conditions indicates that for most months salinity distribution is similar (Figure 6.1-37). However, an upstream shift is relatively frequent during October and November. These results are similar to those identified under 2001 conditions (see Alternative 2A under 2001 conditions, above).

SWP and CVP combined pumping for Alternative 2A varies slightly from pumping that was simulated for Alternative 1 under 2020 conditions (Figure 6.1-38), but the pattern of pumping is similar to the pattern under 2001 conditions (see Figure 6.1-9 under Alternative 2A 2001 conditions, above). On average, CVP pumping is similar under 2020 conditions for Alternatives 1 and 2A, but

SWP pumping, averaged over the 73-year simulation, increases for every month. Although changes in exports are generally small, SWP pumping increases by at least 10% every month during at least 10% of the simulated years (1922–1994). Water supply changes associated with the Alternative 2A monthly changes simulated under 2020 conditions are similar to the impacts identified for 2001 conditions. Table 5.1-4 shows the simulated 2020 CVP pumping patterns compared to the 2001 CVP pumping patterns for Alternative 2A. Table 5.1-6 shows the simulated 2020 SWP pumping patterns compared to the 2001 SWP pumping patterns for Alternative 2A.

Therefore, because the simulated results of this alternative under 2020 conditions are similar to the results under 2001 conditions, operations-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon would be similar to the operational impacts described for Alternative 2A under 2001 conditions (i.e., Impact Fish-42 through Impact Fish-76).

Interim Operations

Implementation of Interim Operations would result in impacts less than those described above for Alternative 2A. Interim Operations would be similar to the proposed operations for December 15 through March 15 for Alternative 2A. The only interim operational changes are in the December 15–March 15 period, when the 8,500 cfs SWP pumping limit is assumed. There are no substantial changes in CVP pumping during these months, but SWP pumping would increase by more than 1,000 cfs during these months in only about 20% of the years (see Section 5.1, Water Supply). However, one of the conditions for Interim operations is that no substantial fish effects are allowed; therefore, effects under Interim Operations would be less than those described under Alternative 2A for December–March, and the same as Alternative 1 for the remainder of the year (i.e., no impacts).

Alternative 2B

Stage 1 (Physical/Structural Component)

Activities to construct and operate the gates are the same as under Alternative 2A. Therefore, construction-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green surgeon are identical to the physical/structural impacts described under Alternative 2A (i.e., Impact Fish-1 through Impact Fish-41). The impacts of gate operations on fish are the same as described under Alternative 2A.

2020 Conditions

The impacts from construction and operation of the physical components of this alternative under 2020 conditions would be the same as those under 2001 conditions—construction activities for Alternative 2B would include all activities described for Alternative 2A. Therefore, construction-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, green sturgeon are identical to the physical/structural impacts described for Alternative 2A under 2001 conditions (i.e., Impact Fish-1 through Impact Fish-41).

Stage 2 (Operational Component)

Relative to Alternative 1, water supply operations with implementation of the SDIP under Alternative 2B would have minimal effect on total Delta pumping and shift the timing of pumping in some months (Appendix K, "Tables and Figures Supporting the Impact Assessment of the SDIP on Fish, Alternatives 1, 2A–2C, 3B, 4B"). Changes in flow in the Trinity, Sacramento, Feather, American, and San Joaquin Rivers are similar to flow changes described under Alternative 2A (Figure 6.1-5; Appendix K). Changes in reservoir storage are negligible, as under Alternative 2A. Changes in Delta inflow from the Sacramento River, effects on flow drawn into the DCC and Georgiana Slough, and changes in Delta outflow (i.e., as reflected by X2) are also similar to changes described under Alternative 2A.

Chinook Salmon

Operations-related impacts of implementing Alternative 2B on winter-, spring-, and fall-/late fall–run Chinook salmon in Central Valley rivers and the Delta are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-42), rearing habitat area (Impact Fish-43), migration habitat conditions (Impact Fish-44), water temperature (Impact Fish-45), and food (Impact Fish-48) reflect the less-than-significant impacts that would also occur under Alternative 2B. Figures and tables for Alternative 2B impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses (Impact-Fish-46 and Impact-Fish-47) are less than the impacts described under Alternative 2A and are less than significant for Alternative 2B as described below.

Under Alternative 1, simulated SWP and CVP pumping result in estimated annual losses of fall-run Chinook salmon that range from about 10,000 juveniles to 55,000 juveniles (Figure 6.1-28). Most fall-run Chinook salmon entrainment losses have occurred historically during May (Appendix J). Entrainment losses under Alternative 2B vary little from Alternative 1, with some substantial reductions in a few years (Figure 6.1-28). Given the relatively small change in entrainment losses in most years, the impact on fall-run Chinook salmon originating from the Sacramento and San Joaquin Rivers is considered less than significant.

Simulated SWP and CVP pumping result in estimated annual losses of late fall–run Chinook salmon that range from about 400 juveniles to 1,500 juveniles (Figure 6.1-28). Entrainment losses for late fall–run Chinook salmon are generally reduced under Alternative 2B, providing a potential small benefit.

Simulated SWP and CVP pumping result in estimated annual losses of winter-run Chinook salmon under Alternative 1 that range from about 1,000 juveniles to 5,000 juveniles (Figure 6.1-28). Similar to late-fall run, entrainment losses are generally reduced under Alternative 2B and may provide a small benefit.

Simulated SWP and CVP pumping result in estimated annual losses of spring-run Chinook salmon under Alternative 1 that range from about 5,000 juveniles to 35,000 juveniles (Figure 6.1-28). Entrainment losses under Alternative 2B vary little from Alternative 1, with some substantial reductions in a few years (Figure 6.1-28). Given the relatively small change in entrainment losses in most years, the impact on spring-run Chinook salmon is considered less than significant. No mitigation is required.

Coho Salmon

Operations-related impacts of implementing Alternative 2B on coho salmon in the Trinity River are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-49), rearing habitat area (Impact Fish-50), migration habitat conditions (Impact Fish-51), water temperature (Impact Fish-52), and food (Impact Fish-53) reflect the effects and less-than-significant impacts that would also occur under Alternative 2B. Figures and tables for Alternative 2B impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Steelhead

Operations-related impacts of implementing Alternative 2B on steelhead in Central Valley rivers and the Delta are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-54), rearing habitat area (Impact Fish-55), migration habitat conditions (Impact Fish-56), water temperature (Impact Fish-57), and food (Impact Fish-59) reflect the less-than-significant impacts that would also occur under Alternative 2B. Figures and tables for Alternative 2B impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses (Impact Fish-58) are less than the impacts described under Alternative 2A and are less than significant under Alternative 2B as described below.

Under Alternative 1, simulated annual salvage of steelhead varies from about 1,000 juveniles to 4,500 juveniles (Figure 6.1-29). Salvage, and hence entrainment losses, generally decreases under Alternative 2B, approaching or exceeding a 10% decrease in some years. Reduced entrainment losses would have a small beneficial effect.

Delta Smelt

Operations-related impacts of implementing Alternative 2B on delta smelt are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-60), rearing habitat area (Impact Fish-61), and migration habitat conditions (Impact Fish-62), reflect the less-than-significant impacts that would also occur under Alternative 2B. Figures and tables for Alternative 2B impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses and food availability (Impact Fish-63 and Impact Fish-64) are less than the impacts described under Alternative 2A and are less than significant as described below.

Under Alternative 1, simulated annual salvage of delta smelt varies from about 6,000 to 35,000 individuals (Figure 6.1-30). Most delta smelt (i.e., about 90%) are salvaged during May–July. Salvage increases slightly under Alternative 2B. The increases are generally less than 5%, and substantial decreases (i.e., 10% to 30%) occur in a few years (Figure 6.1-30). Given the small increase in salvage and the larger reductions in some years, the impact on delta smelt is considered less than significant. No mitigation is required.

Splittail

Operations-related impacts of implementing Alternative 2B on splittail in Central Valley rivers and the Delta are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-65), rearing habitat area (Impact Fish-66), migration habitat conditions (Impact Fish-67), and food (Impact Fish-69) reflect the less-than-significant impacts that would also occur under Alternative 2B. Figures and tables for Alternative 2B impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K. Impacts associated with entrainment losses are less than the impacts described under Alternative 2A (Figure 6.1-31) and are less than significant.

Striped Bass

Operations-related impacts of implementing Alternative 2B on striped bass are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-70), rearing habitat area (Impact Fish-71), and migration habitat conditions (Impact Fish-72), reflect the less-than-significant impacts that would also occur under Alternative 2B. Figures and tables for Alternative 2B impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses and food availability (Impact Fish-73 and Fish-74) are less than the impacts described under Alternative 2A and are less than significant.

Green Sturgeon

Operations-related impacts of implementing Alternative 2B on green sutrgeon are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-75), rearing habitat area (Impact Fish-76), migration habitat conditions (Impact Fish-77), and food availability (Impact Fish-79) reflect the less-than-significant impacts that would also occur under Alternative 2B. Impacts associated with entrainment losses are similar to the impacts described under Alternative 2A (Impact Fish-78).

2020 Conditions

Because the simulated operations of this alternative under 2020 conditions are similar to the results under 2001 conditions, operations-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, green sturgeon would be similar to the operational impacts described for Alternative 2B under 2001 conditions.

Alternative 2C

Stage 1 (Physical/Structural Component)

Activities to construct and operate the gates are the same as under Alternative 2A. Therefore, construction-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are identical to the construction-related impacts described under Alternative 2A (Impact Fish-1 through Impact Fish-41).

2020 Conditions

The physical/structural component of this alternative is the same as Alternative 2A, and the impacts from construction of the physical/strucutural component of this alternative under 2020 conditions would be the same as those under 2001 conditions. Therefore, construction-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are identical to the physical/structural impacts described for Alternative 2A under 2001 conditions (i.e., Impact Fish-1 through Impact Fish-41).

Stage 2 (Operational Component)

Relative to Alternative 1, water supply operations with implementation of the SDIP under Alternative 2C would have a small effect on total Delta pumping and shift the timing of pumping in some months (Appendix K). Changes in flow in the Trinity, Sacramento, Feather, American, and San Joaquin Rivers are similar to flow changes described under Alternative 2A (Figure 6.1-5; Appendix K). Changes in reservoir storage are negligible, as under Alternative 2A. Changes in Delta inflow from the Sacramento River, effects on flow drawn into the DCC and Georgiana Slough, and changes in Delta outflow (i.e., as reflected by X2) are similar to changes described under Alternative 2A (Figure 6.1-6, Figure 6.1-7, Figure 6.1-8).

Chinook Salmon

Operations-related impacts of implementing Alternative 2C on winter-, spring-, and fall-/late fall–run Chinook salmon in Central Valley rivers and the Delta are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-42), rearing habitat area (Impact Fish-43), migration habitat conditions (Impact Fish-44), water temperature (Impact Fish-45), and food availability (Impact Fish-48), reflect the less-than-significant impacts that would also occur under Alternative 2C. Figures and tables for Alternative 2C impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses and food availability (Impact Fish-46 and Fish-47) are similar to the impacts described under Alternative 2A. The same mitigation measures (Fish-MM-1 and Fish-MM-2) would result in less-than-significant impacts on Chinook salmon.

Coho Salmon

Operations-related impacts of implementing Alternative 2C on coho salmon in the Trinity River are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-49), rearing habitat area (Impact Fish-50), migration habitat conditions (Impact Fish-51), water temperature (Impact Fish-52), and food (Impact Fish-53) reflect the effects and less-than-significant impacts that would also occur under Alternative 2C. Figures and tables for Alternative 2C impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Steelhead

Operations-related impacts of implementing Alternative 2C on steelhead in Central Valley rivers and the Delta are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-54), rearing habitat area (Impact Fish-55), migration habitat conditions (Impact Fish-56), water temperature (Impact Fish-57), and food availability (Impact Fish-59) reflect the less-than-significant impacts that would also occur under Alternative 2C. Figures and tables for Alternative 2C impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses (Impact Fish-58) are similar to the impacts described under Alternative 2A. Fish-MM-1 and Fish-MM-2 would result in a less-than-significant impact on steelhead.

Delta Smelt

Operations-related impacts of implementing Alternative 2C on delta smelt are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-60), rearing habitat area (Impact Fish-61), and migration habitat conditions (Impact Fish-62), reflect the less-than-significant impacts that would also occur under Alternative 2C. Figures and tables for Alternative 2C impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses and food availability (Impact Fish-63 and Fish-64) are similar to the impacts described under Alternative 2A. Fish-MM-1, Fish-MM-2, and Fish-MM-3 would result in a less-than-significant impact on delta smelt.

Splittail

Operations-related impacts of implementing Alternative 2C on splittail in Central Valley rivers and the Delta are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-65), rearing habitat area (Impact Fish-66), migration habitat conditions (Impact Fish-67), and food availability (Impact Fish-69) reflect the less-than-significant impacts that would also occur under Alternative 2C. Figures and tables for Alternative 2C impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses (Impact Fish-68) are less than significant and similar to the impacts described under Alternative 2A.

Striped Bass

Operations-related impacts and subsequent mitigation measures of implementing Alternative 2C on striped bass are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-70), rearing habitat area (Impact Fish-71), and migration habitat conditions (Impact Fish-72), reflect the less-than-significant impacts that would also occur under Alternative 2C. Figures and tables for Alternative 2C impacts that correspond to the figures and tables cited under the Alternative 2A discussion are found in Appendix K.

Impacts associated with entrainment losses and food availability (Impact Fish-73 and Fish-74) are similar to the impacts described under Alternative 2A. Mitigation Measures Fish-MM-1, Fish-MM-2, and Fish-MM-3 would result in a less-than-significant impact on striped bass.

Green Sturgeon

Operations-related impacts of implementing Alternative 2C on green sturgeon are similar to those described under Alternative 2A. Impacts described under Alternative 2A for spawning habitat area (Impact Fish-75), rearing habitat area (Impact Fish-76), migration habitat conditions (Impact Fish-77), and food availability (Impact Fish-79) reflect the less-than-significant impacts that would also occur under Alternative 2C. Impacts associated with entrainment losses are similar to the impacts described under Alternative 2A (Impact Fish-78).

2020 Conditions

Because the simulated results of this alternative under 2020 conditions are similar to the results under 2001 conditions, operations-related impacts for Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon would be similar to the operational impacts described for Alternative 2C under 2001 conditions.

Alternative 3B

Stage 1 (Physical/Structural Component)

Construction activities under Alternative 3B include all activities described under Alternative 2A, with the exception of the Grant Line Canal Gate, which would not be built or operated. Therefore, construction-related impacts on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are similar to, but slightly less than, the construction-related impacts described under Alternative 2A (Impact Fish-1 through Impact Fish-41). Operation of the gates under Alternative 3B would be the same as described under Alternative 2B, with the exception of not building/operating the Grant Line Canal Gate. Therefore the impacts of gate operations on fish are nearly the same, but less than as described under Alternative 2B (Impacts Fish-42 through Impact Fish-79).

2020 Conditions

The impacts from construction of the physical/structural component of this alternative would be similar to, but slightly less than, the construction-related impacts described for Alternative 2A, resulting in similar but slightly less impacts on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon (see Alternative 2A under 2001 conditions, Impact Fish-1 through Impact Fish-41).

Stage 2 (Operational Component)

The monthly SWP and CVP operational patterns of Alternative 3B are the same as those of Alternative 2B (see Alternative 2B in Sections 5.1, Water Supply, and 5.3, Water Quality). Therefore, the operational impacts resulting from state and federal operations under Alternative 3B are the same as described for Alternative 2B.

Thus, operations-related impacts for Alternative 3B on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are the same for operational patterns described for Alternative 2B under 2001 conditions.

2020 Conditions

Water supply for Alternative 3B under 2020 conditions are similar to water supply for 2001 conditions. Streamflows, pumping, and diversions associated with Alternative 3B simulated under 2020 conditions are similar to the 2001 conditions simulation. Therefore, the impacts for the operational component for Alternative 3B under 2020 conditions and their levels of significance on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are the same as the impacts described for 2001 conditions, and subsequently, are nearly the same as for Alternative 2B under 2001 conditions.

Alternative 4B

Stage 1 (Physical/Structural Component)

Construction activities under Alternative 4B include all activities described under Alternative 2A, with the exception of the flow control gates (i.e., Grant Line Canal, Old River, and Middle River gates). Under Alternative 4B, the fish control gate at the head of Old River would be constructed and operated. Therefore, physical/structural component impacts on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon are similar to, but less than, the physical/structural component impacts described under Alternative 2A (Impact Fish-1 through Impact Fish-41). Operation of the head of Old River fish control gate under Alternative 4B would be the same as described under Alternative 2B, with the exception of not building/operating the 3 flow control gates. Therefore the impacts of gate operations on fish are the nearly the same, but less than as described under Alternative 2B or 3B (Impacts Fish-42 through Impact Fish-79).

2020 Conditions

The physical/structural component of this alternative is the same as Alternative 2A, with the exception of the flow control gates (i.e., Grant Line Canal, Old River, and Middle River gates), and the impacts from construction and operation of the physical/structural component of Alternative 4B under 2020 conditions would be the same as those described under 2001 conditions. Hence, the impacts from construction and operation of the physical/structural component of this alternative would be similar to, but slightly less than, the construction-related impacts described for Alternative 2A, resulting in similar but slightly less impact on Chinook salmon, steelhead, delta smelt, splittail, striped bass, and green sturgeon (see Alternative 2A under 2001 conditions, Impact Fish-1 through Impact Fish-41).

Stage 2 (Operational Component)

The monthly state and federal operational patterns of Alternative 4B are the same as Alternative 2B (see Alternative 2B in Sections 5.1, Water Supply, and 5.3, Water Quality). Therefore, the operational impacts resulting from state and federal operations under Alternative 4B are the same as described for Alternative 2B.

Thus, operations-related impacts for Alternative 4B on Chinook salmon, steelhead, delta smelt, splittail, striped bass and green sturgeon are the same for operational impacts described for Alternative 2B under 2001 conditions.

2020 Conditions

Water supply for Alternative 4B under 2020 conditions are similar to water supply for 2001 conditions. Streamflows, pumping, and diversions associated with Alternative 4B simulated under 2020 conditions are similar to the 2001 conditions simulation. Therefore, the operations-related impacts for Alternative 4B under 2020 conditions and their levels of significance on Chinook salmon, steelhead, delta smelt, splittail, striped bass and green sturgeon are the same as the impacts described for 2001 conditions, and subsequently, are nearly the same as Alternative 2B under 2001 conditions.

Adaptive Management

To address uncertainties associated with the effectiveness of some of the mitigation measures described for SDIP alternatives, DWR and Reclamation will implement these measures based on the principles of adaptive management, which allow these measures to be adjusted over time, based on results of monitoring and research. The mitigation measures that are subject to adaptive management are related to measures designed to minimize effects on special-status fish species. These species and mitigation measures are shown below:

- Delta smelt—
    - Minimize Entrainment Losses of Juvenile Delta Smelt Associated with Increased SWP Pumping during March–June.
- Central Valley fall-/late fall–run Chinook salmon, Central Valley spring-run Chinook salmon, Sacramento winter-run Chinook salmon, and Central Valley steelhead—
    - Minimize Entrainment-Related Losses of Juvenile Fall-/Late Fall–Run Chinook Salmon Associated with Increased SWP Pumping during March–June.

Results of SDIP effectiveness monitoring and relevant monitoring and research conducted through the CALFED Science Program will be used to determine the effectiveness of these mitigation measures in minimizing effects on special-status fish species. Based on this assessment of monitoring and research results, the measures may be modified to improve their effectiveness. Modifications to the mitigation measures may be proposed by DWR, Reclamation, USFWS, NOAA Fisheries, or DFG. The process for adaptively managing implementation of these measures is described below:

1. **Assessment of Effectiveness of Mitigation Measures.** An annual monitoring report will be prepared that will include an analysis of monitoring results to determine the effectiveness of mitigation measures. Monitoring reports will be submitted to CBDA and the resource agencies for review.
2. **Recommendations for Modifying Mitigation Measures.** Based on the analysis of SDIP monitoring results, DWR and Reclamation may propose modifications to the mitigation measures to improve their effectiveness. The resource agencies will be notified in writing of the proposed modifications and will review the proposed modifications, including the supporting data analyses. If the resource agencies concur with the proposed modifications, they will be implemented.

The resource agencies may also recommend modifications to the mitigation measures. The resource agencies will submit proposed modifications to DWR and Reclamation for review. If DWR and Reclamation concur with the proposed modifications, they will be implemented.

3. **Revisions to the Monitoring Program.** If mitigation measures are modified, the SDIP monitoring program will be revised to provide for monitoring and research to test the effectiveness of the modified measures.

Effects of South Delta Improvements Program on Environmental Water Account Fish Entrainment Protection Effectiveness

The average amount of EWA sponsored pumping reductions that are included in the 2001 CALSIM baseline simulation was 202 taf/yr. The CALSIM model for the SDIP alternatives included a constant purchase of 185 taf/yr; therefore, the variable assets (i.e., half of the SWP gains from CVPIA (b)(2) releases) were 17 taf/yr. The CALSIM 2001 and 2020 baseline simulations are consistent with each other and represent a typical EWA protection pattern within the CALSIM monthly model.

SDIP alternatives may allow increased pumping during periods when EWA actions to reduce entrainment would be taken under the baseline. Additional EWA assets, therefore, would be required to provide the same level of fish protection and water deliveries. This additional SWP pumping would be either for Table A (firm) deliveries or for Article 21 (interruptible) deliveries. However, effects on fish entrainment depend only on the amount of pumping, and not on the type of deliveries being made. Most of the EWA actions to reduce SWP Banks pumping in April and May during VAMP would have the same water supply cost as the baseline because the baseline pumping is less than 6,680 cfs during this period. EWA actions during periods when allowable SDIP pumping is increased would require more EWA assets to maintain the same entrainment protection.

Appendix B, “Simulation of EWA Actions to Reduce Fish Entrainment Losses,” describes the likely effects of 8,500-cfs pumping limit on EWA and fish protection for several recent years. An interagency EWA exercise using an interactive daily simulation model has been conducted, and the observed shifts in EWA assets generally correspond to relatively small shifts in necessary assets. The daily gaming model allowed higher pumping with the 8,500 cfs in the weeks following the specified fish protection actions. The recent years of actual EWA actions have focused pumping reduction actions on the April, May, and June periods when the baseline pumping is below the 6,680-cfs pumping limit and will not be increased with the SDIP increased pumping limits.

The SDIP fish assessment assumes that an expanded EWA (i.e., larger than the CALFED ROD EWA) will be adopted as part of future CALFED programs, and that this will match the general description used for the 2004 OCAP documents.

The mitigation measures that are required to reduce fish impacts of the SDIP Alternatives 2A and 2C to less-than-significant levels each involve reductions from the 8,500-cfs limit to the existing limit when EWA actions are taken to reduce pumping impacts. An EWA credit (of 10% to 30%) would also be given for increased pumping achieved with the increased SDIP limit in the months of November–March. These mitigation measures are designed to provide the identical level of EWA protections with the increased SWP Banks pumping (i.e., CCF diversion) limit. All of these SDIP mitigation measures would be incorporated into the expanded long-term EWA program, once it is adopted.

Effects of Water Transfers on Fish Entrainment

The CALSIM modeling of the 2001 and 2020 baselines (existing conditions and future no action) indicates that in many years there will be unused pumping capacity during the July–September period that may be available for moving additional water transfers through the Delta. This is the major “window of opportunity” for water transfers because the allowable E/I ratio is 65%, there are high water demands for beneficial uses of additional water transfers, there are relatively few fish-related impacts along the river corridors and within the Delta channels, and there are fewer entrainment losses of fish at the export pumps during these summer months. Water transfer capacity is available under existing conditions, and additional water transfer capacity would be provided in some years with the SDIP alternatives.

The SDIP alternatives include the simulation of water transfers made for EWA as generally described in the CALFED ROD and represented in the 2002 benchmark version of CALSIM. The effects of these simulated EWA transfers through the Delta are included in the CALSIM monthly Delta flow values and the subsequent DSM2 modeling and fisheries impact analysis. The Delta impacts of these simulated EWA transfers and exports are therefore fully evaluated in the SDIP impact assessment methods. The water transfer capacity was estimated by assuming that a maximum of 3,300 cfs would be added to each monthly pumping flow unless the existing pumping limit of 7,180 cfs for baseline or 8,500 cfs for SDIP alternatives had been reached. A maximum of 600 taf could therefore be transferred with an increment of 300 cfs for the 3-month period, if pumping capacity was available. Section 5.1 (Table 5.1-14) indicates that the average water transfer capacity based on the 2001 CALSIM baseline was 250 taf.

Alternative 2A would allow an increase in water transfers from 250 taf/yr associated with current pumping limits to 343 taf/yr. The SDIP increase in SWP Banks pumping would allow potential water transfers to increase by an average of 93 taf/yr. The potential fish impacts associated with these additional water transfers of 93 taf/yr would be SDIP indirect impacts. The 250 taf/yr of water transfers that might occur under the baseline conditions are considered in the cumulative effects analysis since they could occur without the SDIP project. (See Chapter 10 for the analysis of Fish effects.)

Table J-7 (Appendix J) shows the monthly historical salvage data at the SWP Skinner fish facility and indicates that the majority of delta smelt salvage has occurred in the months of April, May, June, and July. The average annual SWP entrainment for 1980–2002 was 27,500 fish. The annual entrainment has ranged from about 500 (in 1998) to more than 100,000 (in 1999). The median monthly SWP salvage density values are highest in the months of May (1.64 fish/cfs), June (3.09 fish/cfs), and July (0.45 fish/cfs). June pumping causes the highest entrainment; May pumping causes about half as much entrainment, and July pumping causes 15% of the entrainment caused by June pumping. There is some entrainment in January and February, but this winter pumping entrains only 5% as many fish as May pumping. However, because these adult delta smelt are ready to spawn, they may be more important than the small numbers would indicate.

The possible indirect entrainment impacts of the water transfers in July–September were calculated using the monthly salvage density patterns, and were based on the maximum transfer capacity of 3,300 cfs (see Table 5.1-14). Because there are relatively low salvage densities for the protected fish species (delta smelt, steelhead, and Chinook salmon runs) during the transfer window, the increased entrainment from the transfers are relatively small. Only delta smelt has a large enough assumed salvage density in July to raise the delta smelt entrainment by more than a few percent of the annual entrainment. The delta smelt entrainment would increase by about 1,500 fish in July with a maximum water transfer of 3,300 cfs assuming the median delta smelt density. This would represent about 5% of the average annual entrainment of delta smelt for the 2001 baseline and is considered to be less than significant. If SWP Banks salvage data and the 20-mm delta smelt surveys indicate that the maximum possible July water transfers of 3,300 cfs would pose a substantial risk for the delta smelt population in a particular year (i.e., late spawning with a peak juvenile abundance in July), the normal EWA adaptive management decision-making procedures could be used to inform DWR to delay the beginning of the water transfers to mid-July, or to reduce the allowable water transfer in July.

Adaptive Management of Flow Control Gates for Fish Protection

Section 5.2, Delta Tidal Hydraulics, includes a discussion about how flow control gate operations will affect tidal level and tidal flow in the south Delta channels. This section describes the general influences of the gate operations on south Delta fish habitat and fish movement patterns and gives some general fish protection guidelines that will be incorporated into the adaptive management operations of the flow control gates. All of the SDIP project purposes, as well as the tidal hydraulic and water quality mitigation measures and fish protection measures, can be achieved with the consistent operations of the flow control gates, as described below.

Partially closing the head of Old River fish control gate can reduce the diversion of high-EC San Joaquin River water into the south Delta channels (WQ-MM-2) and provide some protection for any fish migrating downstream in the San Joaquin River (i.e., Chinook salmon, steelhead, and splittail). Maintaining a minimum head of Old River diversion of at least 10% of the Vernalis flow to increase flushing of south Delta channels (WQ-MM-3) will only slightly reduce the protection for juvenile Chinook salmon in April and May, and is consistent with the existing temporary barrier operations with culverts. The permanent flow control gate can be operated for a longer period (i.e., corresponding to early migration of juvenile Chinook salmon in wet years) than is possible with the temporary barrier (April 15–May 15), and thereby increase the duration of the protection of juvenile Chinook salmon.

Flow control gate operations (HY-MM-3) to provide more net tidal flows from Victoria Canal into Middle River and from Old River at Clifton Court Ferry into the Old River channel upstream of CVP Tracy will lower the EC of the western portion of these channels. However, the possible effects of these flow control gate operations on fish habitat and movement are unknown. Although these south Delta channels may provide suitable delta smelt and Chinook salmon rearing habitat, the risk of entrainment during periods of fish movement is relatively high. Flow control gate operations are not assumed to offer any advantage to fish habitat or movement, or to provide any protection from entrainment in the CVP and SWP pumping facilities.

Daily Operations of South Delta Flow Control Gates

The simulated effects of operations of the south Delta flow control gates on tidal level and tidal and net flows have been accurately described in Section 5.2. Based on these simulated tidal hydraulic effects and the anticipated water quality and fish protection effects, the major decisions (choices) for operating each flow control gate must be considered within an adaptive management framework to satisfy the several interrelated purposes of these gates. Adaptive management procedures for the south Delta flow control gates can be developed from three gate operation choices to provide maximum water level, water quality, and fish protection benefits from the flow control gate operations:

1. Operation of the CCF intake gates have two main effects that must be balanced: If the gates are closed during the flood-tide flows prior to the high tide each day, the tidal flushing in south Delta channels can be maximized, and levels at high tide throughout the south Delta channels are preserved. This will allow Tom Paine Slough siphons to operate and provide the maximum tidal flushing upstream of the flow control gates. Fish migration patterns for Chinook salmon or delta smelt might be triggered or cued to tidal fluctuations or diurnal periods (i.e., dawn and dusk). As more is learned about these diurnal or tidal migration patterns, the CCF gate schedule might be modified to reduce opening at peak fish density periods within the day. The CCF intake gates, however, must be opened for a sufficient period each day to maintain the CCF elevations above -2.0 feet msl to prevent cavitation

problems at SWP Banks, which is often used for maximum off-peak (nighttime) pumping.

2. The head of Old River fish control gate can be operated to reduce the San Joaquin River diversions into Old River. This will increase the San Joaquin River flow past Stockton and improve DO conditions in the DWSC, which is assumed to provide fish habitat benefits. Reduction of the head of Old River diversions will also reduce the inflow of higher-salinity San Joaquin River water into the south Delta channels. This may also be beneficial for adult up-migrating Chinook salmon past Stockton during the months of September through November. However, reduced diversions will cause more water to be drawn from the central Delta to supply the CVP and SWP pumping, which may increase entrainment of some larval or juvenile fish (e.g., delta smelt) from the central Delta. Partial closure of the head of Old River gate will also shift the distribution of San Joaquin River salinity away from the CVP Tracy facility toward the CCWD intakes and the SWP Banks facility. There do not appear to be any substantial effects on water levels in the south Delta channels from reduced San Joaquin River diversions at the head of Old River if flow control gates are being operated. Closure of the fish control gate for fish protection or DO improvement may be possible for more of the time than was simulated in the DSM2 modeling of the SDIP alternatives. The fish control gate operations must satisfy the SDIP objective to protect outmigrating Chinook salmon juvenile smolts, as well as satisfy HY-MM-2, WQ-MM-2, WQ-MM-3, and WQ-MM-4.

3. The flow control gates at Grant Line Canal, Old River at DMC, and Middle River can be used to control the water levels in the south Delta channels. In addition, ebb-tide closure of the Old River and Middle River flow control gates can produce a net circulation upstream on Old River and Middle River and downstream in Grant Line Canal. This ebb-tide closure of Old and Middle River flow control gates is expected to have a beneficial effect on salinity in these south Delta channels and should be considered for Alternatives 2A, 2B, and 2C, although only required as mitigation for Alternative 3B. The ebb-tide closure of the flow control gates is not anticipated to substantially change the fish movement patterns that are triggered by or associated with tidal flows.

Mitigation Measures HY-MM-1, HY-MM-2, and HY-MM-3, as well as WQ-MM-1, WQ-MM-2, WQ-MM-3, and WQ-MM-4, involve operations of the CCF gates, the head of Old River fish control gate, and the Old River and Middle River flow control gates to provide more suitable tidal hydraulic and water quality conditions in the south Delta channels, and provide protection for migrating fish in the San Joaquin River. These mitigation measures will vary on a day-by-day basis depending on the inflows, export pumping, and water quality conditions measured at Vernalis and within the south Delta, as well as fish densities measured at the CVP and SWP salvage facilities and in the Mossdale trawls. Each of these mitigation measures therefore should be implemented using these recommended adaptive management procedures for operating the south Delta flow control gates.

6.2 Vegetation and Wetlands

Introduction

This section presents the results and the evaluation of the impacts on constructing or operating the SDIP on vegetation and wetlands. This section:

- provides a description of land cover types, special-status plant species, and waters of the United States;
- evaluates and discusses the impacts associated with construction and operation in the project area; and
- recommends measures to mitigate significant impacts in the project area.

Summary of Significant Impacts

Table 6.2-S presents a summary of the significant impacts on vegetation and wetlands and mitigation measures that are associated with each project alternative. See the impact section for each alternative for a detailed discussion of all impacts and mitigation measures.

Table 6.2-S. Summary of Significant Impacts on and Mitigation for Vegetation and Wetlands

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
VEG-1: Loss or Alteration of Nonjurisdictional Woody Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging	2A–2C, 3B, 4B	Significant	VEG-MM-1: Minimize Impacts on Sensitive Biological Resources VEG-MM-2: Compensate for Unavoidable Temporary and Permanent Loss of Riparian Habitats	Less than significant
VEG-4: Spread of Noxious Weeds as a Result of Gate Construction and Channel Dredging	2A–2C, 3B, 4B	Significant	VEG-MM-3: Avoid Introduction and Spread of New Noxious Weeds during Project Construction and Dredging	Less than significant
VEG-5: Loss or Disturbance of Mason's Lilaeopsis Stands or Potential Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging	2A–2C, 3B, 4B	Significant	VEG-MM-1: Minimize Impacts on Sensitive Biological Resources VEG-MM-4: Conduct Preconstruction Surveys for Special-Status Plants VEG-MM-5: Minimize Impacts on and Compensate for Loss of Mason's Lilaeopsis VEG-MM-6: Monitor Existing Stands of Mason's Lilaeopsis during Gate Operations	Less than significant

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
VEG-6: Loss or Disturbance of Delta Mudwort Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging	2A–2C, 3B, 4B	Significant	VEG-MM-1: Minimize Impacts on Sensitive Biological Resources VEG-MM-4: Conduct Preconstruction Surveys for Special-Status Plants VEG-MM-5: Minimize Impacts on and Compensate for Loss of Mason’s Lilaeopsis VEG-MM-6: Monitor Existing Stands of Mason’s Lilaeopsis during Gate Operations	Less than significant
VEG-7: Loss of Rose-Mallow Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging	2A–2C, 3B, 4B	Significant	VEG-MM-1: Minimize Impacts on Sensitive Biological Resources VEG-MM-4: Conduct Preconstruction Surveys for Special-Status Plants VEG-MM-7: Avoid and Minimize Impacts on Special-Status Plants VEG-MM-8: Compensate for Unavoidable Impacts on Tule and Cattail Tidal Emergent Wetlands	Less than significant
VEG-8: Filling of Tule and Cattail Tidal Emergent Wetland and Jurisdictional Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging	2A–2C, 3B	Significant	VEG-MM-1: Minimize Impacts on Sensitive Biological Resources VEG-MM-2: Compensate for Unavoidable Temporary and Permanent Loss of Riparian Habitats VEG-MM-7: Avoid and Minimize Impacts on Special-Status Plants. VEG-MM-9: Monitor Existing Stands of Tidal Emergent Wetland and Riparian Wetland Vegetation during Gate Operation	Less than significant
VEG-9: Filling or Disturbance of Tidal Perennial Aquatic Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging	2A–2C, 3B, 4B	Significant	VEG-MM-1: Minimize Impacts on Sensitive Biological Resources VEG-MM-10: Compensate for Loss of Tidal Perennial Aquatic Habitat	Less than significant

Affected Environment

The study area as defined for this chapter includes all waterways identified by the DWR Delta Modeling Branch as being affected by gate operation (Figure 6.2-1).

The project area is defined as the construction and dredging zone for the four gate sites (Figures 6.2-2–6.2-5), the three proposed dredge areas and the associated dredged material disposal sites (Figures 6.2-6–6.2-8), and the siphon extension sites (Figure 2-8).

Sources of Information

The following sections describe the existing information used to prepare the affected environment section for vegetation and wetlands:

- studies conducted specifically for the project,
- published literature, and
- previous studies conducted for CALFED.

Land Cover Types

A land cover type represents the dominant features of the land surface and can be defined by natural vegetation, water, or human uses (e.g., agricultural lands, landscaping). For the purpose of this EIS/EIR, most land cover types were mapped in the portion of the study area between the levees, although the agriculture land cover type was partially included at the gate sites (Figures 6.2-1–6.2-8 and Table 6.2-1). The regulatory compliance documents for the SDIP will be consistent with the programmatic documents prepared for CALFED. For this reason, the land cover types identified in the study area for this project are defined based on the CALFED Multi-Species Conservation Strategy (MSCS), which serves as a Natural Community Conservation Plan (NCCP) for compliance of CALFED with the Natural Community Conservation Plan Act (CALFED Bay-Delta Program 2000e).

DWR conducted surveys and mapped the land cover types in the study area in 2000 and 2001. Riparian areas and levee faces were surveyed from a slowly moving boat. Botanical surveys of uplands adjacent to existing and proposed gate sites were conducted by foot in an area extending 500 feet inland from the levee and 500 feet upstream and downstream from proposed gate sites.

DWR botanists mapped and characterized representative sites for the major land cover types within the SDIP area of impact. Large representative stands of the dominant vegetation types were selected at sites throughout the project area. The vegetation was described (species composition and cover), and the location was recorded with a Global Positioning System (GPS) unit. These representative sites were superimposed onto orthorectified, georeferenced aerial photographs of the area (September 1, 2000, 1:2400 scale, acquired at low tide). The aerial photographs were used to classify and map riparian/streamside vegetation. Acreages were calculated either from the GIS data or were planimetered from the aerial photographs.

Jones & Stokes botanists conducted a reconnaissance-level survey of the proposed gate sites on April 16, 2002 and botanical surveys of the proposed dredged material disposal sites on Roberts Island and Stewarts Tract on November 23, 2004.

Additional information on land cover types was reviewed in existing documents previously prepared for the project (California Department of Water Resources and Bureau of Reclamation 1996a) and for CALFED (2000b and 2000e). This information is based on reconnaissance-level surveys conducted within and outside of the study area.

Special-Status Plants

A consolidated list of special-status plant species that potentially occur and were included in the 2000–2001 plant surveys in the study area was generated from four sources:

- USFWS Species List provided for the SDIP, dated November 8, 2004 (Appendix M; U.S. Fish and Wildlife Service 2004);
- CNDDB (California Natural Diversity Database 2001);
- CNDDB (California Natural Diversity Database 2004); and
- California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California (California Native Plant Society 2001).

Each species on the list was evaluated for its potential to occur in the study area; species that are not found in land cover types present in the study area were eliminated from further consideration and are not included in Table 6.2-2.

DWR conducted special-status plant surveys of the study area in 2000 and 2001 to map all occurrences of special-status species in waterways, around all in-channel islands, and in uplands adjacent to existing barriers and proposed gate sites in the SDIP area of impact (Figure 6.2-1). Surveys of waterways and in-channel islands were conducted from a slowly moving boat that allowed staff to reliably find all occurrences of special-status species. DWR botanists conducted floristic surveys of data point areas for vegetation and wetland surveys by examining the entire site by foot and searching for special-status species. Proposed dredged material disposal sites were not included in the study area surveys.

Special-status plant surveys were dispersed throughout the growing season to allow observation of different plant species during their respective flowering periods. Surveys were conducted from June to September to encompass the flowering period of all target special-status species (Table 6.2-2).

Attempts were made to relocate all plant occurrences listed on the CNDDB (California Natural Diversity Database 2001) for the SDIP area of impact. Attempts to relocate two species listed on the CNDDB (marsh skullcap and

Table 6.2-1. Existing Land Cover Types in the SDIP Study Area and Project Area

			Acreage at Gate Sites				Acreage at Dredging Areas				
NCCP Community Type	Land Cover Type	Total Acres in Study Area	Middle River Flow Control Gate	Grant Line Canal Flow Control Gate	Old River at DMC Flow Control Gate	Head of Old River Fish Control Gate	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area	Spot Dredging Areas for Agricultural Diversion	Acreage at Dredge Material Disposal Sites
Tidal perennial aquatic	Tidal perennial aquatic	2225.6	8.3	10.4	3.7	7.6	73.0	72.7	123.5	477.3	0
Tidal freshwater emergent	Tule and cattail tidal emergent wetland	121.2	0.5	0.4	0.4	0	3.3	6.6	8.7	29.04	0
Valley/foothill riparian	Cottonwood-willow woodland (upland and wetland)	384.5	0.4	1.9	0	0	14.2	28.3	69.0	89.7	3.8
	Valley oak riparian woodland	82.6	0	0	0	0	0.1	14.7	23.5	34.5	0.8
	Riparian scrub (upland and wetland)	131.9	0.7	1.0	0.9	0	5.0	28.2	24.2	23.7	2.4
	Willow scrub (upland and wetland)	133.6	0	0.1	0.2	0	4.3	14.4	25.5	22.0	6.6
	Giant reed stand	12.7	0	0	0	0	0.4	0.1	3.7	3.7	0
Upland cropland	Agriculture	125.5	0.5 [1]	2.5 [1]	13.5 [1]	1.6 [1]	0	0	0	0	101.5
Not applicable	Developed land	6.8	– [1]	– [1]	– [1]	– [1]	0	0	0.5	3.5	0
Not applicable	Landscaping	2.4	0	0	0	0	0	0	0.1	1.9	0
Not applicable	Ruderal	526.1	0.2	1.0	0	3.2	29.5	122.7	78.29	77.6	47.4
	Total	**3572.9**	**10.6**	**17.3**	**18.7**	**12.4**	**129.8**	**287.7**	**356.9**	**757.2**	**162.6**

Notes:

DMC = Delta-Mendota Canal.

[1] Agriculture acreages were planimetered from aerial photographs of the proposed dredge drying areas at the gate sites. Part of the agricultural land acreage included in the gate site dredge drying areas is ruderal vegetation, which has not yet been separately mapped in these areas. Developed land was not mapped at the gate sites.

Table 6.2-2. Special-Status Species with Potential to Occur in the Project Area

Species Name	Status [a]			Distribution	Preferred Habitats	Period Identifiable	Occurrence in the Project Area
	Federal	State	Other				
Suisun Marsh aster *Aster lentus*	SC	–	1B, CSC	Sacramento–San Joaquin Delta, Suisun Marsh, Suisun Bay, and Contra Costa, Napa, Sacramento, San Joaquin, and Solano Counties	Tidal brackish and freshwater marsh: 0–10 feet	August–November	Populations recorded along Old River, approximately 5 miles north of proposed dredging section (CNDDB 2003). Not observed during project surveys.
Big tarplant *Blepharizonia plumosa* ssp. *plumosa*	SC	–	1B	Interior Coast Range foothills and Alameda, Contra Costa, San Joaquin, Stanislaus*, and Solano* Counties	Annual grassland, on dry hills and plains: 50–1,500 feet	July–October	Degraded habitat in the project area. CNDDB occurrence approximately 3 miles south of project area (CNDDB 2003). Not observed during project area surveys.
Congdon's tarplant *Centromadia [Hemizonia] parryi* ssp. *congdonii*	SC	–	1B, CSC	East San Francisco Bay Area, Salinas Valley, and Los Osos Valley	Annual grassland on lower slopes, flats, and swales, sometimes on alkaline or saline soils: 3–700 feet	June–November	Suitable habitat in the project area. No CNDDB records within 5 miles of the project area. Not observed during project area surveys.
Slough thistle *Cirsium crassicaule*	SC	–	1B, CSC	San Joaquin Valley and San Joaquin, Kings, and Kern Counties	Marsh along sloughs and canals, riparian scrub, and chenopod scrub: 10-300 feet	May–August	Historical occurrence recorded at the confluence of Old River and San Joaquin River. Last seen in 1933 (CNDDB 2003). Not observed during project area surveys.
Delta coyote thistle *Eryngium racemosum*	–	CE	1B, CSC	San Joaquin River delta, floodplains, and adjacent Sierra Nevada foothills and Calaveras, Merced, San Joaquin*, and Stanislaus Counties	Riparian scrub, and seasonally inundated depressions along floodplains on clay soils: 10–250 feet	June–August	Suitable habitat in the project area. Extirpated CNDDB occurrence approximately 1 mile south of project area (CNDDB 2003). Not observed during project area surveys.

Species Name	Status [a] Federal	State	Other	Distribution	Preferred Habitats	Period Identifiable	Occurrence in the Project Area
Rose-mallow *Hibiscus lasiocarpus*	–	–	2	Central and southern Sacramento Valley, deltaic Central Valley, and Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo Counties	Wet banks and freshwater marshes: generally sea level to 135 feet	August–September	Present throughout south Delta. Populations observed during project surveys along West Canal dredging area, Grant Line Canal, Fabian and Bell Canal, and Middle River gate site.
Carquinez goldenbush *Isocoma arguta*	SC	–	1B, CSC	Deltaic Sacramento Valley, Suisun Slough, and Contra Costa and Solano Counties	Annual grassland on alkaline soils and flats: generally 3–60 feet	August–December	Suitable habitat in project area. No CNDDB records within 5 miles of project area. Not observed during project area surveys.
Northern California black walnut (native stands) *Juglans californica* var. *hindsii*	SC	–	1B, CSC	Native stands in Contra Costa, Napa, Sacramento*, Solano*, and Yolo* Counties	Riparian scrub and woodland: 150–2,700 feet	April–May	Scattered trees occur throughout south Delta but not as entire stands. No CNDDB records within 5 miles of project area. One tree is present near Grant Line site.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	SC	–	1B, CSC	Central Valley (especially the San Francisco Bay region) and Alameda, Contra Costa, Fresno, Marin, Napa, Sacramento, San Benito, Santa Clara, San Joaquin, and Solano Counties	Coastal and estuarine marshes: sea level –15 feet	May–June	Population observed during project surveys in Middle River approximately 2.5 miles northwest of Middle River gate site.
Mason's lilaeopsis *Lilaeopsis masonii*	SC	R	1B, CSC	Southern Sacramento Valley, Sacramento–San Joaquin Delta, northeast San Francisco Bay area, and Alameda, Contra Costa, Marin*, Napa, Sacramento, San Joaquin, and Solano Counties	Freshwater and intertidal marshes and streambanks in riparian scrub: generally sea level–30 feet	April–October	Present throughout project area; observed during project surveys downstream of Middle River gate, at Grant Line Canal gate, at Old River at DMC gate, and at West Canal dredge area.

Species Name	Status [a] Federal	State	Other	Distribution	Preferred Habitats	Period Identifiable	Occurrence in the Project Area
Delta mudwort *Limosella subulata*	–	–	2	Contra Costa, Sacramento, San Joaquin, and Solano Counties; Oregon; Atlantic coast	Intertidal marshes: sea level–10 feet	May–August	Several populations observed during project surveys along Middle River and Victoria and North Canals; several sites within West Canal dredging area.
Sanford's arrowhead *Sagittaria sanfordii*	SC	–	1B, CSC	Scattered locations in Central Valley and Coast Ranges	Freshwater marshes, sloughs, canals, and other slow-moving water habitats: sea level–1,850 feet	May–August	Marginally suitable habitat in project area; channels are probably too fast moving. Project area is 4 miles or more from a historical (1901) CNDDB record in Stockton and nearly 25 miles from a current CNDDB record (CNDDB 2003). Not observed during project area surveys.
Marsh skullcap *Scutellaria galericulata*	–	–	2	Northern high Sierra Nevada, Modoc plateau, and El Dorado, Nevada, Placer, Plumas, Shasta, and Siskiyou Counties	Wet sites, mesic meadows, streambanks, and coniferous forest: sea level–6,300 feet	June–September	Questionable habitat in project area. One recorded site, out of normal range for species, is 3 miles north of Middle River gate site (CNDDB 2003). Not observed during project area surveys.
Blue skullcap *Scutellaria lateriflora*	–	–	2	Northern San Joaquin Valley, east of Sierra Nevada, Inyo and San Joaquin Counties, New Mexico, and Oregon	Mesic meadows, marshes, and swamps: generally sea level–1,500 feet	July–September	Suitable habitat in project area. Would only include nontidal emergent wetland. No CNDDB records within 5 miles of project area. Not observed during project area surveys.

Species Name	Status [a]			Distribution	Preferred Habitats	Period Identifiable	Occurrence in the Project Area
	Federal	State	Other				
Wright's trichocoronis *Trichocoronis wrightii* var.*wrightii*	–	–	2	Scattered locations in Central Valley and southern coast, Texas	Floodplains, moist places, drying river beds, and vernal lakes on alkaline soils: 15–1,300 feet	May–September	Questionable habitat in project area. Historical record presumed extant is approximately 3 miles upstream of the head of Old River fish gate site on San Joaquin River. Not observed during project area surveys.

Notes:

CNDDB = California Natural Diversity Database.

DMC = Delta-Mendota Canal.

Species included in this table are based on search results of the CNDDB (2004), lists provided by the U.S. Fish and Wildlife Service (USFWS) (2002), and field surveys conducted in the project area during 2000 and 2001. Only species from these sources with suitable habitat in the study area are included in this table.

[a] Status

– = not listed.

Federal

SC = USFWS Species of Special Concern.

State

CE = Listed as endangered under the California Endangered Species Act.

R = Listed as rare under California Native Plant Protection Act.

Other

California Native Plant Society (CNPS)

1B = CNPS List 1B—rare or endangered in California and elsewhere

2 = CNPS List 2—rare or endangered in California, more common elsewhere

CALFED Bay-Delta Program (CALFED)

CSC = Other species of concern identified by CALFED.

caper-fruited tropidocarpum) were unsuccessful, and no specimens of either of these species were found at any sites surveyed. An attempt to locate occurrences of Delta tule pea on Grant Line Canal, as documented in the Interim SDIP EIR (California Department of Water Resources and Bureau of Reclamation 1996a), was also unsuccessful. A non-special-status variety of the species was observed in this area.

All observed populations of target special-status species were mapped using a GPS unit (Garmin 12XL, 1–15-meter accuracy, and CMT March II, 50-cm accuracy), and location data for all stands were stored in an ArcView GIS file.

Waters of the United States

The extent of waters of the United States were originally delineated and verified in the project area in 1994 (California Department of Water Resources and Bureau of Reclamation 1996a). In August and September 2001 and June and July 2003, DWR staff conducted a subsequent delineation of the project area. Wetlands were delineated according to the methods outlined in the *U.S. Army Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), and other waters of the United States were identified based on the definition of waters of the United States (33 CFR Part 328). A preliminary delineation of potential dredged material disposal areas was conducted in November 2004.

A Corps wetland delineation datasheet was completed for representative sites of each mapped vegetation type (Appendix L). For the 2001 and 2003 delineation work, jurisdictional wetlands in riparian/streamside areas were delineated throughout the study area by extrapolating the wetland status of the representative vegetation types. This approach was approved by the Corps (Haley pers. comm.). The delineation information provided in this document is preliminary, pending verification by the Corps.

Environmental Conditions

Land Cover Types

Until the early 1800s, the south Delta consisted primarily of a mosaic of tidal marshland dominated by bulrushes (*Scirpus* sp.) with a few low, natural levees that supported woody riparian vegetation, grassland, and upland shrubs (Thompson 1957). 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. Agriculture in the south Delta consisted primarily of dryland farming and land irrigated from artesian wells, groundwater pumping, and some creek canals. In the mid-1800s, levee construction increased, and marshland was drained to provide land for irrigated agriculture. By 1900, about one-half of the Delta's historical wetland areas had been diked and drained. Extensive reclamation continued through the 1940s. Today, agricultural land dominates the south Delta. Some small, apparently natural islands remain in a quasinatural state, as do some in-channel islands that are remnants of dredging and levee construction.

Levees in the south Delta typically have waterside slopes that are fully covered with riprap and are actively maintained, which includes regular herbicide application to control vegetation that could destabilize the levee structure. As a result, there is little or no vegetation or exposed substrate on the actual levees, with the common exception of a fringe at the outside levee toe that is typically very sparsely vegetated and does not support special-status species. Interior areas of most south Delta islands are actively farmed and contain little or no natural (uncultivated) vegetation. Consequently, most remaining undisturbed plant communities and most occurrences of special-status species occur on in-channel islands with no levees.

In the study area, land cover types can be divided into artificial and natural vegetation communities, aquatic communities, and developed land. Agriculture and landscaping are artificial vegetation communities because they are maintained. The other vegetation communities and the aquatic communities are natural community types. Land cover types present in the study area are subtypes of the NCCP communities addressed in the MSCS (CALFED Bay-Delta Program 2000e). The land cover types mapped in the study area are listed in Table 6.2-1 and are discussed below. Table 6.2-1 correlates the MSCS NCCP communities, where applicable, with the land cover types used in this document. Table 6.2-1 also includes the extent of each land cover type as mapped throughout the study area. Gate site acreages in Table 6.2-1 include areas within boundaries drawn around the upstream and downstream extent of dredging, as well as the farthest inland extent on both sides of the channel that were identified in project construction drawings (boundaries shown as *Project Area* in Figures 6.2-2–6.2-5).

Tidal Perennial Aquatic

Tidal perennial aquatic habitat is characterized by open water and is defined as deepwater aquatic (i.e., greater than 3 meters [10 feet] deep from mean low tide), shallow aquatic (i.e., less than or equal to 3 meters [10 feet] deep from mean low tide), and unvegetated intertidal (i.e., tidal flats) zones of estuarine bays, river channels, and sloughs (CALFED Bay-Delta Program 2000e). In the south Delta project area, tidal perennial aquatic habitat includes sloughs, channels, and flooded islands. Deep open-water areas are largely unvegetated, and beds of aquatic plants occasionally occur in shallower open-water areas.

Tidal perennial aquatic habitat is present throughout the project area, including all gate sites and dredge areas (Figures 6.2-2–6.2-8). Typical tidal perennial aquatic plant species include water hyacinth, water primrose, Brazilian waterweed, common waterweed, hornwort, parrot's feather, and western milfoil. Colonies of these aquatic plants are generally infrequent, but mats of noxious weeds, such as water hyacinth or Brazilian waterweed, can clog waterways, shade habitat for native aquatic vegetation, and smother low-growing intertidal vegetation when washed onto channel banks (California Exotic Pest Plant Council 1999; California Department of Boating and Waterways 2000, 2001). Vegetation, when present, is generally restricted to waterways with low water velocities and areas with low levels of disturbance.

Tidal perennial aquatic habitats are jurisdictional waters of the United States under Section 404 of the CWA and the Rivers and Harbors Act.

No special-status plants are known to occur in tidal perennial aquatic habitat in the project area.

Tule and Cattail Tidal Emergent Wetland

The tule and cattail tidal emergent wetland community includes portions of the intertidal zones of the Delta that support emergent wetland plant species that are not tolerant of saline or brackish conditions. Tidal emergent wetland includes all or portions of the freshwater emergent wetland tidal and Delta sloughs and in-channel islands and shoals habitats (CALFED Bay-Delta Program 2000e). This community type occurs on in-channel islands and along mostly unleveed, tidally influenced waterways and qualifies as jurisdictional wetland under Section 404 of the CWA.

The tule and cattail tidal emergent wetland community occurs along all channels and most in-channel islands in the project area. This habitat occurs on the south bank and in-channel island at the Grant Line Canal site (Figure 6.2-4) and on the south bank of the Old River at DMC gate site (Figure 6.2-5). This tidal emergent wetland is also present on the east bank of the West Canal dredging area (Figure 6.2-6) and more extensively in the Middle River and Old River dredging areas (Figures 6.2-7 and 6.2-8).

Tules and cattails, along with common reed, buttonbush, sedges, and rushes, dominate the tule and cattail tidal emergent wetland community. This wetland community provides suitable habitat for the following special-status species: Suisun Marsh aster, slough thistle, rose-mallow, Delta tule pea, Mason’s lilaeopsis, and Delta mudwort. Of these species, rose-mallow, Mason’s lilaeopsis, and Delta mudwort were observed in the project area (Table 6.2-2 and Figure 6.2-9).

Cottonwood-Willow Woodland

The cottonwood-willow woodland community typically occurs on channel islands, on levees, and along unmaintained channel banks of south Delta sloughs and rivers. The riparian zone along leveed islands is usually very narrow, but more extensive riparian areas occur on in-channel islands or other unleveed areas. Cottonwood-willow woodland occurs at the proposed Middle River, Grant Line Canal, and Old River at DMC gate sites.

Cottonwood-willow woodland occurs on an in-channel island at the proposed Middle River gate site (Figure 6.2-3) and is dominated by mature black willow with an understory of shrubs, including California button-willow, sandbar willow, shining willow, and California rose.

Cottonwood-willow woodland at the proposed Grant Line Canal gate site (Figure 6.2-4) is dominated by a mature stand of Fremont cottonwood that forms a nearly contiguous overstory and intergrades with tule and cattail tidal emergent marsh, riparian scrub, and willow scrub. Dominant understory species include black willow, sandbar willow, and shining willow. Other understory species include Himalayan blackberry, California blackberry, California button-willow, Indian hemp, California rose, coyote brush, and California black walnut. Herbaceous cover occurs where shrubs are sparse or absent and includes Santa Barbara sedge, hoary nettle, creeping wildrye, bracken fern, and hedge-nettle. Disturbed portions of the cottonwood-willow woodland at the Grant Line Canal site support many nonnative species or species introduced from elsewhere in the state, including Monterey pine, coast redwood, Modesto ash, Canary Island pine, acacia, tree of heaven, Aleppo pine, and gum tree. Herbaceous cover in disturbed sites includes ruderal species such as Italian thistle, ripgut brome, milk thistle, periwinkle, and poison hemlock.

The Old River at DMC gate site supports patches of cottonwood-willow woodland on both banks (Figure 6.2-5). This woodland includes scattered Fremont cottonwood on the levee bank with a ruderal understory.

Within the West Canal dredging area, cottonwood-willow woodland dominates an in-channel island and occurs in patches on banks (Figure 6.2-6). This woodland also occurs extensively in both the Middle River and Old River dredging areas and on proposed dredged material disposal sites DS-2 and DS-3 on Roberts Island (Figures 6.2-7 and 6.2-8).

Areas of cottonwood-willow woodland growing on in-channel islands or on levee banks within the high tide line may qualify as jurisdictional wetlands under Section 404 of the CWA and as waters under the Rivers and Harbors Act, and are referred to in this chapter as cottonwood-willow woodland wetland. DFG considers riparian communities such as cottonwood-willow woodland to be rare natural communities and maintains a current list of these communities throughout the state in the CNDDB (California Natural Diversity Database 2004).

Cottonwood-willow woodland is suitable habitat for the following special-status plants: western leatherwood, Loma Prieta hoita, and native stands of northern California black walnut. None of these plants, or stands of walnut, were observed in the project area (Table 6.2-2).

Valley Oak Riparian Woodland

Valley oak riparian woodland includes areas where the dominant overstory is valley oak. Associate species are similar to those described for the cottonwood-willow woodland vegetation. This riparian woodland also occurs on banks and on in-channel islands in the study area.

Within the project area, valley oak riparian woodland occurs within the Middle River and Old River dredge areas and on dredged material disposal site DS-2 (Figures 6.2-7 and 6.2-8).

Areas of valley oak riparian woodland growing on in-channel islands or on levee banks within the high tide line may qualify as jurisdictional wetlands under Section 404 of the CWA and as waters under the Rivers and Harbors Act, and are referred to in this chapter as valley oak riparian woodland wetland. DFG considers riparian communities such as valley oak riparian woodland to be rare natural communities and maintains a current list of these communities throughout the state in the CNDDB (California Natural Diversity Database 2004).

Valley oak riparian woodland is suitable habitat for the same special-status plants as listed above for cottonwood-willow woodland.

Riparian Scrub

The riparian scrub community is dominated by dense stands of shrubs, such as California button-willow, wild rose, Himalayan blackberry, and white alder. Where shrub cover is absent, herbaceous cover is often abundant and includes Indian hemp, yellow iris, centaury, vervain, umbrella sedge, creeping bent grass, bugleweed, and hedge-nettle.

Riparian scrub also includes blackberry thickets, which intergrade with riparian habitats. These thickets are characteristically monotypic stands of Himalayan blackberry, with scattered and isolated trees and shrubs, including coyote brush, sandbar willow, shining willow, and white alder. Blackberry thickets occur in association with ruderal habitats; however, an herbaceous understory is not evident within these thickets. Elderberry shrubs may also be associated with this community type and are numerous at the DS-2 dredged material disposal site.

Riparian scrub vegetation occurs throughout the project area. Blackberry thickets occur on levee banks at the Middle River, Grant Line Canal, and Old River at DMC gate sites and on the in-channel island at Grant Line Canal (Figures 6.2-3–6.2-5). Riparian scrub also occurs at all three potential dredging areas and at dredged material disposal sites DS-2 and -3 on Roberts Island (Figures 6.2-6–6.2-8).

Areas of riparian scrub on in-channel islands or on levee banks within the high tide line may qualify as jurisdictional wetland under Section 404 of the CWA and as waters under the Rivers and Harbors Act, and are referred to in this chapter as riparian scrub wetlands. DFG considers riparian communities such as riparian scrub to be rare natural communities and maintains a current list of these communities throughout the state in the CNDDB (California Natural Diversity Database 2004).

Riparian scrub is suitable habitat for the following special-status plants: western leatherwood, Delta coyote-thistle, slough thistle, and Loma Prieta hoita.

Willow Scrub

Willow scrub is a type of riparian scrub habitat dominated by willow species, particularly sandbar willow and young trees of other willow species, such as shining willow and black willow. In disturbed areas, willow scrub intergrades with blackberry vegetation.

Willow scrub occurs at the Grant Line Canal gate site on the in-channel island (Figure 6.2-4), on the south bank at the Old River at DMC gate site (Figure 6.2-5), in the three proposed dredge areas, and at dredged material disposal sites DS-2 and DS-3 on Roberts Island (Figures 6.2-6–6.2-8).

Areas of willow scrub growing on in-channel islands or on levee banks within the high tide line may qualify as jurisdictional wetlands under Section 404 of the CWA and as waters under the Rivers and Harbors Act, and are referred to in this chapter as willow scrub wetland. DFG considers riparian communities such as willow scrub to be rare natural communities and maintains a current list of these communities throughout the state in the CNDDB (California Natural Diversity Database 2004).

Willow scrub is suitable habitat for the same special-status plants as listed above for riparian scrub.

Agricultural Ditch

Ditches are present throughout much of the project area on the landside of the levees, but because avoidance of these features is assumed for most project activities, they were mapped only within the proposed dredged material disposal sites on Roberts Island. Ditches are either cement-lined or earth-lined.

Earth-lined agricultural ditches in the project area are typically installed, removed, and maintained periodically as part of routine farming practices. Most of these ditches are shallow and do not intersect the water table. These ditches are generally saturated or ponded for long durations; however, the water is pumped on and off as needed as part of routine farming operations (irrigation). Because water is present for long durations, ditches may exhibit wetland characteristics. They are, however, created features with an artificial water source and are considered jurisdictional only if water is pumped from the ditch to waters of the United States. This circumstance occurs in one ditch on DS-4 where water is pumped from the ditch to Middle River. This ditch supports wetland species, such as sorghum, knotweed, cocklebur, hyssop loosestrife, sprangle-top, and nutsedge.

Because these features have been excavated and are generally subject to maintenance, they have minimal suitable habitat for special-status plants but have potential to support rose-mallow.

Giant Reed Stand

Areas mapped as giant reed stands in the project area are monotypic stands of giant reed (*Arundo donax*), a noxious weed that is particularly invasive in riparian habitats. Giant reed stands have been mapped at the Old River at DMC site and in the three dredging areas (Figures 6.2-5 and 6.2-6–6.2-8). No special-status plant species are known to occur in giant reed stands and are likely to be excluded from establishing within the areas invaded by giant reed.

Agriculture

Agriculture habitat includes agricultural lands that are not seasonally flooded. Major 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. The distribution of seasonal crops 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. General cropping practices result in monotypic stands of vegetation for the growing season and bare ground in the fall and winter. In areas not intensively cultivated, such as fallow fields, roads, ditches, and levee slopes, regular maintenance precludes the establishment of ruderal vegetation or native vegetation communities.

Agricultural irrigation ditches are a part of most of the agricultural fields in the south Delta. Because the habitat provided by agricultural ditches is different from that of agricultural fields, it is described separately (see above). While agriculture is present throughout much of the project area on the land-side of the levees, it has only been included in the project area mapping at the proposed flow control and fish control gate sites and within the proposed dredged material disposal sites on Roberts Island and Stewarts Tract.

No special-status plant species are known in agriculture habitat because of the soil disturbance inherent in the agricultural practices of the south Delta.

Developed Land

Developed land mapped in the project area includes areas with roads and buildings but also includes barren areas that have been disturbed and are unvegetated. These areas occur along riprapped levee faces and at the tops of levees. Developed land is mapped at all four of the proposed gate sites. No special-status plant species are known to occur in developed land areas because most vegetation has been removed, and these areas remain highly disturbed.

Landscaping

Landscaping includes areas that have been planted with ornamental, usually nonnative, vegetation and turf grasses. A minimal amount of this cover type occurs in the project area and is mapped only on the south bank of Old River west of the Old River at DMC gate site. Because of the disturbance related to installation of landscaping and the ongoing maintenance of these areas, no special-status plant species are expected to occur in landscaped areas.

Ruderal

Areas mapped as ruderal vegetation in the study area are dominated by herbaceous, nonnative, weedy species and may support stands of noxious weeds. Ruderal vegetation generally occurs in disturbed areas, such as levee faces and edges of agricultural fields and roads. Ruderal vegetation is extensive on the land-side levee faces at the Middle River and Old River at DMC gate sites (Figures 6.2-3 and 6.2-5). The entire north bank of the Grant Line Canal site is ruderal, as are patches on the in-channel island (Figure 6.2-4). The head of Old

River fish control gate site supports primarily ruderal vegetation (Figure 6.2-2). Ruderal vegetation also occurs within the proposed dredges areas, particularly at the south end of the Middle River dredge area (Figure 6.2-3). Ruderal vegetation generally occurs in areas subject to periodic disturbances, and the species in this land cover type are generally weedy to invasive. For these reasons, no special-status plants are expected to occur in ruderal vegetation communities.

Special-Status Plants

Special-status plant species are species legally protected under CESA, the ESA, or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. Special-status plants and animals are species in the following categories:

- species listed or proposed for listing as threatened or endangered under the ESA (50 CFR 17.12 and various notices in the FR [proposed species]);
- species that are candidates for possible future listing as threatened or endangered under the ESA (69 FR 24876, May 4, 2004);
- species listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5);
- species that meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380);
- plants listed as rare under the California Native Plant Protection Act (California Fish and Game Code, Section 1900 *et seq.*);
- plants considered by CNPS to be "rare, threatened, or endangered in California" (Lists 1B and 2, available at: <www.cnps.org/rareplants/inventory/6thEdition/htm>); and
- plants listed by CNPS as plants about which more information is needed to determine their status and plants of limited distribution (Lists 3 and 4, available at: <www.cnps.org/rareplants/inventory/6thEdition/htm>), which may be included as special-status species on the basis of local significance or recent biological information.

The following species from the consolidated list described above ("Special-Status Plants") do not have suitable habitat or the appropriate elevation range in the project area, are not included in Table 6.2-2, and will not be further addressed in this document:

- large-flowered fiddleneck *Amsinckia grandiflora*
- bent-flowered fiddleneck *Amsinckia lunaris*
- pallid manzanita *Arctostaphylos pallida*
- coast rock cress *Arabis blepharophylla*
- alkali milkvetch *Astragalus tener* var. *tener*

- heartscale — *Atriplex cordulata*
- San Jacinto Valley crownscale — *Atriplex coronata* var. *notatior*
- brittlescale — *Atriplex depressa*
- San Joaquin saltbush — *Atriplex joaquiniana*
- chaparral harebell — *Campanula exigua*
- bristly sedge — *Carex comosa*
- succulent owl's-clover — *Castilleja campestris* ssp. *succulenta*
- Lemmon's jewelflower — *Caulanthus coulteri* var. *lemmonii*
- Franciscan thistle — *Cirsium andrewsii*
- soft bird's-beak — *Cordylanthus mollis* ssp. *mollis*
- Mt. Diablo bird's-beak — *Cordylanthus nidularius*
- palmate-bracted bird's-beak — *Cordylanthus palmatus*
- Hoover's cryptantha — *Cryptantha hooveri*
- Livermore tarplant — *Deinandra bacigalupii*
- Hospital Canyon larkspur — *Delphinium californicum* ssp. *interius*
- recurved larkspur — *Delphinium recurvatum*
- western leatherwood — *Dirca occidentalis*
- Tiburon buckwheat — *Eriogonum luteolum* var. *caninum*
- Ben Lomond buckwheat — *Eriogonum nudum* var. *decurrens*
- round-leaved filaree — *Erodium macrophyllum*
- Contra Costa wallflower — *Erysimum capitatum* ssp. *angustatum*
- diamond-petaled California poppy — *Eschscholzia rhombipetala*
- stinkbells — *Fritillaria agrestis*
- fragrant fritillary — *Fritillaria liliacea*
- serpentine bedstraw — *Galium andrewsii* ssp. *gatense*
- Boggs Lake hedge-hyssop — *Gratiola heterosepala*
- Diablo helianthella — *Helianthella castanea*
- Brewer's western flax — *Hesperolinon breweri*
- Loma Prieta hoita — *Hoita strobilina*
- Santa Cruz tarplant — *Holocarpha macradenia*
- Contra Costa goldfields — *Lasthenia conjugens*
- showy madia — *Madia radiata*
- Hall's bush mallow — *Malacothamnus hallii*

- Oregon meconella — *Meconella oregana*
- robust monardella — *Monardella villosa* ssp. *globosa*
- little mousetail — *Myosurus minimus* ssp. *apus*
- Antioch Dunes evening-primrose — *Oenothera deltoides* ssp. *howellii*
- Gairdner's yampah — *Perideridia gairdneri* ssp. *gairdneri*
- Mt. Diablo phacelia — *Phacelia phacelioides*
- rock sanicle — *Sanicula saxatilis*
- most beautiful jewel-flower — *Streptanthus albidus* ssp. *peramoensus*
- Mt. Diablo jewelflower — *Streptanthus hispidus*
- caper-fruited tropidocarpum — *Tropidocarpum capparideum*
- Greene's tuctoria — *Tuctoria greenei*

The following section discusses special-status plant species that have been documented in the project area and identifies additional special-status species that have the potential to occur in the project area.

Table 6.2-2 includes a list of special-status plants that have suitable habitat in the project area, occur in the project region, and/or were observed in the study area. The table includes the plant species name, status, habitat, and occurrence in the project area. Figure 6.2-9 identifies the locations of all CNDDB records for special-status plants within 5 miles of the study area.

Four special-status plant species have been documented during botanical surveys of the study area: rose-mallow, Delta tule pea, Mason's lilaeopsis, and Delta mudwort. These species were not regularly dispersed but were found in clusters that correlate with the presence of in-channel islands with unmanaged habitat (i.e., not leveed, farmed, riprapped, or along setback levees) (Figure 6.2-10). Gate sites are primarily active agricultural fields or unmanaged disturbed land on levee faces. The Grant Line Canal site was the only gate site that contained special-status plants.

The special-status species discussed below include the three species that either were found during the 2000–2001 field surveys (i.e., rose-mallow, Mason's lilaeopsis, and Delta mudwort) or that are covered species in the ASIP (SDIP ASIP) for which there is suitable habitat in the project area.

Suisun Marsh Aster

Suisun Marsh aster is a perennial herb that occurs in brackish and freshwater marsh habitat along tidal sloughs and rivers, usually at or near the water's edge, or in drainage and irrigation ditches (California Native Plant Society 2001; California Department of Water Resources 1994c). This species was not found in the study area during the 2000–2001 surveys. The nearest CNDDB-recorded occurrence of Suisun Marsh aster includes two locations at the confluence of Old River and Rock Slough, more than 5 miles north of the proposed dredging area

(California Natural Diversity Database 2004). One location is on an in-channel island, and the other is on the slough bank. The plants occur in tidal marsh habitat in association with goldenrod, blackberry, dallisgrass, and pampas grass. Only 10 plants were observed at this occurrence in 1986.

Slough Thistle

Slough thistle is an annual herb endemic to Kern, King, and San Joaquin Counties, with 17 known occurrences (California Natural Diversity Database 2004). Population sizes of slough thistle appear to fluctuate widely from year to year (California Native Plant Society 2001). Slough thistle occurs in emergent wetland, riparian scrub, and chenopod scrub habitats. This species was not found in the study area during the 2000–2001 surveys, but a potentially extirpated population was last seen in 1933 at the confluence of Old River and San Joaquin River in an area of intensive agriculture (California Natural Diversity Database 2004).

Delta Coyote-Thistle

Delta coyote-thistle is an annual to perennial herb that occurs in seasonally wet depressions within riparian scrub habitats. This species was not found in the study area during the 2000–2001 surveys, although suitable riparian scrub and willow scrub habitat is present. The species is recorded within 1 mile of the project area, in an area that floods and is occupied by a walnut orchard, but may have been extirpated (California Natural Diversity Database 2004).

Rose-Mallow

Rose-mallow is an herbaceous perennial that spreads by rhizomes within freshwater marsh habitat. This species was recorded at approximately 36 sites during the 2000–2001 special-status plant surveys, including populations along Middle River downstream of the proposed gate near the confluence with Victoria and North Canals, and on West Canal, Grant Line Canal, and Fabian and Bell Canal (Figure 6.2-10). In the study area, this species was observed to occur primarily on clay banks in the intertidal zone from the 0 tide level to mean high tide and to tolerate erosion until roots were exposed and it was washed away (Witzman personal observation).

Delta Tule Pea

Delta tule pea is a perennial herb that occurs along tidal sloughs, riverbanks, and levees near the water's edge. Some populations are partially inundated at high tide (California Department of Water Resources 1994c). This species was at one site on Middle River approximately 2 miles north of the proposed gate site during the 2000–2001 special-status plant surveys. Delta tule pea was also previously reported in the study area in the ISDP EIR (California Department of Water Resources and Bureau of Reclamation 1996a). The previously reported occurrence was located in tidal emergent wetland on the south side of the in-channel island on Grant Line Canal upstream of the proposed gate site. The closely related *Lathyrus jepsonii* var. *californicus* was observed in this area during the 2000–2001 surveys. The nearest CNDDB-recorded occurrence is located approximately 3 miles northeast of the project area on an in-channel island in Middle River (California Natural Diversity Database 2004). Habitat at this location is emergent marsh adjacent to tule marsh.

Mason's Lilaeopsis

Mason's lilaeopsis is a diminutive rhizomatous perennial herb that typically occurs on clay or silt tidal mudflats with high organic matter content (Golden and Fiedler 1991). The lilaeopsis occurs in the lower reach of the Napa River and throughout the Delta. The project area is located at the southernmost extent of its range. Mason's lilaeopsis was recorded at approximately 175 sites during the 2000–2001 special-status plant surveys, including populations along Old River within the proposed dredging area and upstream of the proposed gate, West Canal, Victoria and North Canals, Grant Line Canal, Fabian and Bell Canal, and Middle River downstream of the proposed gate (Figure 6.2-10). These locations of Mason's lilaeopsis occur on in-channel islands and unmanaged habitat.

Mason's lilaeopsis lives almost exclusively in intertidal locations where it is inundated twice each day by high tides for varying periods of time during each month (Golden and Fiedler 1991; Zebell and Fiedler 1996). This species appears to become less abundant as tidal range decreases. For example, the map of Mason's lilaeopsis occurrences in the south Delta (Figure 6.2-10) shows that the frequency of occurrences decreases with distance from the Carquinez Strait (source of tidal water and the direction in which tidal range increases). In addition, previous monitoring studies of Mason's lilaeopsis in Old River near the temporary barrier recorded that Mason's lilaeopsis populations shrank or disappeared upstream of the barrier over the 2-year monitoring period but were essentially unaffected below the barrier (California Department of Water Resources 1999c, 2001b). These facts implicate tidal fluctuation as an important factor in determining Mason's lilaeopsis abundance and suggest that decreased tidal range is having an adverse effect on existing populations.

Mason's lilaeopsis populations generally occur at elevations varying from approximately 0.5 to 2 feet NGVD (California Department of Fish and Game 1995a; California Department of Water Resources 2001b). Locations of this species can vary from year to year because of the transient nature of the mudflat habitat on which it grows. Both lack of siltation and accelerated erosion can remove habitat and individual plants. Mason's lilaeopsis successfully tolerates disturbance because it spreads vegetatively by rhizomes. No seedlings were observed during a survey of the entire range of Mason's lilaeopsis, although small tufts were seen floating in the Delta region, indicating that the lilaeopsis may colonize sites by the dispersal of vegetative mats through the Delta waterways (Golden and Fielder 1991).

The instability of Mason's lilaeopsis habitat on mudflats may reduce competition from other larger species (Zebell and Fiedler 1996). However, the lilaeopsis is subject to competition, particularly by water hyacinth in the San Joaquin River region (Golden and Fiedler 1991; Zebell and Fiedler 1996). Water hyacinth negatively affects Mason's lilaeopsis through competition for light, obstruction of habitat, prevention of colonization, and physical disturbance when washed onto the shoreline by wave action (Zebell and Fiedler 1996). Pampas grass may also threaten the lilaeopsis (Golden and Fiedler 1991).

Mason's lilaeopsis occurs in habitats with water salinity from 0.25 up to 8.5 ppt and may tolerate even higher salinities (Golden and Fiedler 1991; Zebell and Fiedler 1996); however, growth and sexual reproduction may be depressed at higher salinity levels (Fiedler and Zebell 1993). Experiments on the response of Mason's lilaeopsis to crude oil at varying salinities indicate that crude oil significantly affects aboveground growth at salinity levels above 0 ppt (Zebell and Fiedler 1996).

DWR purchased mitigation credits at the Kimball Island Mitigation Bank for impacts on Mason's lilaeopsis resulting from implementation of the South Delta Temporary Barriers Project. Impacts on Mason's lilaeopsis were concluded to be attributable to operation of the temporary barriers, which caused an increase in the low-tide level upstream of the barriers. The increased low-tide level caused long-term inundation and loss of the Mason's lilaeopsis at monitored sites (California Department of Water Resources 2001b).

Delta Mudwort

Delta mudwort is a low-growing, herbaceous perennial that occurs on muddy or sandy intertidal flats, sometimes in association with Mason's lilaeopsis (California Native Plant Society 2001; Golden and Fiedler 1991). Delta mudwort was recorded at approximately 40 sites during the 2000–2001 special-status plant surveys, including populations along Middle River and Victoria and North Canals and at several sites within the West Canal dredging area (Figure 6.2-10). During previous surveys conducted in support of the ISDP EIR, Delta mudwort was also found on Grant Line Canal growing in association with Mason's lilaeopsis (California Department of Water Resources and Bureau of Reclamation 1996a).

Delta mudwort likely has similar habitat requirements to those described above for Mason's lilaeopsis, but the mudwort is more sensitive to high salinity levels (Zebell and Fiedler 1996).

Waters of the United States

Based on DWR's preliminary wetland delineation data, there are minimal areas of jurisdictional wetlands along the leveed channels in the study area. Levees are generally covered with riprap and provide few areas with hydrology or soil needed for wetland plant growth. In-channel islands have a higher likelihood of containing jurisdictional wetlands because there are more areas appropriate to plant growth that have exposed soil and are regularly flooded. Land cover types that are considered waters of the United States include:

- tidal perennial aquatic,
- tule and cattail tidal emergent wetland; and

- cottonwood-willow woodland wetland, riparian scrub wetland, and willow scrub wetland growing on in-channel islands.

The dominant plant species and locations of these land cover types are described above in “Land Cover Types.” Preliminary acreages of tidal perennial aquatic habitat and each jurisdictional wetland type in the project area are given in Table 6.2-3. The final acreage of jurisdictional waters of the United States, including wetlands, in the project area is subject to verification by the Corps.

Regulatory Setting

This section provides preliminary information on the major requirements for permitting and environmental review and consultation related to vegetation and waters of the United States for implementation of the SDIP. Certain local, state, and federal regulations require issuance of permits before project implementation; other regulations require agency consultation but may not require issuance of any entitlements before project implementation. The SDIP’s requirements for permits and environmental review and consultation may change during the EIS/EIR review process, as discussions with involved agencies proceed.

Federal Requirements

Endangered Species Act

Section 7 of the ESA requires federal agencies, in consultation with USFWS and/or NOAA Fisheries, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. The required steps in the Section 7 consultation process are as follows:

- Agencies must request information from USFWS and/or NOAA Fisheries on the existence in a project area of special-status species or species proposed for listing.
- Following receipt of the USFWS/NOAA Fisheries response to this request, agencies generally prepare a BA to determine whether any special-status species or species proposed for listing are likely to be affected by a proposed action.
- Agencies must initiate formal consultation with USFWS and/or NOAA Fisheries if the proposed action might adversely affect special-status species.
- USFWS and/or NOAA Fisheries must prepare a BO to determine whether the action would jeopardize the continued existence of special-status species or adversely modify their critical habitat.
- If a finding of jeopardy or adverse modifications is made in the BO, USFWS and/or NOAA Fisheries must recommend reasonable and prudent alternatives that would avoid jeopardy, and the federal agency must modify

Table 6.2-3. Acreage of Waters of the United States Delineated in Each Project Component Area[1]

	Acreage at Gate Sites				Acreage at Dredging Areas				
Land Cover Type	Middle River Flow Control Gate	Grant Line Canal Flow Control Gate	Old River at DMC Flow Control Gate	Head of Old River Fish Control Gate	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area	Spot Dredging Areas for Agricultural Diversions	Acreage at Dredge Material Disposal Sites
Tidal perennial aquatic	8.10	10.40	3.74	7.58	73.02	72.67	123.46	477.27	0
Tule and cattail tidal emergent wetland	0045	0.27	0.39	0	3.12	6.60	8.01	29.04	0
Cottonwood-willow woodland wetland	0.42	1.79	0.03	0	11.45	21.57	57.81	81.94	0
Riparian scrub wetland	0.66	1.02	0.94	0	0.32	13.73	16.51	20.33	0
Willow scrub wetland	0	0.13	0.05	0	1.52	6.40	24.75	21.16	0
Agricultural ditch	0	0	0	0	0	0	0	0	0.4
Total	**9.63**	**13.61**	**5.08**	**7.58**	**89.43**	**120.97**	**230.54**	**629.74**	**0.4**
Total wetlands in each project component area	**1.53**	**3.21**	**1.41**	**0**	**16.41**	**48.30**	**107.08**	**152.47**	**0**
Total other waters of the United States in each project component area	**8.1**	**10.40**	**3.67**	**7.58**	**73.02**	**72.67**	**123.46**	**477.27**	**0.40**

Total Wetlands = 330.41 acres

Total Other Waters = 776.64 acres

Notes:

DMC = Delta-Mendota Canal.

[1] Acreages shown in this table are rounded to the nearest 0.01 acre, rather than 0.1 acre as in Table 6.2-1. Acreages are preliminary and are subject to verification by the U.S. Army Corps of Engineers.

the project to ensure that special-status species are not jeopardized and that their critical habitat is not adversely modified (unless an exemption from this requirement is granted).

In the preparation of the SDIP EIR/EIS, the MSCS approach was used and an ASIP, serving as the equivalent to the CALFED Programmatic SDIP BA, has been prepared in compliance with Section 7 of the ESA.

Clean Water Act Section 404(b)(1) Guidelines and Section 401

Section 404. Section 404 of the CWA requires that a permit be obtained from the Corps for discharges of dredged or fill material into "waters of the United States, including wetlands." Waters of the United States include wetlands and lakes, rivers, streams, and their tributaries. Wetlands are defined for regulatory purposes, at 33 CFR 328.3 and 40 CFR 230.3, as areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

CWA Section 404(b) requires that the Corps issue permits in compliance with guidelines developed by EPA. These guidelines require that an analysis of alternatives be available to meet the project purpose and need, including those that avoid and minimize discharges of dredged or fill material in waters. Once this has been completed, the project that is permitted must be the least environmentally damaging practical alternative before the Corps may issue a permit for the proposed activity.

Actions typically subject to Section 404 requirements are those that would take place in waters of the United States, including wetlands and stream channels, including intermittent streams, even if they have been realigned. Within stream channels, a permit under Section 404 would be needed for any discharge activity below the ordinary high-water mark, which is the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, or the presence of litter or debris.

The Programmatic ROD for the CALFED Final Programmatic EIS/EIR includes a CWA Section 404 MOU signed by Reclamation, EPA, the Corps, and DWR. Under the terms of the MOU, when a project proponent applies for a Section 404 individual permit for CALFED projects, the proponent is not required to reexamine program alternatives already analyzed in the Programmatic EIS/EIR. The Corps and EPA will focus on project-level alternatives that are consistent with the Programmatic EIS/EIR when they select the least environmentally damaging practicable alternative at the time of a Section 404 permit decision.

Note: CWA Section 404 jurisdiction includes areas regulated under the Rivers and Harbors Act Section 10. The Corps typically combines Section 10 and Section 404 into one permitting process.

Section 401. Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in any discharge into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval [such as issuance of a Section 404 permit]) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the State Water Board, and applications for water quality certification under CWA Section 401 are typically processed by the RWQCB with local jurisdiction. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 requirements governing discharge of dredged and fill materials into waters of the United States.

For purposes of this project, Reclamation will obtain certification from the Central Valley RWQCB under Section 401 of the CWA.

River and Harbors Appropriation Act of 1899

The River and Harbors Appropriation Act of 1899 addresses activities that involve the construction of dams, bridges, dikes, and other structures across any navigable water. Placing obstructions to navigation outside established federal lines and excavating from or depositing material in such waters require permits from the Corps. In the Corps Sacramento District, navigable waters of the United States in the project area that are subject to the requirements of the River and Harbors Appropriation Act are Middle River, San Joaquin River, Old River, and all waterways in the Sacramento–San Joaquin drainage basin affected by tidal action (U.S. Army Corps of Engineers 2003). Sections of the River and Harbors Act applicable to the SDIP are described below.

Section 9. Section 9 (33 USC 401) prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the water body lie wholly within the limits of a single state, the structure may be built under authority of the legislature of that state, if the location and plans or any modification thereof are approved by the Chief of Engineers and the Secretary of the Army.

Section 10. Section 10 (33 USC 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the work has been recommended and authorized by the Chief of Engineers.

Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 (May 24, 1977) requires federal agencies to prepare wetland assessments for proposed actions located in or affecting wetlands. Agencies must avoid undertaking new construction in wetlands unless no practicable alternative is available and the proposed action includes all practicable measures to minimize harm to wetlands. This chapter of the EIS/EIR describes impacts on wetlands and mitigation measures for reducing significant impacts.

State Requirements

California Endangered Species Act

CESA requires a state lead agency to consult formally with DFG when a proposed action may affect state-listed endangered or threatened species. The provisions of the ESA and CESA will often be activated simultaneously. The assessment of project effects on species listed under both the ESA and CESA is addressed in USFWS's and NOAA Fisheries' BOs. However, for those species listed only under CESA, DWR must formally consult with DFG, and DFG must issue a BO separate from USFWS's BO.

California State Wetlands Conservation Policy

The Governor of California issued an executive order on August 23, 1993, that created a California State Wetlands Conservation Policy. This policy is being implemented by an interagency task force that is jointly headed by the State Resources Agency and the California Environmental Protection Agency (Cal-EPA). The policy's three goals are to (Cylinder et al. 1995):

1. ensure no overall net loss and a long-term net gain in wetlands acreage and values in a manner that fosters creativity, stewardship, and respect for private property;
2. reduce the procedural complexity of state and federal wetland conservation program administration; and
3. encourage partnerships that make restoration, landowner incentives, and cooperative planning the primary focus of wetlands conservation.

State Regional Water Quality Control Board

Water Code Section 13260 requires "any person discharging waste, or proposing to discharge waste, in any region that could affect the waters of the state to file a report of discharge (an application for waste discharge requirements)." Under the Porter-Cologne definition, the term *waters of the state* is defined as "any surface water or groundwater, including saline waters, within the boundaries of the state." Although all waters of the United States that are within the borders of California are also waters of the state, the converse is not true (i.e., in California, waters of the United States represent a subset of waters of the state). Thus, California retains authority to regulate discharges of waste into any waters of the state, regardless of whether the Corps has concurrent jurisdiction under Section 404.

Section 1602 of the California Fish and Game Code

DFG regulates work that will substantially affect resources associated with rivers, streams, and lakes in California, pursuant to Fish and Game Code Sections

1600–1607. Any action from a public project that substantially diverts or obstructs the natural flow or changes the bed, channel, or bank of any river, stream, or lake or uses material from a streambed must be previously authorized by DFG in a Lake or Streambed Alteration Agreement under Section 1602 of the Fish and Game Code. This requirement may, in some cases, apply to any work undertaken within the 100-year floodplain of a body of water or its tributaries, including intermittent streams and desert washes. As a general rule, however, it applies to any work done within the annual high-water mark of a wash, stream, or lake that contains or once contained fish and wildlife or that supports or once supported riparian vegetation.

Activities associated with the SDIP that require Section 1602 authorization and a Streambed Alteration Agreement include the modification and setting back of existing levees, placement of fish and flow control gates, and conveyance improvements. These actions would result in the alteration of the flow within water bodies and occur within the annual high-water mark of water bodies that contain wildlife and support riparian vegetation.

The current temporary barriers program operates under DFG Section 1602 authorization. This EIS/EIR will be used as the CEQA review document by DWR as part of a new permit application, submitted to DFG for either continued authorization of activities under the existing agreement or for the issuance of a new Streambed Alteration Agreement (California Fish and Game Code 1600 *et seq.*).

Environmental Consequences

Impact Assessment Methods

Impact Mechanisms

Vegetation and wetland resources could be directly or indirectly affected by the SDIP. The following types of activities could cause varying degrees of impacts on these resources:

- vegetation removal, grading, and paving activities during gate construction, building activities, dredging, and siphon extensions;
- channel dewatering or installation of temporary water-diversion structures;
- temporary stockpiling and sidecasting of soil, construction materials, or other construction wastes;
- soil compaction, dust, and water runoff from the construction site into adjacent areas;
- introduction of invasive nonnative species in construction areas that could displace native plant species in adjacent open space areas;
- burying of vegetation under riprap used for bank stabilization near the gates;

- dredging activities in wetlands and channels that contain ponded or flowing water and saturated soils;
- disposal of dredged material on the waterside of levee banks or adjacent to the landside of levees;
- runoff of herbicides, fertilizers, diesel, gasoline, oil, raw concrete, and other toxic materials used for gate construction and maintenance into sensitive resource areas (e.g., wetlands, streams, special-status plant populations); and
- alteration of the tidal range and water levels during increased diversions into CCF, seasonally increased pumping at the SWP Banks facility, and operation of the gates that could result in the inundation or stranding of vegetation.

Impact Analysis Assumptions

The SDIP would result in temporary and permanent impacts on vegetation and wetland resources in the project area. Temporary impacts would be those that occur only during the construction period or during the maintenance dredging, which will be conducted once within 3–5 years after construction. Permanent impacts would be irreversible changes in land cover types.

In assessing the magnitude of possible impacts, the following project understandings and assumptions were made regarding construction, project operations, and maintenance activities.

- **Temporary impact areas** at each gate site caused by equipment staging and equipment movement would include the temporary staging area, any new temporary access roads, and the area within the temporary construction easement (shown as *Project Area* on Figures 6.2-2–6.2-5). However, as discussed under "Environmental Commitments" in Chapter 2, all staging areas and access roads will be selected to avoid sensitive biological resources. Temporary impacts would occur within any portions of the channels that would be dewatered for gate construction if the cofferdam method is used for gate construction. These impacts would occur only during construction. Temporary impacts associated with dredging would include the following categories:
  - Sealed clamshell dredging would be used at the gate sites and spot dredging locations for the siphon extensions. Clamshell dredging could also potentially be used at the West Canal, Middle River, and Old River dredge areas. The clamshell dredging method would occur either from barges or the levee top. Dredged material would be transported to a barge or to the landside of the levee in the bucket attached to the arm of the dredge equipment into a runoff management basin.
  - Temporary impacts of initial dredging, using a sealed clamshell to clear the area for construction and placement of the gate, at gate sites would affect the area 150 feet upstream and 350 feet downstream of each gate site. Maintenance dredging at the gate sites would occur within 150 feet

upstream of each gate. All riparian vegetation would be avoided in the upstream and downstream areas.

- Hydraulic dredging, if used, would occur from barges in West Canal, Middle River, and Old River. By this method, dredged material would be siphoned into a flexible pipe and transported to a stationary pipe that extended up the levee face and over the levee. Decant water would be returned to the river via another stationary pipe.
- If hydraulic dredging is used at the West Canal, Middle River, and Old River conveyance dredging areas (Figures 6.2-6–6.2-8), temporary impacts of initial dredging would include the locations where dredge disposal pipelines extend across the levee face. Therefore, this analysis assumes removal of vegetation at up to two crossings of the levee face for placing pipes on West Canal, up to 12 crossings on Middle River, and up to two crossings on Old River, for a total of 16 crossings. Old River dredged material would be barged to the Stewarts Tract dredged material disposal area. The analysis assumes that each pipe crossing would directly remove vegetation in a 10-foot-wide strip across the estimated 15-foot-high levee face. Vegetation removal would total approximately 150 square feet at each pipe location, for a total of up to 0.06 acre (2,400 square feet) over the 16 crossings.
- Temporary impacts of conveyance dredging at West Canal, Middle River, and Old River (Figure 6.2-1) may also include some pruning of riparian vegetation that overhangs the water surface and that may impede barge access. The number of trees that may require pruning is likely to be small and is not quantifiable based on the current level of design.
- The extent of dredge material disposal areas at the three conveyance dredging areas would include impacts on up to 155 acres for disposal areas on Roberts Island for the Middle River dredge area, and up to 10 acres for a disposal area on Stewarts Tract for Old River and Middle River dredging activities. Currently a total of 148.9 acres have been identified and mapped within the proposed dredged material disposal areas on Roberts Island and Stewarts Tract. Dredged material disposal for the West Canal dredge area will be at an existing pond on Fabian Tract and will not create additional impacts.
- Proposed locations of the dredge material disposal areas have been identified, and DWR has mapped land cover types within the disposal area footprints (Figure 2-8). DWR has committed to constructing all dredge drying areas on agricultural land adjacent to the dredge operations and to avoiding sensitive habitats, including wetlands and occurrences of special-status species. It is assumed that construction, operation, and removal of the dredged material disposal areas will not affect adjacent sensitive resources or land cover types, including (i.e., not limited to) wetlands and other waters of the United States, riparian, and VELB habitat. These disposal areas would remain in use for up to 5 years and would then be returned to agricultural use.

  - Temporary construction staging for siphon extensions would occupy approximately 100 square feet of channel at each location (Figure 2-9). This analysis assumes that construction activities at each of the 24 locations would temporarily affect an area of up to 100 square feet, for a project-wide impact of approximately 0.06 acre (2,400 square feet) of perennial tidal aquatic habitat. Siphon extension activities and dredging around siphons would occur completely in the channel and would not affect adjacent land or levees. Construction and dredging methods could affect vegetation and wetland resources in the vicinity of the extensions, depending the construction method(s) to be used.

- **Permanent impact areas** for each gate site and dredge area would include:
  - all land and channel aquatic area within the footprint of the gate and associated structures (e.g., control structure, parking area);
  - new permanent access roads;
  - extent of levee where slope protection would be placed;
  - intertidal areas that experience changes in hydrologic regime during project operation, causing intertidal vegetation zones to shift location in response to the new tide levels;
  - dredge material disposal areas to be used for dredging at gate sites (sealed clamshell dredge spoils would require runoff management basins to dewater dredged material prior to transport to a dredged material disposal area [Figure 2-1]) (this analysis assumes that each disposal area at the gate sites would occupy up to 1.2 acres); and
  - up to 24 siphon extensions, which will lie below the ordinary high-tide level of channels. This analysis assumes that placement of a siphon extension at each of the 24 locations would permanently affect an area of up to 12 square feet, for a project-wide impact of approximately 0.01 acre (288 square feet) of perennial tidal aquatic habitat.

- Initial dredging would occur as part of project construction, and one additional maintenance conveyance dredging for maintenance purposes would occur within 3 to 5 years of the initial dredging. It is expected that this dredging would be necessary every 3 to 5 years for the life of the project and that dredging activities would be minimal, removing only sediments that are deposited on the upstream side of the gate. This analysis includes only the initial dredging at the time of construction and the first round of maintenance dredging. Any dredging at a later time would be reviewed in a separate document. It is assumed that maintenance dredging at the gates and the three dredge areas would affect only the channel bottom and would not affect intertidal vegetation, based on the Project Commitments for the Dredging and Sampling Analysis Plan described in Chapter 2.

- Erosion of levees and in-channel islands in the Delta is primarily caused by wind- and boat-generated waves and by the shear stress from the channel flow (California Department of Water Resources 2003c). Dredging, therefore, is not a major cause of erosion in the project area. Slopes of dredging would be gentle enough to prevent any effect on levees or in-channel islands, dredging would occur in the channel center, and details of dredging slopes would be addressed in the site-specific dredging plans (see additional discussion of sediment transport and scouring in Section 5.6).

- All in-channel islands would be avoided during sealed clamshell dredging from a barge. Patches of tule and cattail tidal emergent wetland would be avoided during placement of the stationary pipes for hydraulic dredging.
- For dredging at the gate sites, three conveyance dredging areas, and siphon extensions, no impacts are assumed where a 6- to 12-inch layer of dredged material would be placed on unvegetated areas on the landside of the levees for levee reinforcement.
- Before construction begins, DWR would obtain all necessary permits pertaining to affected waters of the United States. Grading or other construction activities within all habitats on the waterside of levees would require a Streambed Alteration Agreement from DFG. Discharge of dredged or fill material into waters of the United States, including that associated with gate construction and placement of siphon extensions, would require a CWA Section 404 permit from the Corps and Section 401 certification from the RWQCB. Grading would require a CWA Section 402 permit and preparation of a SWPPP. Because the project area includes navigable waterways, work within the channels is also subject to Corps jurisdiction under the Rivers and Harbors Act of 1899. The permitting process would also require compensation for construction, initial dredging, and maintenance dredging impacts.
- The analysis for the Operational Components of Alternatives 2A–2D assumes that water levels will be maintained to at least 0.0 foot msl throughout the study area. For Alternatives 3B and 4B, water levels are likely to drop below the 0.0 foot msl level during periods of increased pumping in the areas that will not be protected by the construction of flow control gates.
- During gate operation, changes in water level of more than 1 foot would result in a measurable gain or loss of perennial tidal aquatic habitat and inundation or stranding of emergent wetland vegetation. Water level changes of less than 1 foot could have measurable effects on intertidal special-status plants if the change results in the loss of suitable habitat.
- The cross-sectional shapes of study area channels have not bee mapped. During periods of increased pumping without the protection of water levels by flow control gates under Alternatives 3B and 4B, subsurface projections on the channel bottom may become exposed and create patches of wetland in the channel. However, due to the lack of information on channel topography, the potential for creation of new wetland area cannot be predicted or quantified. Therefore, this potential for mitigation of some wetland loss is not included in the impact analysis.
- The estimated loss of waters of the United States under Alternatives 3B and 4B was base on an assumed decrease in the minimum water level of 2 feet during the periods of increased pumping from April to October. The

minimum water levels would remain the same as under current conditions with temporary barriers from October to March.

- Losses of common or artificial vegetation community types, including agriculture, ruderal, and landscaping, would be considered less-than-significant impacts on vegetation.

Impact Assessment Approach and Methods

This vegetation and wetland resources impact analysis is based on:

- the most current proposed project, as developed by DWR and summarized in the above assumptions;
- existing biological resource information (sources are discussed in "Affected Environment"); and
- current baseline conditions (as of 2000–2001, 2003, and 2004 field surveys).

The mitigation measures for impacts on vegetation and wetland resources were developed through review of the MSCS (CALFED Bay-Delta Program 2000e), prior environmental impact studies and reports for affected resources, discussions with resource agency personnel, and professional judgment.

Impacts in the following sections are grouped into:

- structural/physical components, which include impacts resulting from construction of the gates and dredging at the gate sites, three conveyance dredging areas, and siphon extension locations, and
- operational components, which include impacts resulting from operation of gates (i.e., changes in water level/tidal regime).

Most construction-related impacts address all project components, but, for clarity, some construction-related impacts are divided into gate construction, dredging at gates, dredging at the three conveyance dredging areas, and spot dredging at siphon extensions.

Land Cover Types

Construction impacts on land cover types were assessed by comparing the project footprint within the gate sites and the dredge areas with the mapped land cover types. Loss of all vegetation is assumed within the construction footprint. No loss of vegetation is assumed on in-channel islands within the dredge areas because the dredge equipment would not directly encroach on the islands, and no significant increase in scouring would result from dredging (Section 5.6). Hydrologic modeling was used to identify the location and magnitude of water level changes expected to result from operation of the project.

Special-Status Plants

For plant species known to occur in the project area and included in the ASIP (i.e., rose-mallow, Delta tule pea, and Mason's lilaeopsis), a species assessment model was used to analyze the impacts and determine appropriate mitigation. The results from the species assessment model are summarized in the following impacts section, and the complete model analysis is included in the ASIP (SDIP ASIP).

The species assessment model illustrates the potential linkages between project actions, environmental conditions, environmental correlates (the environmental conditions that determine biological performance), and biological performance (survival of the species) (Figure 6.2-11). Assessment of project impacts using the species assessment model considers the occurrence of each life stage of the species (i.e., plant establishment, plant growth and maintenance, and dispersal) relative to environmental conditions that result from the magnitude and timing of project activities. Elements of the model include life stage occurrence, descriptions of changes in environmental conditions, key environmental correlates, and measures of the species' biological performance.

The environmental correlates affecting dispersal of intertidal plants include continuity of habitat and entrainment. Environmental correlates will be affected by environmental conditions that may be altered by the project, including placement and operation of the permanent gates, proposed water diversions, and flow velocity, water level, and pattern in the channels during gate operation.

Establishment, growth, and maintenance of intertidal plants are affected by a number of environmental correlates, including contaminants, key habitat quantity, scour, physical injury, and competition. The environmental conditions affecting this set of correlates include tidal level, substrate, water salinity, nonnative competitors, gate construction, and flow velocity.

The assessment of the species response using the model is based on professional judgment and qualitative interpretation of available data. For each environmental correlate, hypotheses state relationships between environmental conditions and the expected species response, including explanations of the underlying principles of certain observed or expected species responses. Other key components of the model are described below:

- *Species sensitivity* to changes in environmental conditions documents the judgment applied in assessing the effects of SDIP actions.
- C*ertainty* of the level of sensitivity is considered for each environmental correlate. Certainty indicates the potential that the species' predicted response is reliable, adequate, accurate, and precise. Certainty comprises proof and error.
- *Proof* is the scientific support for the hypotheses, ranging from speculative relationships (i.e., low certainty) to those relationships that are thoroughly

established, generally accepted, and supported by peer-reviewed evidence (i.e., high certainty).

Certainty provides the basis for assessing the risk associated with management decisions, based on the estimated project effects, including risk to the persistence and resilience of the species population. Development of effective mitigation for project effects, including avoidance, minimization, and compensation measures, also depends on certainty.

Waters of the United States

Impacts on waters of the United States were analyzed using the same approach as for the land cover types described above. The land cover types included in this category are tidal perennial aquatic, tidal freshwater emergent, cottonwood-willow woodland wetland, and willow scrub wetland.

Significance Criteria

The criteria for determining significant impacts on biological resources were developed by reviewing State CEQA Guidelines and the CALFED Programmatic EIS/EIR (CALFED Bay-Delta Program 2000b). Based on these sources of information, the SDIP would likely cause a significant impact if it would result in:

- temporary or permanent removal, filling, grading, or disturbance of waters of the United States, including wetlands and jurisdictional and nonjurisdictional woody riparian vegetation;
- temporary or permanent loss of occupied special-status species habitat or indirect or direct mortality of more than 10% of the individuals of a special-status species documented by project surveys in the project area;
- a reduction in the area or geographic range of rare natural communities and significant natural areas;
- a conflict with the provisions of the MSCS (CALFED Bay-Delta Program 2000e); or
- spread or introduce new noxious weed species into the project area.

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project-specific actions. The mitigation measures address the short-term, long-term, and cumulative effects of CALFED.

The discussion of significant impacts and mitigation measures in this section will include a citation of one or more of the following programmatic mitigation measures used to build project-specific mitigation measures to offset significant impacts identified from implementation of the SDIP. These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. A complete list of CALFED programmatic mitigation measures is provided in Appendix E, “Mitigation Measures Adopted in the CALFED Record of Decision.”

1. Avoid direct or indirect disturbance to wetland and riparian communities, special-status species habitat, rare natural communities, significant natural areas, and other sensitive habitat.
2. Restore and enhance sufficient in-kind wetland and riparian habitat or rare natural communities and significant natural areas at offsite locations (near project area) before or at the time that project impacts are incurred. Replace not only acreage lost, but also habitat value loss.
3. Design program features to permit on-site mitigation or nearby restoration of wetland, riparian habitat, special-status species habitat, rare natural communities, and significant natural areas that have been removed by permanent facilities.
4. Phase the implementation of Ecosystem Restoration Program (ERP) habitat restoration to offset temporary habitat losses and to restore habitat (including special-status species habitat) before, or at the same time that, project impacts associated with the ERP are incurred.
5. Restore wetland and riparian communities, special-status species habitat, and wildlife use areas temporarily disturbed by on-site construction activities immediately following construction. Example actions include direct planting of native plants, controlling nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow for the natural reestablishment of the affected plant community.
6. Avoid creating wetlands in areas with high concentrations of mercury in sediments and anaerobic conditions.

14. Avoid direct or indirect disturbance to areas occupied by special-status species.

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

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

Alternative 1 (No Action)

Under the No Action alternative, the SDIP would not be implemented, the permanent fish control and flow control gates would not be built or operated, and an increase in diversion and pumping would not occur. The State Water Project would also continue to operate under its currently permitted pumping capacity of 6,680 cfs. All of the existing temporary barriers (head of Old River fish control barrier, and Middle River, Grant Line Canal, and Old River at DMC barriers) would continue to be installed and removed annually. No dredging would occur under Alternative 1.

Under Alternative 1, impacts on vegetation as a result of annually installing the temporary barriers would continue. The existing conditions at the barrier sites are such that installing and removing the barriers is not anticipated to result in alteration of existing riparian communities nor adversely affect special-status plants. However, activities involved with placing and removing fill within perennial aquatic habitat would continue to have a significant impact on water quality and habitat. Placement of the temporary rock barriers causes a temporary loss of aquatic habitat, releases sediments into the water, and blocks movement of plant propagules when the temporary barriers are in place. Mitigation for the original loss of habitat attributable to barrier installation and monitoring of water quality in the barrier areas was implemented as part of the environmental compliance requirements for the project.

2020 Conditions

Under Future No Action conditions (2020 conditions), SDIP would not be implemented. It is expected that the temporary barriers program would continue. Activities involved with placing and removing fill in perennial aquatic habitat would continue to have a significant impact on water quality and habitat, which has been mitigated as part of the original project. It is expected that the effects caused by placement of the temporary barriers would remain the same as existing conditions.

No additional significant effects of Alternative 1 are anticipated. No mitigation is required.

Alternative 2A

Stage 1 (Physical/Structural Component)

Land Cover Types

Impacts on land cover types that are considered waters of the United States, including tidal perennial aquatic, tule and cattail tidal emergent wetland, and jurisdictional riparian land cover types, are discussed below in “Waters of the United States.” Impacts on other vegetated land cover types are discussed in this section. Land cover impact acreages for Alternatives 2A–2C are shown in Table 6.2-4.

Impact VEG-1: Loss or Alteration of Nonjurisdictional Woody Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Gate Construction. Construction of the flow control gate at Old River at DMC would result in the permanent loss of less than 0.01 acre of nonjurisdictional willow scrub (Table 6.2-4). Construction of the Middle River and Grant Line Canal gates would not affect nonjurisdictional riparian vegetation. Loss of jurisdictional woody riparian communities at the gates is discussed under Impact VEG- 8. No riparian vegetation occurs at the head of Old River fish control gate site.

Sealed clamshell dredging at the three flow control gate sites would avoid impacts on riparian vegetation. Dredging at the head of Old River fish control gate would not affect any riparian vegetation.

Gate Operation. Nonjurisdictional riparian habitats occupy the area above the existing high-tide levels. Gate operation would not substantially alter the existing high-tide levels from existing conditions in the areas upstream or downstream of the gates. The low-tide level would decrease by approximately 1 foot upstream of the gates and by approximately 2–3 inches in the downstream area, as further discussed under Impact VEG-5. Woody riparian vegetation generally has root systems that can access groundwater when surface water is unavailable. The change in water availability caused by decreased low-tide levels downstream of the gates under project operations would not cause a perceptible change in water availability to riparian vegetation. Because the high tide during project operations would not substantially change from existing conditions and low-tide changes would not be expected to significantly affect riparian vegetation, gate operation is not expected to have a significant impact on the nonjurisdictional riparian vegetation. This alteration would be considered a less-than-significant impact. No mitigation is required.

Channel Dredging. The use of hydraulic dredging in West Canal, Middle River, and Old River would minimize but not entirely avoid temporary impacts on woody riparian vegetation because of the placement of the stationary pipes for dredged material on the levee face. Pockets of riparian vegetation occur on the levees between Middle River and Union and Roberts Islands. The exact locations of stationary pipes to transport dredged material over the levees to dredge disposal areas are currently unknown, but placement of pipes on the levee banks would temporarily affect up to a maximum of 16 locations of woody riparian vegetation throughout the three conveyance dredging areas. Assuming removal of vegetation in a 10-foot-wide band for placement of each of the 16 stationary pipes and an estimated levee face height of 15 feet, up to 0.06 acre (2,400 square feet) of woody riparian vegetation would be removed. DWR would avoid placing pipe within woody riparian vegetation to the extent possible. This impact conservatively assumes the maximum possible impact, and the actual impact would likely be less. This impact would continue for up to 5 years after initial dredging, until the pipes were removed and the banks were revegetated. This impact is considered significant.

Table 6.2-4. Land Cover Impacts Associated with Gate Construction and Dredging—Alternatives 2A–2C

Land Cover Type	Acreages Affected by Gate Construction: Middle River Flow Control Gate	Grant Line Canal Flow Control Gate	Old River at DMC Flow Control Gate	Head of Old River Fish Gate	Total Permanent Impacts Associated with Gate Construction	Acreages Affected by Dredging[1]: Impacts Associated with Dredging at Gate Sites	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area	Total Temporary Impacts Associated with Conveyance Dredging	Temporary Impacts Associated with Agricultural Diversions	Permanent Impacts Associated with Agricultural Diversions	Impacts Associated with Dredge Material Disposal[4]
Tidal perennial aquatic	0.16	0.32	0.26	0.14	0.88	29.82	73.02	72.67	123.46	269.15	0.06	<0.01	0
Tule and cattail tidal emergent wetland	0.07	<0.01	<0.01	0	<0.08	0	0	0	0	0	0	0	0
Cottonwood-willow woodland	0	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Cottonwood-willow woodland wetland	0	0.03	0	0	0.03	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Valley oak riparian woodland	0	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub	0	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub wetland	0.02	0.03	0.12	0	0.17	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub	0	0	<0.01	0	<0.01	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub wetland	0	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Agricultural land	0.50	0.25	2.00	0	2.75	4.80[3]	0	0	0	0	0	0	101.50
Ruderal	0	0.02	0	0.02	0.04	0	0	0	0	0	0	0	47.40

Notes:

DMC = Delta-Mendota Canal.

[1] Dredge impacts assumed impacts on all tidal perennial aquatic habitat within the dredge area. Actual loss of tidal perennial aquatic habitat will probably be less as a result of confining dredge activities to the center of the channel.

[2] Dredge impacts on individual riparian land cover types are not yet determined because the exact placement of the stationary pipes has not been identified. The riparian impact will total up to 0.06 acre at the three dredge areas.

[3] The acreage for the gate site agricultural impact includes the areas used for dredge drying areas at all four gate sites, which was assumed to require 1.2 acres at each site. This represents a permanent impact.

[4] The acreage for dredge drying areas at the 3 conveyance dredging areas is a temporary impact.

Sealed clamshell dredging of channels, if used in the conveyance dredging areas, would avoid direct impacts on all riparian vegetation. Clamshell dredging at siphon locations would not have an impact on woody riparian vegetation.

Temporary indirect impacts of dredging adjacent to the gate sites, at all three conveyance dredging locations, and at siphon extensions could include decreased water quality levels caused by turbidity. Riparian vegetation near the waterline would not likely be significantly affected by the temporarily small increase in water turbidity. See Impact WQ-2 for discussion of water quality impacts during dredging.

Riparian areas are suitable habitat for special-status plants, are important wildlife habitat for breeding and foraging, and provide movement corridors and links between habitats. DFG considers riparian habitat a sensitive natural community because of its high value to wildlife and its documented scarcity in California.

The temporary impacts on up to 0.06 acre of woody riparian vegetation as a result of conveyance dredging would be considered significant. These losses of woody riparian vegetation would reduce the extent of riparian communities, which are rare natural communities. Implementation of the mitigation measures listed below and environmental commitments (Chapter 2) would reduce this impact to a less-than-significant level.

Mitigation Measure VEG-MM-1: Minimize Impacts on Sensitive Biological Resources. DWR and Reclamation will include the following measures in the project construction conditions to minimize indirect impacts on sensitive natural communities, including riparian habitats and waters of the United States, and on special-status plants:

1. DWR and Reclamation will provide a biologist/environmental monitor who will be responsible for monitoring implementation of the conditions in the state and federal permits (CWA Section 401, 402, and 404; ESA Section 7; Fish and Game Code Section 1602; project plans (SWPPP); and EIS/EIR mitigation measures).
2. The biologist/environmental monitor will determine the location of environmentally sensitive areas adjacent to each gate site and dredge area based on mapping of existing land cover types and special-status plant species (Figures 6.2-2–6.2-9). To avoid construction-phase disturbance to sensitive habitats immediately adjacent to the project area, the monitor will identify the boundaries of sensitive habitats and add a 50-foot buffer, where feasible, using orange construction barrier fencing. The fencing will be mapped on the project designs. Erosion-control fencing will also be placed at the edges of construction where the construction activities are upslope of wetlands and channels to prevent washing of sediments offsite. The ESA and erosion-control fencing will be installed before any construction activities begin and will be maintained throughout the construction period.
3. The biologist/environmental monitor will ensure the avoidance of all sensitive habitat areas, including patches of tule and cattail emergent wetland in channels, during dredging operations.

4. The biologist/environmental monitor will flag the locations of special-status plants recorded during the 2000–2001 and preconstruction surveys (outlined in VEG-MM-4) that are in proposed construction and dredging areas but outside of the gate footprints. The monitor will ensure that floating vegetation is not washed onto these special-status plants on the shoreline during in-channel construction and dredging activities.
5. DWR and Reclamation will provide a worker environmental training program for all construction personnel prior to the start of construction activities. The program will educate workers about special-status species, riparian habitats, and waters of the United States present on and adjacent to the site and also about the regulations and penalties for unmitigated impacts on these sensitive biological resources.
6. Landing on in-channel islands, anchoring boats and/or barges to these islands, and encroaching by construction personnel on the islands will be prohibited. The exception to this measure is at Grant Line Canal, where the utility lines will cross the island, and construction personnel will have to access the utility corridor during installation.
7. Where feasible, construction will avoid removal of woody vegetation by trimming vegetation to approximately 1 foot above ground level
8. Following construction at the gate sites, the construction contractor will remove all trash and construction debris and implement a revegetation plan for temporarily disturbed vegetation in the construction zones. The elements that should be included in the revegetation of these sites are described in Mitigation Measures VEG-MM-2 and VEG-MM-7.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1 and 14.

Mitigation Measure VEG-MM-2: Compensate for Unavoidable Temporary and Permanent Loss of Riparian Habitats. DWR and Reclamation will compensate for the temporary loss of up to 0.06 acre of nonjurisdictional riparian habitat for dredge pipe placement in conveyance dredging areas permanent loss of less than 0.01 acre of nonjurisdictional willow scrub at the Old River at DMC gate, and permanent loss of up to 0.20 acre of jurisdictional riparian vegetation at the Middle River, Grant Line Canal, and Old River at DMC gates. Compensation will include restoring or enhancing in-kind riparian habitat at a ratio of 2–3 acres for each acre affected, for a total of 0.54 – 0.81 acre. If temporary impacts are avoided during placement of stationary pipelines, the required mitigation will be less. The mitigation ratio will ensure long-term replacement of habitat functions and values. Revegetation will be planned and implemented prior to the removal of existing riparian vegetation. This mitigation is consistent with the MSCS Conservation Measure to “restore or enhance 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts are incurred before implementing actions that could result in the loss or degradation of habitat” (CALFED Bay-Delta Program 2000e).

As much of the mitigation habitat as possible will be created on-site or near the project area. The Grant Line Canal gate impact will be mitigated by replanting the disturbed vegetation on the in-channel island. This mitigation is consistent with the following MSCS Conservation Measure (CALFED Bay-Delta Program 2000e):

> to the extent practicable, include project design features that allow for onsite reestablishment and long-term maintenance of riparian vegetation following project construction.

Site selection, however, will avoid areas where future dredging, improvements, or maintenance is likely. DWR and Reclamation will obtain site access through a conservation easement or fee title. To the extent practicable, mitigation sites will be located near ongoing and future ERP projects.

In addition to the requirements of the MSCS Conservation Measures, DWR and Reclamation will prepare a revegetation plan and monitor the restoration or enhancement mitigation sites. The revegetation plan will be prepared by a qualified restoration ecologist and reviewed by the appropriate agencies. The revegetation plan will specify the planting stock appropriate for each riparian land cover type and each mitigation site, ensuring the use of genetic stock from the south Delta area. The plan will employ the most successful techniques available at the time of planting. Success criteria will be established as part of the plan. Plantings will be maintained for a minimum of 5 years, including weed removal, irrigation, and herbivory protection.

DWR and Reclamation will monitor the plantings annually for 4 years, followed by monitoring in years 8 and 10 following initial mitigation implementation, to ensure they have established successfully. DWR and Reclamation will submit annual monitoring reports of survival to the regulatory agencies issuing permits related to habitat impacts, including the DFG, Corps, and USFWS. Replanting will be necessary if success criteria are not being met. The riparian habitat mitigation will be considered successful when the number of sapling trees established meet the success criteria, the habitat no longer requires active management, and vegetation is arranged in groups that, when mature, replicate the area, natural structure, and species composition of similar riparian habitats in the region.

Specific mitigation funding sources are not identified at this time, but funding will be required and could include contributions from Proposition 13 (Safe Drinking Water, Clean Water, Watershed Protection, and Flood Protection Act, 2000), Proposition 204 (SB 900) (Safe, Clean, Reliable Water Supply Act, 1996), and/or water contractor contributions.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 2, 3, 4, and 5.

Impact VEG-2: Loss of Agricultural Land and Ruderal Vegetation as a Result of Gate Construction and Disposal of Dredged Material.

Agricultural land and ruderal vegetation will be permanently lost as a result of gate construction and dredging at gate sites and the three conveyance dredging areas. These two components are discussed below.

Gate Construction and Channel Dredging. Construction at the four gate sites would result in the removal of 7.55 acres of agricultural land and 0.04 acre of ruderal vegetation. Approximately 1.2 acres of agricultural land at each gate site, for a total of 4.8 acres, would be permanently lost as a result of construction of runoff management basins at each gate site.

Conveyance Dredging. Up to 165 acres of temporary spoils ponds or runoff management basins will be constructed as part of the conveyance dredging action. The potential locations of the spoils ponds or runoff management basins have been identified and mapped, although specific sites have not been selected. It is assumed, however, that all spoils ponds or runoff management basin areas would be constructed on agricultural land adjacent to the dredge operations. DWR is committed to minimizing impacts on sensitive habitats, including wetlands and occurrences of special-status species, and will construct the ponds or basins on agricultural land. These factors will play a major role in the determination of the dredged material disposal sites. These dredge ponds or basins would remain in use for up to 7 years and would then be returned to agricultural use.

Siphon Extensions. Dredged material associated with siphon extensions would be placed in the disposal sites described above.

Because agricultural land and ruderal communities support few native plant species, have low potential for supporting special-status plant species, and are locally and regionally abundant throughout the Delta, the impact on vegetation would be less than significant, and no mitigation is required.

Impact VEG-3: Removal of Giant Reed for Gate Construction.

Approximately 0.08 acre of giant reed is present on the north bank adjacent to the Old River at DMC gate project area. Assuming removal of all vegetation within the project area, this area of giant reed (shown as *Arundo* on Figure 6.2-5) would also be removed. Giant reed is recognized by the California Exotic Pest Plant Council and the California Department of Food and Agriculture (California Exotic Pest Plant Council 1999; California Department of Food and Agriculture 2000) as a noxious invasive weed that displaces and degrades the wildlife habitat value of riparian vegetation.

Removal of the stand of giant reed during construction of the Old River at DMC gate would be a beneficial impact. No mitigation is required.

Impact VEG-4: Spread of Noxious Weeds as a Result of Gate Construction and Channel Dredging.

Gate construction and channel dredging activities could result in the introduction or spread of noxious weed species, which could displace native species, thereby changing the diversity of species or number of any species of plants. Soil-disturbing activities during construction could promote the introduction of plant species that are not currently found in the project area, including exotic pest plant species. Construction activities could also spread exotic pest plants that already occur in the project area. One noxious weed, giant reed, has been documented in the project area.

Introduction or spread of noxious weeds in the project area would be considered a significant impact because it would result in degradation of special-status plant habitat and riparian communities. Implementation of Mitigation Measure VEG-MM-3 below would reduce this impact to a less-than-significant level.

Mitigation Measure VEG-MM-3: Avoid Introduction and Spread of New Noxious Weeds during Project Construction and Dredging. DWR and Reclamation will include the following measures in the project construction conditions to minimize the potential for the introduction of new noxious weeds and the spread of weeds previously documented in the project area:

1. Educate construction supervisors and managers on weed identification and the importance of controlling and preventing the spread of noxious weed infestations.
2. Treat isolated infestations of giant reed or other noxious weeds identified in the project area with approved eradication methods at an appropriate time to prevent further formation of seed and destroy viable plant parts and seed.
3. Minimize surface disturbance to the greatest extent possible.
4. Seed all disturbed areas with certified weed-free native and nonnative mixes, as provided in the revegetation plan developed in cooperation with DFG. Mulch with certified weed-free mulch. Rice straw may be used to mulch upland areas.
5. Use native, noninvasive species or nonpersistent hybrids in erosion control plantings to stabilize site conditions and prevent invasive species from colonizing.
6. Restore or enhance 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.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measure 5.

Special-Status Plants

Impact VEG-5: Loss or Disturbance of Mason's Lilaeopsis Stands or Potential Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Approximately 175 stands of Mason's lilaeopsis were identified in the study area during the 2000–2001 surveys (Figure 6.2-10). Mason's lilaeopsis stands located near the project area include:

- approximately 20 stands almost 0.5 mile downstream of the Middle River gate site;
- approximately 20 stands within the project area along Grant Line Canal, up to three of these within the gate site and nine within 0.5 mile upstream of the site;
- one stand less than 0.25 mile upstream of the Old River at DMC gate site and another approximately four stands immediately downstream of the site;
- approximately 17 stands along the West Canal within the proposed conveyance dredging area;
- approximately six stands at siphon extension locations on Victoria and North Canals; and
- approximately four stands at the siphon extension at the confluence of Old River and Grant Line Canal and Fabian and Bell Canal.

Gate Construction. Construction activities associated with the Middle River gate are not anticipated to affect the lilaeopsis stands located downstream. There would be no direct construction impact on these stands. Indirect impacts caused by the spread or introduction of invasive plants or chemical contaminants are unlikely to affect plants nearly 0.5 mile downstream.

Construction of the Grant Line Canal gate would have a direct impact on Mason's lilaeopsis, resulting in the permanent loss of up to three stands of the lilaeopsis as a result of excavation for the cofferdam, if used, and the placement of riprap for slope protection of the levee. Construction would remove the existing stands, permanently remove the habitat for any reestablishment after construction, and reduce the number of reproductive plants in the area. This impact would be significant.

Indirect impacts could result from construction activities for the Grant Line Canal and Old River at DMC gates. Upstream of the Grant Line Canal gate footprint, up to nine other stands could be indirectly affected. Construction of the Old River at DMC gate could indirectly affect the approximately five stands upstream and downstream of the gate. Construction equipment could spread or introduce plants that compete with Mason's lilaeopsis for mudflat habitat, including pampas grass and water hyacinth. This impact would be significant. The equipment could also cause water contamination by leaking oil or fuel, which has the potential to be toxic to the established stands of lilaeopsis. However, the potential for water contamination by construction equipment is unlikely to exceed the existing potential for contamination from recreational boats.

Gate Operation. Changes in tidal water levels in the project area would occur because of gate operations. The flow control gates would operate through most of the growing season. The head of Old River fish control gate would not operate during the summer.

Upstream of the gates during gate operation, high-tide water levels would remain approximately the same as existing conditions, except at the Grant Line Canal gate, where the high-tide level would decrease by up to 1 foot. Low-tide levels would decrease by up to 1 foot from existing conditions with the temporary barriers during the summer months (Section 5.2; Figures 5.2-33, 5.2-37, 5.2-39, and 5.2-41; Impacts HY-3, HY-5, HY-6, and HY-7). The net effect of the project would be an increase in the extent of the intertidal zone by up to 1 foot in the area upstream of each gate (i.e., on Middle River from the gate to Old River; on Grant Line Canal to Old River; and on Old River to the head of Old River). This increase would reverse much of the effect on low-tide levels during spring and summer caused by the temporary barriers program. Downstream of the gates during the growing season, water levels would be 2–3 inches lower than existing conditions at low tide and high tide. The net result would be a shifting of the water level downslope in the area downstream of the gate, but there would be no substantial change in the extent of intertidal habitat.

The high-tide level upstream of Grant Line Canal would be reduced by project operations to a minimum of about 2 feet and would be higher at most times (Figure 5.2-41). Mason's lilaeopsis grows at elevations up to about 2 feet msl (California Department of Water Resources 1999c, 2001b). The decrease in high-tide level upstream of the gate, therefore, would not likely affect the tidal inundation of existing Mason's lilaeopsis stands. The decrease in low-tide levels upstream of all gates would potentially increase the extent of suitable intertidal habitat for Mason's lilaeopsis. The approximately 17 stands of Mason's lilaeopsis upstream of the Grant Line Canal gate and 1 stand upstream of the Old River at DMC gate would not likely be significantly affected by gate operations.

The Mason's lilaeopsis stands located downstream of the three gate sites could experience a shifting of low- and high-tide water levels downslope by 2–3 inches (Section 5.2; Figures 5.2-29 and 5.2-31; Impacts HY-1 and HY-2). Stands of Mason's lilaeopsis closest to CCF occur in areas that would experience the greatest decreases in the tidal water level. The low-tide level would decrease by less than 1 foot, and the high-tide level would decrease by 3 feet but would remain above 2 feet msl (Figure 5.2-31). The lilaeopsis could grow farther downslope to occupy the new intertidal area created by the increased pumping diversions. The decrease in low-tide levels downstream of all gates and in the area near CCF would potentially increase the extent of suitable intertidal habitat for Mason's lilaeopsis. The stands of Mason's lilaeopsis downstream of gates, therefore, would not be significantly affected by project operations.

No significant increase in tidal flow velocity would occur in the project area as a result of the gate operation, and flow velocities would be reduced by the increased conveyance capacity produced by dredging (see Impacts HY-3 through HY-7 in Section 5.2 for additional discussion of changes in tidal flow). This effect would be a less-than-significant impact on Mason's lilaeopsis.

No discernable change in average salinity would be anticipated as a result of gate operations (Section 5.3). The long-term average salinity would be 600–700 µS/cm, which is equivalent to less than 1 ppt (Figures 5.3-15–5.3-17). The salinity objective for project operations is 1,000 µS/cm. Growth of Mason's lilaeopsis is not affected by less than 3 ppt salinity (Fiedler and Zebell 1993). Seed germination is best at 0 ppt salinity, but existing conditions exceed that level. The extent of suitable habitat for Mason's lilaeopsis, therefore, would not be altered as a result of changes in salinity. This effect would be a less-than-significant impact.

Operation of the permanent gates would not be anticipated to affect dispersal of Mason's lilaeopsis upstream or downstream of the gates. The lilaeopsis colonizes new habitat either by seed or vegetative mats of plants that float to new habitat (Golden and Fiedler 1991). Either method requires transportation by water. The permanent gates could block movement upstream and downstream for a substantial portion of the day during the operation periods in spring, summer, and fall. The lilaeopsis propagules (seed or mat), however, would be able to move across the gates during the portion of the day when the gates were open. Implementation of permanent gates, therefore, would not be expected to change the success of colonization of new habitat by Mason's lilaeopsis.

The operation of the permanent gates would not substantially change the upstream or downstream flow velocity, salinity, or dispersal potential from the existing conditions in the project area. Changes in the upstream and downstream tidal water levels from project operation could result in increased suitable habitat for Mason's lilaeopsis and would not have an adverse effect on Mason's lilaeopsis. Although this effect would be considered a less-than-significant impact, Mitigation Measure VEG-MM-6 is included below to monitor existing populations during the initial years of gate operation to verify the absence of impact.

Channel Dredging. Conveyance dredging of the West Canal and dredging at siphon extensions in Victoria, North, Grant Line, and Fabian and Bell Canals would avoid direct removal of Mason's lilaeopsis but could indirectly affect up to 27 stands that grow at the edges of the canals in these areas. Disturbance of the water in the canal from the barge during dredging could result in higher than normal wave action on the shoreline, which could dislodge lilaeopsis plants growing there or possibly wash floating vegetation on top of the plants, which would smother them. This impact would be significant. Dredge equipment also has the potential to contaminate the water with oil or fuel, which may be toxic to the lilaeopsis, but is unlikely to exceed the existing potential for water contamination produced by boats.

The decrease in water velocity after channel dredging may benefit Mason's lilaeopsis and other intertidal plants by reducing erosion of the canal banks. Transport of sediment (scouring) during channel dredging would be minimized to a less-than-significant level by implementing proposed dredging methods (Impact SS-4).

Mason's lilaeopsis is a state-listed rare species restricted to small areas of ephemeral habitat and susceptible to adverse effects by direct and indirect habitat loss. The project would result in the loss of up to three stands of Mason's lilaeopsis because of the direct impacts of project construction at the Grant Line Canal site. Disturbance of up to 41 stands would occur because of potential indirect impacts at the Grant Line Canal and Old River sites and indirect impacts of dredging activities in the West, Victoria, North, Grant Line, and Fabian and Bell Canals. Including disturbances that could eradicate the stands, the project could, therefore, cause mortality of more than 10% of the approximately 175 stands mapped in the project area. For this reason, the direct and indirect impacts of construction and dredging would be considered significant impacts. Implementation of Mitigation Measures VEG-MM-1 and those listed below would reduce these impacts to a less-than-significant level.

Mitigation Measure VEG-MM-4: Conduct Preconstruction Surveys for Special-Status Plants. Within 1 year prior to initiating gate construction or channel dredging, DWR and Reclamation will conduct special-status plant surveys of all proposed areas of disturbance. The purpose of these surveys will be to verify that the locations of special-status plants in the 2000–2001 surveys are extant, identify any new special-status plant occurrences, and cover any portions of the project area not previously identified. This mitigation is consistent with the MSCS Conservation Measure stating that (CALFED Bay-Delta Program 2000e):

> before implementing actions that could result in take or the loss or degradation of occupied habitat, conduct surveys in suitable habitat within portions of the species' range that CALFED actions could affect to determine the presence and distribution of the species.

The extent of mitigation for direct loss of or indirect impacts on special-status plants will be based on these survey results. Locations of special-status plants within proposed construction areas will be recorded using a GPS unit and flagged.

The survey will include mapping of tidal mud flat habitat in the project area, including the gate footprints and dredging areas. The survey will also include an evaluation of the habitat quality based on surrounding habitats (e.g., adjacent riprapped levee banks would lower the habitat quality, adjacent riparian vegetation would increase habitat quality). The extent of both Mason's lilaeopsis occupied habitat and unoccupied tidal mud flat habitat will be quantified for use in determining the amount of habitat mitigation required under Mitigation Measure VEG-MM-5.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measure 14.

Mitigation Measure VEG-MM-5: Minimize Impacts on and Compensate for Loss of Mason's Lilaeopsis. Stands of Mason's lilaeopsis that can be avoided within the construction area will be fenced, including a buffer of 50 feet on all sides.

DWR and Reclamation will initiate mitigation for unavoidable loss of Mason's lilaeopsis prior to construction and will base the compensation on the survey results obtained from the preconstruction surveys. The MSCS conservation measure for Mason's lilaeopsis habitat compensation states that "for each linear foot of occupied habitat lost, create 5 to 10 linear feet, depending on habitat quality, of suitable habitat with 1 year of loss" (CALFED Bay-Delta Program 2000e). Compensation for loss of Mason's lilaeopsis as a result of gate construction for the SDIP, therefore, will include creation of new tidal mud flat habitat at a ratio of 5–10 linear feet for each linear foot removed by the project. The quality of the removed occupied habitat will be evaluated during the preconstruction survey required under Mitigation Measure VEG-MM-4. Low-quality mud flat habitat at the base of riprapped levee banks, for example, would be mitigated at a ratio of 5:1 (5 linear feet created for each linear foot removed), while high-quality mud flat habitat adjacent to emergent wetland and/or riparian vegetation would be mitigated at or near the 10:1 (10 linear feet created for each linear foot removed) mitigation ratio. DWR will identify suitable habitat creation sites that:

- are located as close to the site of plant removal as possible;
- will include areas with minimal boat wakes, shallow water, and slow water velocities, and
- are not likely to be dredged or have other improvements constructed.

Created habitat will include a suitable mud flat substrate at appropriate elevations (approximately 0.5–2 feet NGVD) with minimal disturbance from boat wakes, channel dredging, and levee maintenance. DWR and Reclamation will obtain mitigation site access through a conservation easement or fee title. To the extent practicable, mitigation sites will be located near ongoing or future ERP projects.

If offsite mitigation sites are identified, mitigation will be implemented prior to the loss of occupied habitat, and salvaged plant material will be planted at the mitigation site. If onsite mitigation sites will be used, salvaged plant material will be stockpiled or propagated at a native plant nursery for later planting, and mitigation will be implemented as soon as practicable after completion of construction or dredging activities.

If offsite mitigation is necessary, a location that does not currently support tidal flats should be selected. An area that currently supports minimal habitat value, such as the portion of Old River upstream of the proposed fish control gate, would be desirable. If water is too deep at a potential mitigation site, dredged material could be used to construct a bench area as substrate for the tidal mud flat habitat. Prior to use, however, such material would be subject to analysis for the presence of contaminants, such as heavy metals. Excessively high levels of contaminants may prohibit the use of dredged materials for bench construction. This mitigation approach is also likely to require permitting under Sections 401 and 404 of the CWA for placement of dredged or fill material in waters of the United States, and under the Rivers and Harbors Act if it occurs in navigable waters.

As additional experimental compensation to the MSCS measure, DWR and Reclamation will prepare a transplanting plan for the lilaeopsis, adapting the methodology outlined in the monitoring plan for transplanting Mason's lilaeopsis in Barker Slough (California Department of Water Resources 1990b). The plan will include a success criterion for the transplanted plants to achieve 80% survival at the end of a 5-year monitoring period and additional compensatory measures to implement if the survival rate is not achieved.

All unavoidable stands of Mason's lilaeopsis to be removed from the construction area will be salvaged and transplanted to a portion of the created suitable habitat. Areas of occupied habitat should also be considered for enhancement, if transplanting is possible without disturbance of the existing Mason's lilaeopsis plants. DWR and Reclamation will obtain site access through a conservation easement or fee title.

DWR and Reclamation will maintain the transplant areas for a minimum of 5 years, including replanting, removal of trash or debris washed onshore, and removal of nonnative species, if possible, without disturbing the Mason's lilaeopsis plants.

DWR and Reclamation will monitor the transplanted plants for at least 10 years after transplanting, adapting the methods used for the Barker Slough transplanting, as appropriate (California Department of Water Resources 1990b). Monitoring will include measurement of cover of the transplanted plants using large-sized quadrants or, preferably, a transect method. Monitoring will be conducted on a quarterly basis for 1 year, annually for the next 3 years, and once every 2 years for an additional 6 years. For each monitoring period, DWR and Reclamation will submit a report to DFG describing the results of the monitoring period. The reports will include the monitoring data, as well as a discussion of any problems with the plants and the measures implemented or proposed to correct the problems. The reports will also indicate the annual precipitation and note the occurrence of drought conditions or above normal flooding events. This information will assist in evaluating whether the transplanted plants have been able to tolerate more than just normal precipitation years. If the monitoring period has coincided with an extended period of drought or high precipitation, DFG may request additional monitoring to measure the response of transplants to a greater range of natural processes.

Specific mitigation funding sources are not identified at this time, but funding will be required and could include contributions from Proposition 13: Safe Drinking Water, Clean Water, Watershed Protection, and Flood Protection Act, 2000; Proposition 204 (SB 900): Safe, Clean, Reliable Water Supply Act, 1996; and/or water contractor contributions.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 14, 17, and 19.

Mitigation Measure VEG-MM-6: Monitor Existing Stands of Mason's Lilaeopsis during Gate Operations. During gate operations, DWR and Reclamation will monitor the Mason's lilaeopsis populations identified in the surveys conducted for Mitigation Measure VEG-MM-4. The purpose of monitoring will be to determine whether changes in the tidal zone that occur as a result of gate operations result in any loss of Mason's lilaeopsis. An approximately 1.0-foot lowering of the tidal level is predicted to occur in the area upstream of the gates. DWR and Reclamation will annually monitor the extent and condition of the Mason's lilaeopsis populations identified during preconstruction surveys within 0.5-mile upstream of the gates.

The extent of Mason's lilaeopsis will be monitored, adapting the methods used for the Barker Slough transplanting project, as appropriate (California Department of Water Resources 1990b). Monitoring will include measurement of cover of the Mason's lilaeopsis plants using large-sized quadrats or a transect method. Monitoring of the areas upstream of the gates will be conducted annually for a 5-year period after the gates are constructed (also see Mitigation Measure VEG-MM-10: Monitor Existing Stands of Tidal Emergent Wetland Vegetation During the Gate Operation Phase).

If a decrease in the extent of Mason's lilaeopsis is observed after gate operation begins or anytime during the 5-year monitoring period, DWR and Reclamation will compensate for the loss of this vegetation by implementing Mitigation Measure VEG-MM-5.

Impact VEG-6: Loss or Disturbance of Delta Mudwort Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging. Approximately 40 stands of Delta mudwort were identified in the study area during the 2000–2001 surveys. This number includes stands located approximately 0.5 mile downstream of the Middle River gate site, within the West Canal conveyance dredging area, and at dredge areas for siphon extensions on Victoria and North Canals (Figure 6.2-10).

Gate Construction. Construction activities associated with the Middle River gate would not be expected to affect the Delta mudwort stands located downstream. Construction of the other gates would not be expected to affect Delta mudwort.

Gate Operation. Fewer data on habitat and tolerance of disturbance are available for Delta mudwort than for Mason's lilaeopsis. Because these species often grow in association with each other, however, it is likely that impacts on Delta mudwort because of changes in existing tidal level would be similar to those predicted and described above for Mason's lilaeopsis. However, no Delta mudwort stands were observed in the project area upstream of any of the gates. No extant populations, therefore, would likely be affected by the operation of the gates.

The operation of the permanent gates would not significantly change the tidal levels, flow velocity, or salinity from the existing conditions where Delta mudwort occurs in the project area (see additional discussion of these habitat components under Impact VEG-12). Therefore, no loss of Delta mudwort caused by gate operation is anticipated, and this effect would be considered a less-than-significant impact. No mitigation is required.

Channel Dredging. Conveyance dredging of the West Canal and dredging at the siphon extension locations would avoid direct removal of Delta mudwort but could indirectly affect three stands at the north end of West Canal and up to seven stands on the west half of Victoria and North Canals. Disturbance of the water in the canal during dredging from the barge could result in higher than normal wave action on the shoreline, which could dislodge mudwort plants growing there or wash floating vegetation on top of the plants and smother them. The decrease in water velocity after channel dredging, however, may benefit Delta mudwort and other intertidal plants by reducing erosion of the canal banks. Transport of sediment (scouring) during channel dredging would be minimized to a less-than-significant level by implementing proposed dredging methods (see Impact SS-4).

Disturbance and potential loss of up to 10 stands of Delta mudwort as a result of dredging in the West, Victoria, and North Canals could cause mortality of more than 10% of the approximately 40 stands mapped in the project area. For this reason, project impacts of construction and dredging would be considered significant impacts. However, implementation of mitigation for loss of Mason’s lilaeopsis would also benefit Delta mudwort by creating suitable habitat. Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-5, and VEG-MM-6 would reduce this impact to a less-than-significant level.

Impact VEG-7: Loss of Rose-Mallow Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Approximately 36 stands of rose-mallow were identified during the 2000–2001 surveys. The only stands near the project area were located immediately downstream of the Middle River gate site and within the West Canal conveyance dredging area (Figure 6.2-10). Other stands of rose-mallow were observed in Grant Line Canal, but they were more than 1 mile upstream of the proposed gate site.

Gate Construction. Construction activities at the Middle River gate site would not be expected to significantly affect the stands of rose-mallow. Direct or indirect loss of rose-mallow is not expected as a result of project construction.

Gate Operation. In the project area and vicinity, rose-mallow occurs in the intertidal zone and is within approximately 1 mile upstream of the Grant Line Canal gate site and 0.1 mile downstream of the Middle River gate site. As described under Impact VEG-9, the operation of the permanent gates would not substantially change the downstream tidal levels. Operation of the permanent gate on Middle River, therefore, would not cause a discernable change in tidal levels compared to the existing operation of temporary barriers where rose-mallow occurs (Figure 6.2-10; Figures 5.2-33, 5.2-35, 5.2-37, 5.2-39, and 5.2-41; and Impacts HY-3 through HY-7).

The operation of the permanent gates would not substantially change the tidal level, flow velocity, or salinity from the existing conditions in the project area. Therefore, no loss of rose-mallow caused by gate operations would be anticipated, and this effect would be considered a less-than-significant impact. No mitigation is required.

Channel Dredging. Conveyance dredging of the West Canal would be unlikely affect this species because vegetation on the canal banks and on the in-channel island would be avoided by dredging activities. Rose-mallow is a large, robust plant, relative to Mason's lilaeopsis and Delta mudwort, and would not likely be affected by wave action generated by the dredging activities. The decrease in water velocity after channel dredging may benefit rose-mallow and other intertidal plants by reducing erosion of the canal banks. Transport of sediment (scouring) during channel dredging would be minimized to a less-than-significant level by implementing proposed dredging methods (see Impact SS-4).

Dredged material disposal areas to be identified within agricultural lands could include irrigation ditches. Rose-mallow is known to occur in irrigation ditches within its range (California Natural Diversity Database 2004) and, therefore, has the potential to occur in irrigation ditches in dredge disposal areas. If the ditches are not entirely avoided, disposal of dredged material could cover and cause the loss of rose-mallow plants present.

Loss of rose-mallow plants would potentially be a significant impact. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-7, and VEG-MM-8 would reduce this potential impact to a less-than-significant level.

Mitigation Measure VEG-MM-7: Avoid and Minimize Impacts on Special-Status Plants. If any rose-mallow plants or any other special-status plants are found during preconstruction surveys or surveys of dredged material disposal sites and cannot be avoided by construction or dredging activities, DWR and Reclamation will salvage the plants prior to the onset of the activities. Salvaged plants will be immediately transplanted to an area of suitable habitat. For rose-mallow, plants will be transplanted to an area of tidal emergent wetland habitat restored or enhanced as part of Mitigation Measure VEG-MM-7. This mitigation measure is consistent with CALFED Programmatic Mitigation Measure 19.

Mitigation Measure VEG-MM-8: Compensate for Unavoidable Impacts on Tule and Cattail Tidal Emergent Wetlands. DWR and Reclamation will compensate for the unavoidable permanent loss of up to 0.08 acre of tule and cattail tidal emergent wetland as a result of construction of the Middle River gate by restoring or enhancing in-kind habitat at a ratio of 2–3 acres for each acre affected, for a total of 0.16–0.24 acre. Revegetation will be planned and implemented prior to the removal of existing emergent wetland vegetation. This mitigation is consistent with the MSCS Conservation Measure to (CALFED Bay-Delta Program 2000e):

> restore or enhance 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts are incurred before implementing actions that could result in the loss or degradation of habitat.

As much of the mitigation habitat as possible will be created at or near the Old River at DMC gate site. This mitigation is consistent with the following MSCS Conservation Measure (CALFED Bay-Delta Program 2000e):

> to the extent practicable, include project design features that allow for onsite reestablishment and long-term maintenance of tidal freshwater emergent wetland habitat following project construction.

Mitigation sites will include areas with minimal boat wakes, shallow water, and slow water velocities, and will avoid areas likely to be dredged or where other improvements may be constructed. DWR and Reclamation will obtain site access through a conservation easement or fee title.

If offsite mitigation is necessary, a location that does not currently support tidal flats and that is near ongoing or future ERP projects should be selected. This mitigation is consistent with the following MSCS Conservation Measure (CALFED Bay-Delta Program 2000e):

> to the extent practicable, before restoring habitat in areas that support emergent vegetation, initially restore habitat in locations that do not support tidal emergent vegetation. This will ensure that there is no net loss of habitat over the period that restoration is implemented.

An area that currently supports minimal habitat value, such as the portion of Old River upstream of the proposed fish control gate, would be desirable. If water is too deep at a potential mitigation site, dredged material could be used to construct a bench area as substrate for the tidal emergent wetland habitat. Prior to use, however, such material would be subject to analysis for the presence of contaminants, such as heavy metals. Excessively high levels of contaminants would prohibit the use of dredged materials for bench construction. This mitigation approach is also likely to require permitting under Sections 401 and 404 of the CWA for placement of dredged or fill material in waters of the United States, and under the Rivers and Harbors Act if it occurs in navigable waters.

As described in Mitigation Measure VEG-MM-2, DWR and Reclamation will prepare a revegetation plan to compensate for the loss of emergent wetland habitat and submit the plan to the appropriate regulatory agencies for review. DWR and Reclamation will implement the revegetation plan, maintain plantings, and conduct annual monitoring for 4 years, followed by monitoring every 2 years for the next 6 years. Existing native tidal emergent wetland vegetation from the gate sites should be harvested and maintained for replanting after construction.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 2, 3, 4, 5, and 6.

Waters of the United States

Impact VEG-8: Filling of Tule and Cattail Tidal Emergent Wetland and Jurisdictional Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Gate Construction. Construction of the Middle River gate would result in the permanent loss of 0.07 acre of tule and cattail tidal emergent wetland and 0.02 acre of jurisdictional riparian scrub (Table 6.2-3 and Figure 6.2-3). Construction would avoid impacts on the jurisdictional cottonwood-willow woodland and tule and cattail tidal emergent wetland located on the in-channel island in the project area.

Construction of the Grant Line Canal gate would result in the permanent loss of jurisdictional cottonwood-willow woodland and tule and cattail tidal emergent wetland on the in-channel island at the gate (Table 6.2-3 and Figure 6.2-4). Gate construction would permanently remove riparian vegetation along a 10-foot-wide strip across the approximately 125-foot-wide island for placement of buried utilities and construction of a sheetpile wall, resulting in approximately 0.03 acre of fill within the jurisdictional cottonwood-willow woodland wetland and less than 0.01 acre of fill within the tule and cattail wetland. Construction of the gate on the south levee face would permanently remove approximately 0.03 acre of jurisdictional riparian scrub wetland. Permanent loss of this riparian vegetation would be a significant impact.

Construction of the Old River at DMC gate would result in the permanent loss of 0.12 acre of jurisdictional riparian scrub wetland and less than 0.01 acre of tule and cattail tidal emergent wetland adjacent to the gate footprint on the south bank (Table 6.2-4 and Figure 6.2-5).

No tidal emergent wetland or jurisdictional riparian wetlands occur the head of Old River fish control gate site.

Loss of tidal emergent wetland and jurisdictional riparian communities would also result in the loss of suitable habitat in the project area for Suisun Marsh aster, Delta tule pea, slough thistle, Delta coyote-thistle, rose-mallow, Mason's lilaeopsis, and Delta mudwort. Project construction for the gates would directly remove these habitats, thus decreasing the potential habitat for special-status plants in the project area.

Gate Operation. Jurisdictional tule and cattail tidal emergent wetland and jurisdictional riparian wetlands in the study area occur in the intertidal zone up to the high-tide line on levee banks and on in-channel islands. Wetland vegetation in the study area is partially exposed during low tides and is inundated during high tide. Soils remain saturated within this habitat, but the plants do not require constant inundation. Plants in tule and cattail tidal emergent wetland commonly spread by rhizomes and often have an extensive system of rhizomes within a wetland patch. Woody riparian wetland vegetation commonly has root systems that can access groundwater.

As described in Impact VEG-5, high-tide water levels would remain approximately the same as existing conditions upstream of the gates during gate operation, except at the Grant Line Canal gate, where the high-tide level would decrease by up to 1 foot. Low-tide levels would decrease by up to 1 foot from existing conditions with the temporary barriers during the summer months (Figures 5.2-33, 5.2-37, 5.2-39, and 5.2-41; Impacts HY-3, HY-5, HY-6, and HY-7). The net effect of the project would be an increase in the extent of the intertidal zone by up to 1 foot in the area upstream of each gate (i.e., on Middle River from the gate to Old River; on Grant Line Canal to Old River; and on Old River to the head of Old River). Downstream of the gates during the growing season, water levels would be 2–3 inches lower than existing conditions at low tide and high tide. The net result would be a shifting of the water level downslope in the area downstream of the gate, but there would be no change in the extent of intertidal habitat.

Because of the adaptability of tule and cattail vegetation to alternating inundation and exposure and the rapidity of rhizome growth to colonize new habitat and the rooting depth of woody riparian vegetation, the minor change in tide levels upstream and downstream of the gates under project operations would not likely affect these habitats. Upstream vegetation would potentially increase in area and spread into the new lower-tide area. At the Grant Line Canal gate, the suitable habitat zone would shift downslope by 1 foot. Because the tidal range during project operations would not substantially change from existing conditions, gate operation would not be expected to have a significant impact on the tidal emergent wetland or riparian wetland vegetation. However, Mitigation Measure VEG-MM-9 will be implemented to monitor tidal emergent and riparian wetland vegetation and verify the level of impact during gate operation.

Channel Dredging. Sealed clamshell dredging at the three flow control gate sites and the siphon extension locations and hydraulic or clamshell dredging in the three conveyance dredging areas would not result in any additional direct impacts on tule and cattail tidal emergent wetland (Table 6.2-4 and Figures 6.2-3–6.2-8). Clamshell dredging would avoid direct impacts on tidal emergent wetlands and jurisdictional riparian wetlands. Hydraulic dredging would avoid direct impacts on jurisdictional riparian wetlands.

Indirect impacts of dredging adjacent to the gate sites, at all three conveyance dredging locations, and at the siphon extension locations could include decreased water quality levels caused by turbidity. Tule and cattail emergent wetland vegetation and riparian wetland vegetation would not be significantly affected by the temporary, small increase in channel water turbidity. See Impact WQ-2 for discussion of water quality impacts during dredging.

Dredging at Gate Sites. Dredging of channels adjacent to the gate sites would avoid the areas of tidal emergent wetland. Dredging activities would also avoid direct impacts on jurisdictional riparian wetlands on the in-channel island in the project area. The head of Old River fish control gate project area does not support tidal emergent wetlands or jurisdictional riparian wetlands.

Conveyance Dredging at West Canal. Direct impacts on tule and cattail emergent wetland vegetation would be avoided within the West Canal dredge area. The West Canal supports tidal emergent wetland, primarily on the in-channel island at the north end, in narrow patches along the canal (Table 6.2-3 and Figure 6.2-6). Placement of up to four stationary pipes for transporting dredged material to the existing pond on Fabian Tract and placement of dredged material on levee banks would avoid tidal emergent vegetation.

Conveyance Dredging at Middle River. The Middle River dredge area includes tule and cattail tidal emergent wetland scattered on the banks (Table 6.2-3 and Figure 6.2-7). Temporary impacts within the dredge area could occur as a result of placement of up to 12 stationary pipes that will be used for transporting dredged material. However, the tidal emergent wetland is relatively sparse within this area, and these areas would be avoided during placement of the stationary pipes. A portion of the cottonwood-willow woodland, valley oak riparian woodland, and willow scrub is jurisdictional and occurs on the in-channel islands and below the high-tide line in the proposed dredge area. However, no pipelines or dredged material will be placed on the islands.

Conveyance Dredging at Old River. The Old River dredge area includes tule and cattail tidal emergent wetland on in-channel islands and on channel banks, and some of the riparian vegetation in the area is jurisdictional (Table 6.2-3 and Figure 6.2-8). Temporary impacts of dredging would affect the channel banks on the north side of Stewarts Tract, where up to two stationary pipes for transporting dredged material would be placed. Placement of the two stationary pipes would avoid all areas of tidal emergent wetland.

Spot Dredging at Siphon Locations. Spot dredging at up to 24 locations of the siphon extensions could affect tule and cattail tidal emergent wetland along the channel edges. However, the tidal emergent marsh along channels are generally limited to areas within 10–15 feet of the bank, and these areas would be avoided by dredging activities to the extent feasible. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the South Delta Temporary Barriers Project. NOAA Fisheries issued BOs for the South Delta Diversions Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S. Fish and Wildlife Service 2001 and National Marine Fisheries Service 2001, 2003 respectively). A Streambed Alteration Agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the south Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Tule and cattail tidal emergent wetland and jurisdictional riparian wetlands are suitable habitat for a number of special-status plants and are important aquatic wildlife habitats that provide cover and areas for breeding and foraging. Riparian habitat is important to wildlife for breeding and foraging habitat and as movement corridors and links between habitats. These wetlands are regulated by the Corps under Section 404 of the CWA, the Rivers and Harbors Act if tidal or navigable, and by the RWQCB under Section 401 of the CWA. The EPA has an additional oversight role in the regulation of wetlands. Under Section 1600 *et seq.* of the California Fish and Game Code, DFG has jurisdiction over the habitats within the floodplain of the project area channels. DFG additionally considers emergent wetlands and riparian habitat as sensitive natural communities because of their high value to wildlife and documented scarcity in California.

The permanent impact on up to 0.08 acre of tule and cattail tidal emergent wetland and 0.17 acre of jurisdictional riparian scrub wetland at the Middle River, Grant Line Canal, and Old River at DMC gates and on 0.03 acre of jurisdictional cottonwood-willow woodland wetland at the Grant Line Canal gate would be considered significant because the wetlands are waters of the United States and are regulated under Section 404 of the CWA. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-2, VEG-MM-7, and VEG-MM-9 would reduce this impact to a less-than-significant level.

Mitigation Measure VEG-MM-9: Monitor Existing Stands of Tidal Emergent Wetland and Riparian Wetland Vegetation during Gate Operation. DWR and Reclamation will monitor the extent of tidal emergent wetland and riparian wetland vegetation during gate operation to determine whether changes in the tidal zone that occur as a result of gate operations result in the loss of these wetlands. DWR and Reclamation will monitor the extent and condition of the existing tidal emergent wetland and riparian wetlands for a distance of 0.5 mile upstream of the gate for a 5-year period after the gate is constructed.

The extent of tidal emergent wetland and riparian wetlands will be mapped on an aerial photograph and compared to the baseline mapping performed by DWR and Reclamation. If a decrease in tidal emergent wetland or riparian wetland vegetation is observed DWR and Reclamation will compensate for the loss of this vegetation by implementing Mitigation Measures VEG-MM-2 and/or VEG-MM-8.

Impact VEG-9: Filling or Disturbance of Tidal Perennial Aquatic Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Temporary disturbance of tidal perennial aquatic habitat would occur during construction of the three flow control gates and the fish control gate, channel dredging, and construction of siphon extensions.

Temporary disturbance would occur as a result of any dewatering activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. Temporary impacts on tidal perennial aquatic habitat are discussed in more detail as they relate to sedimentation and scouring (Section 5.6, Impact SS-1) and fisheries (Section 6.1, Impacts Fish-1, Fish-14, and Fish-21).

Gate Construction. Gate construction would result in the permanent removal of 0.88 acre of tidal perennial aquatic habitat within the gate footprints (Table 6.2-5).

Table 6.2-5. Acreage of Tidal Perennial Aquatic Habitat within the Gate Footprints

Project Component	Tidal Perennial Aquatic Habitat Acreage in Footprint
Middle River flow control gate (two bottom-hinged gates, fish passage, and sheetpile wall)	0.16
Grant Line Canal flow control gate (four bottom-hinged gates and boat lock)	0.32
Old River Delta Mendota Canal (DMC) gate (fish passage and a sheetpile wall)	0.26
Head of Old River fish control gate (bottom-hinged gates and boat lock)	0.14
Total	**0.88**

Tidal perennial aquatic habitat at the four temporary barrier sites is currently affected each year by the placement of fill material to build temporary barriers in the spring and the subsequent removal of the material in the fall. The proposed construction of gates would permanently remove this aquatic habitat within the gate footprint. Structures within the footprint would vary at each gate site but would include gate structures, boat passages, and fish passages (Table 6.2-5). During construction, additional area upstream and downstream of the permanent gate would be temporarily affected for placement of sheetpile-braced cofferdams and channel dredging associated with gate construction.

Gate Operation. Gate operations would not result in an overall loss of tidal perennial aquatic habitat, but zone types could change between deepwater, shallow water, and tidal flats in the area upstream of the gates (i.e., more tidal flat because of the increased tidal range caused by gate operation). The individual acreage of each of these three zones has not been determined; therefore, the potential variation in abundance cannot be determined. The operations-related effect on tidal perennial aquatic habitat, overall, would not be considered significant because these zones would be expected to reestablish as the system adapts to new water level fluctuations.

Channel Dredging. Tidal perennial aquatic habitat in the gate dredging and conveyance dredging areas includes deepwater aquatic, shallow aquatic, and unvegetated intertidal zones. A total of 298.97 acres of tidal perennial aquatic habitat occur in the gate site and conveyance dredging areas. However, impacts from maintenance dredging at the gate sites would be intermittent and primarily would affect water quality. It is assumed that maintenance dredging at the gates and the three dredge areas would affect only the channel bottom and would not affect intertidal vegetation, based on the Project Commitments for the Dredging and Sampling Analysis Plan described in Chapter 2. Impacts from conveyance dredging at the three conveyance dredging sites would occur one time and would be temporary.

Temporary construction staging for the 24 siphon extensions would occupy approximately 100 square feet of channel at each location (Figure 2-8), for a project-wide impact of approximately 0.06 acre (2,400 square feet) of perennial tidal aquatic habitat. Siphon extensions at up to 24 locations would result in a small amount (0.007 acre) of permanent fill of tidal perennial aquatic habitat. Each extension would be extended to a depth of –3 to –5 feet msl. The pipe extensions would be a maximum of 2 feet in diameter and 6 feet in length, for a total of 12 square feet each. The 24 siphon extensions placed within the tidal aquatic area would cover a maximum of 288 square feet (0.007 acre) of the channel bed. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the South Delta Temporary Barriers Project. NOAA Fisheries issued BOs for the South Delta Diversions Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S. Fish and Wildlife Service 2001 and National Marine Fisheries Service 2003 and 2001 respectively). A Streambed Alteration Agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the South Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Tidal perennial aquatic habitat is waters of the United States and is regulated by the Corps under Section 404 of the CWA and the Rivers and Harbors Act, and by the RWQCB under Section 401 of the CWA, with oversight by the EPA. This habitat is additionally regulated by the DFG under Section 1600 *et seq.* of the California Fish and Game Code. Fish and other aquatic wildlife occupy this habitat.

Permanent loss of up to 0.88 acre of tidal perennial aquatic habitat would be a significant impact. Implementation of Mitigation Measures VEG-MM-1 and VEG-MM-10, listed below, would reduce this impact to a less-than-significant level.

Mitigation Measure VEG-MM-10: Compensate for Loss of Tidal Perennial Aquatic Habitat. DWR and Reclamation will compensate for the permanent loss of up to 0.88 acre of tidal perennial aquatic habitat caused by construction of the Middle River, Grant Line Canal, Old River at DMC, and head of Old River gates at a ratio of 2–3 acres for each acre affected, for a total of 1.76 to 2.64 acres. This mitigation is consistent with the MSCS conservation measure for tidal perennial aquatic habitat to “restore or enhance 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts on habitat are incurred” (CALFED Bay-Delta Program 2000a).

DWR and Reclamation would purchase the 1.76 to 2.64 acres of tidal perennial aquatic habitat as mitigation credits from an appropriate mitigation bank in the project vicinity. One potential site is the Kimball Island Mitigation Bank.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 2, 3, 4, and 5.

Impact VEG-10: Potential Degradation of Wetland Communities as a Result of Release of Contaminants by Channel Dredging.
Dredging in the project area would remove sediments from channel beds. Disruption of buried sediments could carry the risk of exposing and releasing heavy metals into waterways. This potential impact would primarily be a hazard for wildlife that ingest vegetation contaminated by heavy metals or other toxic constituents. However, this potential increase in heavy metals from dredged sediment would not be expected to have a significant effect on vegetation in tule and cattail tidal emergent wetland or jurisdictional riparian wetlands.

The potential for degradation of wetland communities by dredging-released sediment contaminants would be considered a less-than-significant impact. No mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from implementation of Alternative 2A under 2020 conditions would be similar to those described above. In addition, the same mitigation would apply.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in changes that would affect vegetation beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from operation of Alternative 2A under 2020 conditions would be similar to 2001 conditions. There would be no additional impacts under 2020 conditions, and no additional mitigation is required.

Interim Operations

Interim operations are expected to have the same impacts on vegetation as existing operations. Interim operations would not result in ground-disturbing activities, and the occasional diversion of 8,500 cfs to CCF is not expected to substantially change the surface elevations of Delta waterways.

Alternative 2B

Stage 1 (Physical/Structural Component)

The impacts on vegetation and wetland resources resulting from construction and operation of gates, dredging, and extension of agricultural diversions of Alternative 2B are the same as those discussed under Alternative 2A (Table 6.2-4). The fish control gate at the head of Old River and the flow control gates in Old River, Grant Line Canal, and Middle River would be constructed in the same locations and the same manner as discussed under Alternative 2A. As a result, the physical/structural component impacts and mitigation measures identified for Alternative 2A would be the same for Alternative 2B.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from operation of Alternative 2B under 2020 conditions would be similar to 2001 conditions. There would be no additional impacts under 2020 conditions, and no additional mitigation is required.

Alternative 2C

Stage 1 (Physical/Structural Component)

The physical/structural component impacts on vegetation and wetland resources of Alternative 2C are the same as those discussed under Alternative 2A (Table 6.2-4). The fish control gate at the head of Old River and the flow control gates in Old River, Grant Line Canal, and Middle River would be constructed in the same locations and the same manner as discussed under Alternative 2A. As a result, the construction and dredging impacts and mitigation measures identified for Alternative 2A would be the same for Alternative 2C.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from operation of Alternative 2C under 2020 conditions would be similar to 2001 conditions. There would be no additional impacts under 2020 conditions, and no additional mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Land Cover Types

Land cover impact acreages for Alternative 3B are shown in Table 6.2-6.

Impact VEG-1: Loss or Alteration of Nonjurisdictional Woody Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Gate Construction. Construction of the flow control gate at Old River at DMC would result in the permanent loss of less than 0.01 acre of nonjurisdictional willow scrub (Table 6.2-4). Construction of the Middle River gate would not affect nonjurisdictional riparian vegetation. Loss of jurisdictional woody riparian communities at the gates is discussed under Impact VEG-8. No riparian vegetation occurs at the head of Old River fish control gate site. Sealed clamshell dredging at the two flow control gate sites would avoid impacts on riparian vegetation.

Gate Operation. Nonjurisdictional riparian habitats occupy the area above the existing high-tide levels. Gate operation would not substantially alter the existing high-tide levels from existing conditions in the areas upstream or downstream of the gates. The low-tide level would decrease by approximately 1 foot upstream of the gates and by approximately 2–3 inches in the downstream area, as further discussed under Impact VEG-5. Woody riparian vegetation generally has root systems that can access groundwater when surface water is unavailable. The change in water availability caused by decreased low-tide levels downstream of the gates under project operations would not cause a perceptible change in water availability to riparian vegetation. Because the high tide during project operations would not substantially change from existing conditions and low-tide changes would not be expected to significantly affect riparian vegetation, gate operation is not expected to have a significant impact on the nonjurisdictional riparian vegetation. This alteration would be considered a less-than-significant impact. No mitigation is required.

Channel Dredging. The use of hydraulic dredging in West Canal, Middle River, and Old River would minimize but not entirely avoid temporary impacts on woody riparian vegetation because of the placement of stationary pipes for dredged material on the levee face. Pockets of riparian vegetation occur on the levees between Middle River and Union and Roberts Islands. The exact locations of stationary pipes to transport dredged material over the levees to dredge drying areas are currently unknown, but placement of pipes on the levee

Table 6.2-6. Land Cover Impacts Associated with Gate Construction and Dredging—Alternative 3B

Land Cover Type	Acreages Affected by Gate Construction			Total Permanent Impacts Associated with Gate Construction	Acreages Affected by Dredging[1]					Temporary Impacts Associated with Agricultural Diversions	Permanent Impacts Associated with Agricultural Diversions	Impacts Associated with Dredge Material Disposal[4]
	Middle River Flow Control Gate	Old River at DMC Flow Control Gate	Head of Old River Fish Gate		Permanent Impacts Associated with Dredging at Gate Sites	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area	Total Temporary Impacts Associated with Conveyance Dredging			
Tidal perennial aquatic	0.16	0.26	0.14	0.56	19.42	73.02	72.67	123.46	269.15	0.06	<0.01	0
Tule and cattail tidal emergent wetland	0.07	<0.01	0	<0.08	0	0	0	0	0	0	0	0
Cottonwood-willow woodland	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Cottonwood-willow woodland wetland	0	0	0	0		–[2]	–[2]	–[2]	<0.06[2]			0
Valley oak riparian woodland	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub wetland	0.02	0.12	0	0.14		–[2]	–[2]	–[2]	<0.06[2]			0
Willow scrub	0	<0.01	0	0.3	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub wetland	0	0	0	0		–[2]	–[2]	–[2]	<0.06[2]			0
Agricultural land	0.50	2.00	0	2.50	3.60[3]	0	0	0		0	0	101.50
Ruderal	0	0	0.02	0.02	0	0	0	0	0	0	0	47.40

Notes:

DMC = Delta-Mendota Canal.

[1] Dredge impacts assumed impacts on all tidal perennial aquatic habitat within the dredge area. Actual loss of tidal perennial aquatic habitat will probably be less as a result of confining dredge activities to the center of the channel.

[2] Dredge impacts on individual riparian land cover types are not yet determined because the exact placement of the stationary pipes has not been identified. The riparian impact will total up to 0.06 acre at the three dredge areas.

[3] The acreage for the gate site agricultural impact includes the areas used for dredge drying areas at all three gate sites, which was assumed to require 1.2 acres at each site. This represents a permanent impact.

[4] The acreage for dredge drying areas at the 3 conveyance dredging areas is a temporary impact.

banks would temporarily affect up to a maximum of 16 locations of woody riparian vegetation throughout the three conveyance dredging areas. Assuming removal of vegetation in a 10-foot-wide band for placement of each of the 16 stationary pipes and an estimated levee face height of 15 feet, up to 0.06 acre (2,400 square feet) of woody riparian vegetation would be removed. DWR would avoid placing pipe within woody riparian vegetation to the extent possible. This impact conservatively assumes the maximum possible impact, and the actual impact would likely be less. This effect would continue for up to 5 years after initial dredging until the pipes were removed and the banks would be revegetated. This effect would be a significant impact.

Sealed clamshell dredging of channels, if used in the conveyance dredging areas, would avoid direct impacts on all riparian vegetation. Sealed clamshell dredging at siphon locations would not have an impact on woody riparian vegetation.

Temporary indirect impacts of dredging adjacent to the gate sites, at all three conveyance dredging locations, and at siphon extensions could include decreased water quality levels caused by turbidity. Riparian vegetation near the waterline would not likely be significantly affected by the temporarily small increase in water turbidity. See Impact WQ-2 for discussion of water quality impacts during dredging.

Riparian areas are suitable habitat for special-status plants, are important wildlife habitat for breeding and foraging, and provide movement corridors and links between habitats. DFG considers riparian habitat a sensitive natural community because of its high value to wildlife and its documented scarcity in California.

The temporary impacts on up to 0.06 acre of woody riparian vegetation because of conveyance dredging would be considered significant impacts. These losses of woody riparian vegetation would reduce the extent of riparian communities, which are rare natural communities. Implementation of Mitigation Measure VEG-MM-1, Mitigation Measure VEG-MM-2, and environmental commitments (Chapter 2) would reduce this impact to a less-than-significant level.

Impact VEG-2: Loss of Agricultural Land and Ruderal Vegetation as a Result of Gate Construction and Disposal of Dredged Material.

Agricultural land and ruderal vegetation will be permanently lost as a result of gate construction and dredging at gate sites and dredging at the three conveyance dredging areas. These two components are discussed below.

Gate Construction and Channel Dredging. Construction at the Middle River and Old River at DMC gate sites and the head of Old River fish control gate site would result in the removal of up to6.1 acres of agricultural land and 0.02 acre of ruderal vegetation. Approximately 1.2 acres of agricultural land at each gate site, for a total of 3.6 acres, would be permanently lost because of construction of dredge material disposal areas to contain material from dredging at each gate site.

Conveyance Dredging. Up to 165 acres of settling ponds or runoff management basins for dredged material disposal would be constructed as part of the conveyance-dredging action. The potential locations of the disposal sites have been identified and mapped, although specific sites have not been selected. It is assumed, however, that all dredged material disposal sites would be constructed on agricultural land adjacent to the dredge operations. DWR is committed to minimizing impacts on sensitive habitats, including wetlands and occurrences of special-status species, and will construct the drying areas on agricultural land. These factors will play a major role in the determination of the disposal sites. These ponds or basins would remain in use for up to 7 years and would then be returned to agricultural use.

Siphon Extensions. Dredged material associated with siphon extensions would be placed in the disposal sites described above. Because agricultural land and ruderal communities support few native plant species, have low potential for supporting special-status plant species, and are locally and regionally abundant throughout the Delta, this effect would be a less-than-significant impact from a botanical perspective, and no mitigation is required.

Impact VEG-3: Removal of Giant Reed for Gate Construction.

Within the project area, giant reed is found only at the Grant Line Canal site and, therefore, because Alternative 3B does not include the Grant Line gate, this alternative would have no impact on giant reed. No mitigation is required.

Impact VEG-4: Spread of Noxious Weeds as a Result of Gate Construction and Channel Dredging.

As discussed under Alternative 2A, this effect would be a significant impact. Implementation of Mitigation Measure VEG-MM-3 would reduce this impact to a less-than-significant level.

Special-Status Plants

Impact VEG-5: Loss or Disturbance of Mason’s Lilaeopsis Stands or Potential Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Approximately 175 stands of Mason’s lilaeopsis were identified within the study area during the 2000–2001 surveys (Figure 6.2-10). Mason’s lilaeopsis stands located near the project area include:

- approximately 20 stands almost 0.5 mile downstream of the Middle River gate site,
- one stand less than 0.25 mile upstream of the Old River at DMC gate site and approximately four stands immediately downstream of the site,
- approximately 17 stands along the West Canal within the proposed conveyance dredging area,
- approximately six stands at siphon extension locations on Victoria and North Canals, and
- approximately four stands at the siphon extension at the confluence of Old River and Grant Line Canal and Fabian and Bell Canal.

Gate Construction. Construction activities associated with the Middle River gate are not anticipated to affect the lilaeopsis stands located downstream. There would be no direct construction impact on these stands. Indirect impacts caused by the spread or introduction of invasive plants or chemical contaminants are unlikely to affect plants nearly 0.5 mile downstream.

Indirect impacts could result from construction activities for the Old River at DMC gate. Construction of the Old River at DMC gate could indirectly affect the approximately five stands upstream of the gate. Construction equipment could spread or introduce plants that compete with Mason's lilaeopsis for mudflat habitat, including pampas grass and water hyacinth. This spread/introduction would be a significant impact. The equipment could also cause water contamination by leaking oil or fuel, which has the potential to be toxic to the established stands of lilaeopsis. However, the potential for water contamination by construction equipment is unlikely to exceed the existing potential for contamination from recreational boats.

Gate Operation. Changes in tidal water levels in the project area would occur because of gate operations. The flow control gates would operate through most of the growing season, as they do under existing conditions. The head of Old River fish control gate would not operate during the summer.

Upstream of the gates during gate operation, high-tide water levels would remain approximately the same as existing conditions. Low-tide levels would decrease by up to 1 foot from existing conditions with the temporary barriers during the summer months (Section 5.2; Figures 5.2-33, 5.2-37, 5.2-39, and 5.2-41; Impacts HY-3, HY-5, HY-6, and HY-7). The net effect of the project would be an increase in the extent of the intertidal zone by up to 1 foot in the area upstream of each gate (i.e., on Middle River from the gate to Old River and on Old River to the head of Old River). This increase would reverse much of the effect on low-tide levels during spring and summer caused by the temporary barriers program. Downstream of the gates during the growing season, water levels would be 2–3 inches lower than existing conditions at low tide and high tide. The net result would be a shifting of the water level downslope in the area downstream of the gate, but there would be no substantial change in the extent of intertidal habitat.

The decrease in low-tide levels upstream of all gates would potentially increase the extent of suitable intertidal habitat for Mason's lilaeopsis. The 1 stand upstream of the Old River at DMC gate would not likely be significantly affected by gate operations.

The Mason's lilaeopsis stands located downstream of the gate sites could experience a shifting of low- and high-tide water levels downslope by 2–3 inches (Section 5.2; Figures 5.2-29 and 5.2-31; Impacts HY-1 and HY-2). Stands of Mason's lilaeopsis closest to CCF occur in areas that would experience the greatest decreases in the tidal water level. The low-tide level would decrease by less than 1 foot, and the high-tide level would decrease by 3 feet but would remain above 2 feet msl (Figure 5.2-31). The lilaeopsis could grow farther downslope to occupy the new intertidal area created by the increased pumping diversions. The decrease in low-tide levels downstream of all gates and in the area near CCF would potentially increase the extent of suitable intertidal habitat for Mason's lilaeopsis. The stands of Mason's lilaeopsis downstream of gates, therefore, would not be significantly affected by project operations.

No significant increase in tidal flow velocity would occur in the project area as a result of the gate operation, and flow velocities would be reduced by the increased conveyance capacity produced by dredging (see Impacts HY-3 through HY-7 in Section 5.2 for additional discussion of changes in tidal flow). This effect would be a less-than-significant impact on Mason's lilaeopsis.

No discernable change in average salinity would be anticipated as a result of gate operations (Section 5.3). The long-term average salinity would be 600–700 µS/cm, which is equivalent to less than 1 ppt (Figures 5.3-15–5.3-17). The salinity objective for project operations is 1,000 µS/cm. Growth of Mason's lilaeopsis is not affected by less than 3 ppt salinity (Fiedler and Zebell 1993). Seed germination is best at 0 ppt salinity, but existing conditions exceed that level. The extent of suitable habitat for Mason's lilaeopsis, therefore, would not be altered as a result of changes in salinity. This effect would be a less-than-significant impact.

Operation of the permanent gates would not be anticipated to affect dispersal of Mason's lilaeopsis upstream or downstream of the gates. The lilaeopsis colonizes new habitat either by seed or vegetative mats of plants that float to new habitat (Golden and Fiedler 1991). Either method requires transportation by water. The permanent gates could block movement upstream and downstream for a substantial portion of the day during the operation periods in spring, summer, and fall. The lilaeopsis propagules (seed or mat), however, would be able to move across the gates during the portion of the day when the gates were open. Implementation of permanent gates, therefore, would not be expected to change the success of colonization of new habitat by Mason's lilaeopsis.

The operation of the permanent gates would not substantially change the upstream or downstream flow velocity, salinity, or dispersal potential from the existing conditions in the project area. Changes in the upstream and downstream tidal water levels from project operation could result in increased suitable habitat for Mason's lilaeopsis and would not have an adverse effect on Mason's lilaeopsis. Although this effect would be considered a less-than-significant impact, Mitigation Measure VEG-MM-6 is included to monitor existing populations during the initial years of gate operation to verify the absence of impact.

Channel Dredging. Conveyance dredging of the West Canal and dredging at the siphon extensions in Victoria, North, Grant Line, and Fabian and Bell Canals would avoid direct removal of Mason's lilaeopsis but could indirectly affect the approximately 27 stands that grow at the edges of the canals in these areas. Disturbance of the water in the canal during dredging from the barge could result in higher-than-normal wave action on the shoreline, which could dislodge lilaeopsis plants growing there or possibly wash floating vegetation on top of the plants, which would smother them. This disturbance would be a significant impact. Dredge equipment also has the potential to contaminate the water with oil or fuel, which may be toxic to the lilaeopsis, but is unlikely to exceed existing potential for water contamination produced by boats.

The decrease in water velocity after channel dredging may benefit Mason's lilaeopsis and other intertidal plants by reducing erosion of the canal banks. Transport of sediment (scouring) during channel dredging would be minimized to a less-than-significant level by implementing proposed dredging methods (Impact SS-4).

Mason's lilaeopsis is a state-listed rare species restricted to small areas of ephemeral habitat and susceptible to adverse impacts by direct and indirect habitat loss. The project would result in potential indirect impacts on up to 32 stands at the Old River at DMC gate site and dredging areas within the West, Victoria, North, Grant Line, and Fabian and Bell Canals. Including disturbances that could eradicate the stands, the project could cause mortality of more than 10% of the approximately 175 stands mapped in the project area. For this reason, the indirect impacts of construction and dredging would be considered significant impacts. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-5, and VEG-MM-6 would reduce these impacts to a less-than-significant level.

Impact VEG-6: Loss or Disturbance of Delta Mudwort Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging.

As discussed under Alternative 2A, this loss/disturbance would be considered a significant impact. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-5, and VEG-MM-6 would reduce this impact to a less-than-significant level.

Impact VEG-7: Loss of Rose-Mallow Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging.

As discussed under Alternative 2A, this loss would be a potentially significant impact. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-7, and VEG-MM-8 would reduce this potential impact to a less-than-significant level.

Waters of the United States

Impact VEG-8: Filling of Tule and Cattail Tidal Emergent Wetland and Jurisdictional Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Gate Construction. Construction of the Middle River gate would result in the permanent loss of 0.07 acre of tule and cattail tidal emergent wetland and 0.02 acre of jurisdictional riparian scrub (Table 6.2-3 and Figure 6.2-3). Construction would avoid impacts on the jurisdictional cottonwood-willow woodland and tule and cattail tidal emergent wetland located on the in-channel island in the project area.

Construction of the Old River at DMC gate would result in the permanent loss of 0.12 acre of jurisdictional riparian scrub wetland and less than 0.01acre of tule and cattail tidal emergent wetland adjacent to the gate footprint on the south bank (Table 6.2-6 and Figure 6.2-5). This loss would be a significant impact.

No tidal emergent wetland occurs at the Middle River or head of Old River fish control gate sites, and no jurisdictional riparian habitats occur at the three flow control gate sites.

Loss of tidal emergent wetland habitat would also result in the loss of suitable habitat in the project area for Suisun Marsh aster, Delta tule pea, slough thistle, rose-mallow, Mason's lilaeopsis, and Delta mudwort. Project construction for the gates would directly remove these habitats, thus decreasing the potential habitat for special-status plants in the project area.

Gate Operation. Jurisdictional tule and cattail tidal emergent wetland and jurisdictional riparian wetlands in the study area occur in the intertidal zone up to the high-tide line on levee banks and on in-channel islands. Wetland vegetation in the study area is partially exposed during low tides and is inundated during high tide. Soils remain saturated within this habitat, but the plants do not require constant inundation. Plants in tule and cattail tidal emergent wetland commonly spread by rhizomes and often have an extensive system of rhizomes within a wetland patch. Woody riparian wetland vegetation commonly has root systems that can access groundwater.

As described in Impact VEG-5, high-tide water levels would remain approximately the same as existing conditions upstream of the gates during gate operation. Low-tide levels would decrease by up to 1 foot from existing conditions with the temporary barriers during the summer months (Figures 5.2-33, 5.2-37, 5.2-39, and 5.2-41; Impacts HY-3, HY-5, HY-6, and HY-7). The net effect of the project would be an increase in the extent of the intertidal zone by up to 1 foot in the area upstream of each gate (i.e., on Middle River from the gate to Old River and on Old River to the head of Old River). Downstream of the gates during the growing season, water levels would be 2–3 inches lower than existing conditions at low tide and high tide. The net result would be a shifting of the water level downslope in the area downstream of the gate, but there would be no change in the extent of intertidal habitat.

Because of the adaptability of tule and cattail vegetation to alternating inundation and exposure and the rapidity of rhizome growth to colonize new habitat and the rooting depth of woody riparian vegetation, the minor change in tide levels upstream and downstream of the gates under project operations would not likely affect these habitats. Upstream vegetation would potentially increase in area and spread into the new lower-tide area. Because the tidal range during project operations would not substantially change from existing conditions, gate operation would not be expected to have a significant impact on the tidal emergent wetland or riparian wetland vegetation. However, Mitigation Measure VEG-MM-9 will be implemented to monitor tidal emergent and riparian wetland vegetation and verify the level of impact during gate operation.

Channel Dredging. Sealed clamshell dredging at the three flow control gate sites and the siphon extension locations and hydraulic or clamshell dredging in the three proposed conveyance dredging areas would not result in additional direct impacts on tule and cattail tidal emergent wetland (Table 6.2-3 and Figures 6.2-3–6.2-8). Clamshell dredging would avoid direct impacts on tidal emergent wetlands and jurisdictional riparian wetland. Hydraulic dredging would also avoid direct impacts on jurisdictional riparian wetlands.

Indirect impacts of dredging adjacent on the gate sites, at all three conveyance dredging locations, and at the siphon extension locations could include decreased water quality levels because of turbidity. Tule and cattail emergent wetland vegetation and riparian wetland vegetation would not be significantly affected by the temporarily small increase in turbidity of channel water. See Impact WQ-2 for discussion of water quality impacts during dredging.

Dredging at Gate Sites. At the Old River at DMC gate, no impacts on tidal emergent wetland, beyond those from the gate construction, would occur. The Middle River and head of Old River fish control gate sites do not support tidal emergent or jurisdictional riparian wetlands.

Conveyance Dredging at West Canal. Direct impacts on tule and cattail emergent wetland vegetation would be avoided within the West Canal dredge area. The West Canal supports tidal emergent wetland, primarily on the in-channel island at the north end, in narrow patches along the canal (Table 6.2-3 and Figure 6.2-6). Placement of up to four stationary pipes for transporting dredged material to the existing pond on Fabian Tract and placement of dredged material on levee banks would avoid tidal emergent vegetation.

Conveyance Dredging at Middle River. The Middle River dredge area includes tule and cattail tidal emergent wetland scattered on the banks (Table 6.2-3 and Figure 6.2-7). Temporary dredge impacts within the dredge area could occur because of placement of up to 12 stationary pipes for transporting dredged material. However, tidal emergent wetland is relatively sparse within this area and would be avoided when placing the stationary pipes. A portion of the cottonwood-willow woodland, valley oak riparian woodland, and willow scrub is jurisdictional and occurs on the in-channel islands and below the high-tide line in the proposed dredge area. However, no pipelines or dredged material would be placed on the islands.

Dredging at Old River. The Old River dredge area includes tule and cattail tidal emergent wetland on in-channel islands and on channel banks, and a portion of the riparian vegetation is jurisdictional (Table 6.2-3 and Figure 6.2-8). Temporary impacts of dredging would affect the channel banks on the north side of Stewarts Tract, where up to two stationary pipes for transporting dredged material would be placed. Placement of the two stationary pipes would avoid all areas of tidal emergent wetland.

Spot Dredging at Siphon Locations. Spot dredging at up to 24 locations of the siphon extensions could affect tule and cattail tidal emergent wetland located at the channel edges. However, the tidal emergent marsh along channels are generally limited to areas within 10–15 feet of the bank, and these areas would be avoided by dredging activities to the extent feasible. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the South Delta Temporary Barriers Project. NOAA Fisheries issued BOs for the South Delta Diversions Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S. Fish and Wildlife Service 2001 and National Marine Fisheries Service 2003 and 2001 respectively). A Streambed Alteration Agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the South Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Tule and cattail tidal emergent wetland and jurisdictional riparian wetlands are suitable habitat for a number of special-status plants and are important aquatic wildlife habitats that provide cover and areas for breeding and foraging. Riparian habitat is important wildlife habitat for breeding and foraging and provides movement corridors and links between habitats. These wetlands are regulated by the Corps under Section 404 of the CWA and the Rivers and Harbors Act, and by the RWQCB under Section 401 of the CWA. The EPA has an additional oversight role in the regulation of wetlands. Under Section 1600 *et seq.* of the California Fish and Game Code, DFG has jurisdiction over the habitats within the floodplain of the project area channels. DFG additionally considers emergent wetlands and riparian habitat as sensitive natural communities because of their high value to wildlife and documented scarcity in California.

The permanent impacts on up to 0.08 acre of tule and cattail tidal emergent wetland and 0.14 acre of jurisdictional riparian scrub wetland at the Middle River and at the Old River at DMC gate would be considered a significant impact because the wetland is waters of the United States and is regulated under Section 404 of the CWA. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-2, VEG-MM-7, and VEG-MM-9 would reduce this impact to a less-than-significant level.

Impact VEG-9: Filling or Disturbance of Tidal Perennial Aquatic Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Temporary disturbance of tidal perennial aquatic habitat would occur during construction of the three flow control gates and the fish control gate, dredging of the channel, and construction of the siphon extensions. Temporary disturbance would occur because of any dewatering activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. Temporary impacts on tidal perennial aquatic habitat are discussed in more detail as they relate to sedimentation and scouring (Section 5.6, Impact SS-1) and fisheries (Section 6.1, Impacts Fish-1, Fish-14, and Fish-21).

Gate Construction. Gate construction would also result in the permanent removal of 0.56 acre of tidal perennial aquatic habitat within the Middle River, Old River at DMC, and Head of Old River gate footprints (Table 6.2-6, Impact VEG-9).

Tidal perennial aquatic habitat at the three gate sites is currently affected each year by the placement of fill material to build temporary barriers in the spring and the subsequent removal of the material in the fall. The proposed construction of gates would permanently remove this aquatic habitat within the gate footprint. Structures within the footprint vary at each gate site but include gate structures, boat passages, and fish passages (Table 6.2-5). During construction, additional area upstream and downstream of the permanent gate would be temporarily affected for placement of sheetpile-braced cofferdams and dredging associated with gate construction.

Gate Operation. Gate operations would not result in an overall loss of tidal perennial aquatic habitat, but zone types could change between deepwater, shallow water, and tidal flats in the area upstream of the gates (i.e., more tidal flat because of the increased tidal range caused by gate operation). The individual acreage of each of these three zones has not been determined; therefore, the potential variation in abundance cannot be determined. The operations-related effect on tidal perennial aquatic habitat, overall, would not be considered significant because these zones would be expected to reestablish as the system adapts to new water level fluctuations.

Channel Dredging. Tidal perennial aquatic habitat in the gate dredging and conveyance dredging areas includes deepwater aquatic, shallow aquatic, and unvegetated intertidal zones. A total of 288.57 acres of tidal perennial aquatic habitat occurs in the gate site and conveyance dredging areas. However, impacts from maintenance dredging at the gate sites would be intermittent and primarily would affect water quality. It is assumed that maintenance dredging at the gates and the three dredge areas would affect only the channel bottom and would not affect intertidal vegetation, based on the Project Commitments for the Dredging and Sampling Analysis Plan described in Chapter 2. Impacts from conveyance dredging at the three conveyance dredging sites would occur one time and would be temporary.

Temporary construction staging for the 24 siphon extensions would occupy approximately 100 square feet of channel at each location (Figure 2-8) for a project-wide impact of approximately 0.06 acre (2,300 square feet) of perennial tidal aquatic habitat. Siphon extensions at up to 24 locations would result in a small amount (0.007 acre) of permanent fill of tidal perennial aquatic habitat. Each extension would be extended to a depth of -3 to -5 feet msl. The pipe extensions would be a maximum of 2 feet in diameter and 6 feet in length, for a total of 12 square feet each. The 24 siphon extensions placed within the tidal aquatic area would cover a maximum of 288 square feet (0.007 acre) of the channel bed. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the South Delta Temporary Barriers Project. NOAA Fisheries issued BOs for the South Delta Diversions

Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S. Fish and Wildlife Service 2001 and National Marine Fisheries Service 2003 and 2001 respectively). A Streambed Alteration Agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the South Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Tidal perennial aquatic habitat is waters of the United States and is regulated by the Corps under Section 404 of the CWA and the Rivers and Harbors Act, and by the RWQCB under Section 401 of the CWA, with oversight by the EPA. This habitat is additionally regulated by DFG under Section 1600 *et seq.* of the California Fish and Game Code. Fish and other aquatic wildlife occupy this habitat.

Permanent loss of 0.56 acre of tidal perennial aquatic habitat at the gate sites would be a significant impact. Implementation of Mitigation Measures VEG-MM-1 and VEG-MM-10 would reduce this impact to a less-than-significant level.

Impact VEG-10: Potential Degradation of Wetland Communities as a Result of Release of Contaminants by Channel Dredging.

As discussed under Alternative 2A, this effect would be considered a less-than-significant impact. No mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from implementation of Alternative 3B under 2020 conditions would be similar to those described above. In addition, the same mitigation would apply.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from operation of Alternative 3B under 2020 conditions would be similar to 2001 conditions. There would be no additional impacts under 2020 conditions, and no additional mitigation is required.

Alternative 4B

Stage 1 (Physical/Structural Component)

Land Cover Types

Land cover impact acreages for Alternative 4B are shown in Table 6.2-7.

Impact VEG-1: Loss or Alteration of Nonjurisdictional Woody Riparian Communities as a Result of Gate Construction, Gate Operation, and Channel Dredging.

No riparian vegetation occurs at the head of Old River fish control gate site, and there would be no impact on riparian vegetation as a result of gate construction, gate operation, or dredging.

If sealed clamshell dredging were used within the three conveyance dredging areas, there would be no direct impacts on riparian vegetation.

The use of hydraulic dredging in West Canal, Middle River, and Old River would minimize but not entirely avoid temporary impacts on woody riparian vegetation because of the placement of the stationary pipes for dredged material on the levee face. Pockets of riparian vegetation occur on the levees between Middle River and Union and Roberts Islands. The exact locations of stationary pipes to transport dredged material over the levees to dredged material disposal areas are currently unknown, but placement of pipes on the levee banks would temporarily affect up to a maximum of 16 locations of woody riparian vegetation throughout the three conveyance dredging areas. Assuming removal of vegetation in a 10-foot-wide band for placement of each of the 16 stationary pipes and an estimated levee face height of 15 feet, up to 0.06 acre (2,400 square feet) of woody riparian vegetation would be removed. DWR would avoid placing pipe within woody riparian vegetation to the extent possible. This impact conservatively assumes the maximum possible impact, and the actual impact would likely be less. This effect would continue for up to 5 years after initial dredging, until the pipes were removed and the banks were revegetated. This effect would be a significant impact.

Sealed clamshell dredging at siphon locations would not have an impact on woody riparian vegetation.

Temporary indirect impacts of dredging adjacent on the gate sites, at all three conveyance dredging locations, and at siphon extensions could include decreased water quality levels caused by turbidity. Riparian vegetation near the waterline would not likely be significantly affected by the temporarily small increase in water turbidity. See Impact WQ-2 for discussion of water quality impacts during dredging.

Riparian areas are suitable habitat for special-status plants, are important wildlife habitat for breeding and foraging, and provide movement corridors and links between habitats. DFG considers riparian habitat a sensitive natural community because of its high value to wildlife and its documented scarcity in California.

The temporary impacts on 0.06 acre of woody riparian vegetation as a result of conveyance dredging would be considered significant because losses of woody riparian vegetation would reduce the extent of riparian communities, which are rare natural communities. Implementation of Mitigation Measure VEG-MM-1, Mitigation Measure VEG-MM-2, and environmental commitments (Chapter 2) would reduce this impact to a less-than-significant level.

Impact VEG-2: Loss of Agricultural Land and Ruderal Vegetation as a Result of Gate Construction and Disposal of Dredged Material. Agricultural land and ruderal vegetation will be permanently lost as a result of gate construction and dredging at the Old River fish control gate site and as a result of dredging at the three conveyance dredging areas. These two components are discussed below.

Gate Construction and Channel Dredging. Construction at the head of Old River fish control gate site would result in the removal of approximately 1.2 acres of agricultural land and 0.02 acre of ruderal vegetation. Approximately 1.2 acres of the agricultural land would be permanently lost because of construction of dredge drying areas to contain material from dredging at each gate site.

Conveyance Dredging. Up to 165 acres of settling ponds or runoff management basins for dredged material disposal will be constructed as part of the conveyance dredging action. The potential locations of the settling ponds or runoff management basins have been identified and mapped, although specific sites have not been selected. It is assumed, however, that all dredged material disposal areas would be constructed on agricultural land adjacent to the dredge operations. DWR is committed to minimizing impacts on sensitive habitats, including wetlands and occurrences of special-status species, and will construct the ponds or basins on agricultural land. These factors will play a major role in the determination of the dredged material disposal sites. These sites would remain in use for up to 7 years and would then be returned to agricultural use.

Siphon Extensions. Dredged material associated with siphon extensions would be placed in the disposal sites described above.

Because agricultural land and ruderal communities support few native plant species, have low potential for supporting special-status plant species, and are locally and regionally abundant throughout the Delta, this effect would be a less-than-significant impact from a botanical perspective, and no mitigation is required.

Impact VEG-3: Removal of Giant Reed for Gate Construction. Within the project area, giant reed is found only at the Grant Line Canal site. Because Alternative 4B does not include the Grant Line gate, this alternative will have no affect on giant reed. No mitigation is required.

Table 6.2-7. Land Cover Impacts Associated with Gate Construction and Dredging—Alternative 4B

Land Cover Type	Permanent Impacts Associated with Gate Construction	Acreages Affected by Dredging[1]					Temporary Impacts Associated with Agricultural Diversions	Permanent Impacts Associated with Agricultural Diversions	Impacts Associated with Dredge Material Disposal[4]
		Permanent Impacts Associated with Dredging at Head of Old River Fish Gate Site	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area	Total Temporary Impacts Associated with Conveyance Dredging			
Tidal perennial aquatic	0.14	7.58	73.02	72.67	123.46	269.15	0.06	<0.01	0
Tule and cattail tidal emergent wetland	0	0	0	0	0	0	0	0	0
Cottonwood-willow woodland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Cottonwood-willow woodland wetland			–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Valley oak riparian woodland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub wetland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub wetland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Agricultural land	0	1.20[3]	0	0	0	0	0	0	101.50
Ruderal	0.02	0	0	0	0	0	0	0	47.40

Notes:

1 Dredge impacts assumed impacts on all tidal perennial aquatic habitat within the dredge area. Actual loss of tidal perennial aquatic habitat will probably be less as a result of confining dredge activities to the center of the channel.

2 Dredge impacts on individual riparian land cover types are not yet determined because the exact placement of the stationary pipes has not been identified. The riparian impact will total up to 0.06 acre at the three dredge areas.

3 The acreage for the gate site agricultural impact includes the areas used for dredge drying areas at the gate site, which was assumed to require 1.2 acres. This represents a permanent impact.

4 The acreage for dredge drying areas at the 3 conveyance dredging areas is a temporary impact.

Impact VEG-4: Spread of Noxious Weeds as a Result of Gate Construction and Channel Dredging.

As discussed under Alternative 2A, this effect would be a significant impact. Implementation of Mitigation Measure VEG-MM-3 would reduce this impact to a less-than-significant level.

Special-Status Plants

Impact VEG-5: Loss or Disturbance of Mason's Lilaeopsis Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Approximately 175 stands of Mason's lilaeopsis were identified within the study area during the 2000–2001 surveys (Figure 6.2-10). No stands occur in the vicinity of the head of Old River fish control gate and no impacts on Mason's lilaeopsis are anticipated due to gate construction or operation. Mason's lilaeopsis stands identified near the project area include:

- approximately 17 stands along the West Canal within the proposed conveyance dredging area,
- approximately six stands at siphon extension locations on Victoria and North Canals, and
- approximately four stands at the siphon extension at the confluence of Old River and Grant Line Canal and Fabian and Bell Canal.

Conveyance dredging of the West Canal and dredging at siphon extensions in Victoria, North, Grant Line, and Fabian and Bell Canals would avoid direct removal of Mason's lilaeopsis but could indirectly affect up to 27 stands that grow at the edges of the canals in these areas. Disturbance of the water in the canal from the barge during dredging could result in higher than normal wave action on the shoreline, which could dislodge lilaeopsis plants growing there or possibly wash floating vegetation on top of the plants, which would smother them. This effect would be a significant impact. Dredge equipment also has the potential to contaminate the water with oil or fuel, which may be toxic to the lilaeopsis, but is unlikely to exceed existing potential for water contamination produced by boats.

The decrease in water velocity after channel dredging may benefit Mason's lilaeopsis and other intertidal plants by reducing erosion of the canal banks. Transport of sediment (scouring) during channel dredging would be minimized to a less-than-significant level by implementing proposed dredging methods (Impact SS-4).

Mason's lilaeopsis is a state-listed rare species restricted to small areas of ephemeral habitat and susceptible to adverse effects by direct and indirect habitat loss. Disturbance of up to 27 stands would occur because of potential indirect impacts at the Grant Line Canal and Old River sites and because of indirect impacts of dredging activities in the West, Victoria, North, Grant Line, and Fabian and Bell Canals. Including disturbances that could eradicate the stands, the project could, therefore, cause mortality of more than 10% of the approximately 175 stands mapped in the project area. For this reason, the indirect impacts of construction and dredging would be considered significant impacts. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-5, and VEG-MM-6 would reduce this impact to a less-than-significant level.

Impact VEG-6: Loss or Disturbance of Delta Mudwort Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging.
As discussed under Alternative 2A, this loss/disturbance would be considered a significant impact. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-5, and VEG-MM-6 would reduce this impact to a less-than-significant level.

Impact VEG-7: Loss of Rose-Mallow Stands as a Result of Gate Construction, Gate Operation, and Channel Dredging.
As discussed under Alternative 2A, this loss would be a potentially significant impact. Implementation of Mitigation Measures VEG-MM-1, VEG-MM-4, VEG-MM-7, and VEG-MM-8 would reduce this potential impact to a less-than-significant level.

Waters of the United States

Impact VEG-8: Filling of Tule and Cattail Tidal Emergent Wetland and Jurisdictional Riparian Wetlands as a Result of Gate Construction, Gate Operation, and Channel Dredging.
No tidal emergent wetland or jurisdictional riparian wetlands occur at the head of Old River fish control gate site, and there would be no impact on these wetlands caused by gate construction, gate operation, or channel dredging at the gate.

Hydraulic dredging at the three proposed conveyance dredging areas and sealed clamshell dredging at the siphon extension locations would not result in any additional direct impacts on tule and cattail tidal emergent wetland (Table 6.2-7 and Figures 6.2-3–6.3-8). Hydraulic dredging would also avoid direct impacts on jurisdictional riparian wetlands. Clamshell dredging would avoid direct impacts on tidal emergent wetlands and jurisdictional riparian wetlands.

Indirect impacts of dredging at all three conveyance dredging locations and siphon extension locations could include decreased water quality levels as a result of turbidity. Tule and cattail emergent wetland vegetation and riparian wetland vegetation would not be significantly affected by the temporarily small increase in turbidity of channel water. See Impact WQ-2 for discussion of water quality impacts during dredging.

Conveyance Dredging at West Canal. Direct impacts on tule and cattail emergent wetland vegetation would be avoided within the West Canal dredge area. The West Canal supports tidal emergent wetland, primarily on the in-channel island at the north end, in narrow patches along the canal (Table 6.2-3 and Figure 6.2-6). Placement of up to four stationary pipes for transporting dredged material to the existing pond on Fabian Tract, and placement of dredged material on levee banks would avoid tidal emergent vegetation.

Conveyance Dredging at Middle River. The Middle River dredge area includes tule and cattail tidal emergent wetland scattered on the banks (Table 6.2-3 and Figure 6.2-7). Temporary dredge impacts within the dredge area could occur because of placement of up to 12 stationary pipes for transporting dredged material and placement of dredged material on the levee bank. However, the tidal emergent wetland is relatively sparse within this area, and these areas would be avoided when placing the stationary pipes. A portion of the cottonwood-willow woodland, valley oak riparian woodland, and willow scrub is jurisdictional and occurs on the in-channel islands and below the high-tide line in the proposed dredge area. However, no pipelines or dredged material will be placed on the islands.

Conveyance Dredging at Old River. The Old River dredge area includes tule and cattail tidal emergent wetland on in-channel islands and on channel banks, and a portion of the riparian vegetation is jurisdictional (Table 6.2-3 and Figure 6.2-8). Temporary impacts of dredging would affect the channel banks on the north side of Stewarts Tract where up to two stationary pipes for transporting dredged material would be placed. Placement of the two stationary pipes would avoid all areas of tidal emergent wetland.

Spot Dredging at Siphon Locations. Spot dredging at up to 24 locations of the siphon extensions could affect tule and cattail tidal emergent wetland located at the channel edges. However, the tidal emergent marshes along channels are generally limited to areas within 10–15 feet of the bank, and these areas would be avoided by dredging activities to the extent feasible. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the South Delta Temporary Barriers Project. NOAA Fisheries issued BOs for the South Delta Diversions Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S Fish and Wildlife Service 2001 and National Marine Fisheries Service 2003 and 2001 respectively). A Streambed Alteration Agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the South Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Tule and cattail tidal emergent wetland and jurisdictional riparian wetlands are suitable habitat for a number of special-status plants and are important aquatic wildlife habitats that provide cover and areas for breeding and foraging. Riparian habitat is important wildlife habitat for breeding and foraging and provides movement corridors and links between habitats. These wetlands are regulated by the Corps under Section 404 of the CWA and the Rivers and Harbors Act, and by the RWQCB under Section 401 of the CWA. The EPA has an additional oversight role in the regulation of wetlands. Under Section 1600 *et seq.* of the California Fish and Game Code, DFG has jurisdiction over the habitats within the floodplain of the project area channels. DFG additionally considers emergent wetlands and riparian habitat as sensitive natural communities because of their high value to wildlife and documented scarcity in California.

No temporary or permanent impacts on tule and cattail tidal emergent wetland or jurisdictional riparian wetlands would occur because of the construction of the head of Old River fish control gate or dredging at the gate and the three conveyance dredging areas. No mitigation is required.

Impact VEG-9: Filling or Disturbance of Tidal Perennial Aquatic Habitat as a Result of Gate Construction, Gate Operation, and Channel Dredging.

Temporary disturbance of tidal perennial aquatic habitat would occur during construction of the head of Old River fish control gate, dredging of the channel, and construction of the siphon extensions. Temporary disturbance would occur because of any dewatering activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. Temporary impacts on tidal perennial aquatic habitat are discussed in more detail as they relate to sedimentation and scouring (Section 5.6, Impact SS-1) and fisheries (Section 6.1, Impacts Fish-1, Fish-14, and Fish-21).

Gate Construction. Tidal perennial aquatic habitat at the gate site is currently affected each year by the placement of fill material to build a temporary barrier in the spring and in the fall. The proposed construction of the gate would permanently remove 0.14 acre of this aquatic habitat within the gate footprint. Structures within the footprint at the gate site include a hinged-bottom gate structure and a boat lock. During construction, additional area upstream and downstream of the permanent gate would be temporarily affected for placement of sheetpile-braced cofferdams and dredging associated with gate construction.

Gate Operation. Gate operations would not result in an overall loss of tidal perennial aquatic habitat, but zone types could change between deepwater, shallow water, and tidal flats in the area upstream of the gates (i.e., more tidal flat because of the increased tidal range caused by gate operation). The individual acreage of each of these three zones has not been determined; therefore, the potential variation in abundance cannot be determined. The operations-related effect on tidal perennial aquatic habitat, overall, would not be considered significant because these zones would be expected to reestablish as the system adapts to new water level fluctuations.

Channel Dredging. Tidal perennial aquatic habitat in the gate dredging and conveyance dredging areas includes deepwater aquatic, shallow aquatic, and unvegetated intertidal zones. A total of 298.97 acres of tidal perennial aquatic habitat occur in the gate site and conveyance dredging areas. However, impacts from maintenance dredging at the gate sites would be intermittent and primarily would affect water quality. It is assumed that maintenance dredging at the gates and the three dredge areas would affect only the channel bottom and would not affect intertidal vegetation, based on the Project Commitments for the Dredging and Sampling Analysis Plan described in Chapter 2. Impacts from conveyance dredging at the three conveyance dredging sites would occur one time and would be temporary.

Temporary construction staging for the 24 siphon extensions would occupy approximately 100 square feet of channel at each location (Figure 2-8) for a project-wide impact of approximately 0.06 acre (2,300 square feet) of perennial tidal aquatic habitat. Siphon extensions at up to 24 locations would result in a small amount (0.007 acre) of permanent fill of tidal perennial aquatic habitat. Each extension would be extended to a depth of -3 to -5 feet msl. The pipe extensions would be a maximum of 2 feet in diameter and 6 feet in length, for a total of 12 square feet each. The 24 siphon extensions placed within the tidal aquatic area would cover a maximum of 288 square feet (0.007 acre) of the channel bed. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the south Delta temporary barriers program. NOAA issued BOs for the South Delta Diversions Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S. Fish and Wildlife Service 2001 and National Marine Fisheries Service 2003 and 2001 respectively). A Streambed Alteration Agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the South Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Tidal perennial aquatic habitat is waters of the United States and is regulated by the Corps under Section 404 of the CWA and the Rivers and Harbors Act, and by the RWQCB under Section 401 of the CWA, with oversight by the EPA. This habitat is additionally regulated by DFG under Section 1600 *et seq.* of the California Fish and Game Code. Fish and other aquatic wildlife occupy this habitat.

Permanent loss of 0.14 acre of tidal perennial aquatic habitat at the gate construction site would be a significant impact. Implementation of Mitigation Measures VEG-MM-1 and VEG-MM-10 would reduce this impact to a less-than-significant level.

Impact VEG-10: Potential Degradation of Wetland Communities as a Result of Release of Contaminants by Channel Dredging.

As discussed under Alternative 2A, this effect would be considered a less-than-significant impact. No mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from the physical/structural component of Alternative 4B under 2020 conditions would be similar to those described above. In addition, the same mitigation would apply.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on vegetation and wetlands resulting from operation of Alternative 4B under 2020 conditions would be similar to 2001 conditions. There would be no additional impacts under 2020 conditions, and no additional mitigation is required.

Cumulative Evaluation of Impacts

Cumulative impacts on vegetation resources are analyzed in Chapter 10, "Cumulative Impacts." This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

Historically, the study area consisted of a mosaic of tidal marshland dominated by bulrushes with a few low natural levees that supported woody riparian vegetation, grassland, and upland shrubs (Thompson 1957). Today, agricultural land dominates the study area. Some small, apparently natural, islands remain as do some in-channel islands that are remnants of dredging and levee construction.

Levees in the south Delta typically have waterside slopes that are rock-lined or dominated by ruderal vegetation. Levees are actively maintained to control woody vegetation that could destabilize the levee structure. As a result, there is little or no native woody vegetation on the levees. Interior areas of most south Delta islands are actively farmed and contain little or no natural vegetation. Consequently, most remaining undisturbed native land cover types occur on in-channel islands or in small isolated patches along the waterside of the levees.

The study area includes all lands within the construction footprint of the gates, the channel dredging and gate dredging areas, and areas affected by operation of the gates within the study area (Figures 6.2-1 through 6.2-8). The study area land cover types can be divided into artificial and natural vegetation communities. Agriculture and landscaped and developed lands are artificial vegetation communities because they are maintained. The other vegetation communities and the aquatic communities are natural community types. Both the artificial and natural community types are addressed as NCCP communities in the MSCS (CALFED Bay-Delta Program 2000e). The mapped land cover types are described in Section 6.2, Vegetation and Wetlands. Table 6.3-1 includes a crosswalk between the CALFED NCCP communities, where applicable, and the land cover types identified in this document. Table 6.3-1 also includes the extent of each land cover type mapped by DWR as well as the affected area associated with each of the gates and the areas proposed for dredging.

Table 6.3-S. Summary of Significant Impacts and Mitigation Measures on Wildlife Resources for the South Delta Improvements Program

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
WILD-2: Loss of Riparian-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-1: Replace Riparian Land Cover Types WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources.	Less than significant
WILD-3: Loss of Tidal Emergent Wetland–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B	Significant	WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-4: Replace Wetland Land Cover Types	Less than significant
WILD-4: Loss of Tidal Perennial Aquatic–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-5: Compensate for Loss of Tidal Perennial Aquatic Habitat.	Less than significant
WILD-5: Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Potentially significant	No mitigation is required. WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources.	Less than significant
WILD-8: Loss of Valley Elderberry Longhorn Beetle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-6: Perform Preconstruction and Postconstruction Surveys for Elderberry Shrubs. WILD-MM-7: Avoid and Minimize Impacts on Elderberry Shrubs. WILD-MM-8: Compensate for Unavoidable Impacts on Elderberry Shrubs.	Less than significant

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
WILD-9: Loss or Disturbance of Swainson's Hawk Nests or Foraging Habitat as a Result of Gate Construction, Channel Dredging and Siphon Extensions.	2A–2C	Significant	WILD-MM-1: Replace Riparian Land Cover Types. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-9: Perform Preconstruction Surveys for Nesting Swainson's Hawks Prior to Construction and Maintenance. WILD–MM-10: Avoid and Minimize Construction-Related Disturbances within ½ Mile of Active Swainson's Hawk Nest Sites. WILD-MM-11: Replace or Compensate for the Loss of Swainson's Hawk Foraging Habitat. WILD-MM-12: Avoid Removal of Occupied Nest Sites.	Less than significant
WILD-9: Loss or Disturbance of Swainson's Hawk Nests or Foraging Habitat as a Result of Gate Construction, Channel Dredging and Siphon Extensions.	3B, 4B	Significant	WILD-MM-1: Replace Riparian Land Cover Types. WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-9: Perform Preconstruction Surveys for Nesting Swainson's Hawks Prior to Construction and Maintenance. WILD–MM-10: Avoid and Minimize Construction-Related Disturbances within ½ Mile of Active Swainson's Hawk Nest Sites. WILD-MM-11: Replace or Compensate for the Loss of Swainson's Hawk Foraging Habitat. WILD-MM-12: Avoid Removal of Occupied Nest Sites.	

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
WILD-10: Loss or Disturbance of San Joaquin Kit Fox or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-13: Perform Preconstruction Surveys for San Joaquin Kit Fox. WILD-MM-14: Minimize Construction-Related Disturbances near Active Den Sites. WILD-MM-15: Replace Lost San Joaquin Kit Fox Habitat.	Less than significant
WILD-11: Loss of Giant Garter Snake or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-4: Replace Wetland Land Cover Types. WILD-MM-16: Conduct Preconstruction Surveys for Giant Garter Snake. WILD-MM-17: Minimize Construction-Related Disturbances in the Vicinity of Occupied Habitat.	Less than significant
WILD-12: Loss of Western Pond Turtle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-4: Replace Wetland Land Cover Types. WILD-MM-18: Avoid and Minimize Construction-Related Disturbances in the Vicinity of Occupied Habitat.	Less than significant
WILD-13: Loss or Disturbance of Raptor Nest Sites as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources.	Less than significant

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
WILD-14: Loss of Tricolored Blackbirds or Suitable Nesting Habitat as a Result of Gate Construction and Channel Dredging.	2A–2C, 3B, 4B	Significant	WILD-MM-1: Replace Riparian Land Cover Types. WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-4: Replace Wetland Land Cover Types. WILD-MM-19: Conduct Preconstruction Surveys for Tricolored Blackbird. WILD-MM-20: Minimize Construction-Related Disturbances in the Vicinity of Active Tricolored Blackbird Colonies.	Less than significant
WILD-15: Loss or Disturbance of Nesting or Wintering Western Burrowing Owls as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-21: Conduct Preconstruction Surveys for Burrowing Owls. WILD-MM-22: Minimize Construction-Related Disturbances near Occupied Nest Sites. WILD-MM-23: Avoid or Minimize Disturbance to Active Nest and Roost Sites. WILD-MM-24: Mitigation of Impacts on Occupied Burrows. WILD-MM-25: Replace Lost Burrowing Owl Foraging Habitat.	Less than significant

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
WILD-16: Loss or Disturbance of California Black Rail or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions.	2A–2C, 3B, 4B	Significant	WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. WILD-MM-4: Replace Wetland Land Cover Types. WILD-MM-26: Conduct Preconstruction Surveys for California Black Rail. WILD-MM-27: Minimize Construction-Related Disturbances in the Vicinity of Active California Black Rail Nest Sites.	Less than significant

Table 6.3-1. Crosswalk between Land Cover Types and Wildlife Habitats in the Study Area

Wildlife Habitats	Land Cover Types in the Study Area: Land Cover Type	Acres	Total Acres for Wildlife Habitat Association
Tidal perennial aquatic habitat	Tidal perennial aquatic	2,225.6	2,225.6
Tidal freshwater emergent marsh habitat	Tule and cattail tidal emergent wetland	121.2	121.2
Riparian woodland	Cottonwood-willow woodland	384.5	467.1
	Valley oak riparian woodland	82.6	
Riparian scrub	Riparian scrub	131.9	278.2
	Willow scrub	133.6	
	Giant reed stand	12.7	
Agricultural land	Agriculture (at gate sites only)	125.5	125.5
Developed lands	Developed land	6.8	7.2
	Landscaping	2.4	
Ruderal herbaceous	Ruderal	526.1	526.1

Sources of Information

The following key sources of information were used in the preparation of this section:

- a review of the project alternatives;
- the wildlife resources sections of the CALFED Programmatic EIR/EIS, the ISDP EIR/EIS, and the CALFED MSCS;
- habitat mapping provided by DWR;
- field surveys performed by DWR;
- personal communications with DWR staff;
- a review of aerial photographs (September 2000);
- a review of the CNDDB (California Natural Diversity Database 2004); and
- a species list provided by USFWS for the SDIP, dated November 8, 2004 (Appendix M).

The CNDDB search included all USGS quadrangle maps in which the project area is located. The CNDDB search included the Woodward Island, Holt, CCF, Union Island, Lathrop, and Stockton West 7.5-minute quadrangles. The USFWS species list included special-status species that occur or may occur in Contra Costa and San Joaquin Counties (Appendix M).

Wildlife Habitat—Land Cover Type Associations in the Study Area

This section summarizes the land cover types identified in the study area and describes the conceptual relationship between land cover types and the wildlife habitats addressed in this analysis. Land cover types are described in Section 6.2, Vegetation and Wetlands. While land cover types emphasize floristic composition, structure, and other physical attributes, wildlife habitats additionally emphasize a land cover type's function and value for wildlife species. In some instances two or more land cover types may provide similar functions and values for wildlife (e.g., riparian scrub and willow scrub). Table 6.3-2 presents wildlife species and species groups whose habitat can be provided by each land cover type. Table 6.3-1 provides a crosswalk between the land cover types and wildlife habitat nomenclature for each cover type and identifies the acreage of each land cover type in the study area.

The following sections summarize the relationship between wildlife habitats and the associated land cover types within the project area that were identified in Section 6.2, Vegetation and Wetlands. Additionally, this section identifies the functions and values of each wildlife habitat, identifies associated common and special-status species wildlife species, and identifies supporting ecological processes in the project area. For the purpose of this analysis, the general wildlife groups identified in this section are composed of common wildlife species. Special-status species are discussed separately later in this section.

Seven general wildlife groups were identified for this analysis. Although other wildlife groups could be developed for the project area, the wildlife groups represent the most common and abundant species in the project area. The wildlife groups for this analysis include:

- waterfowl,
- shorebirds,
- water and wading birds,
- songbirds,
- raptors,
- mammals, and
- reptiles and amphibians.

Five natural land cover types and two artificial land cover types are present in the study area (Table 6.3-3). The natural land cover types are tidal perennial aquatic, tidal emergent wetland, riparian woodland, riparian scrub, and ruderal. The artificial land cover types are agricultural and developed lands. The following sections:

- describe the wildlife habitats and land cover types associated with each habitat type;

		Primary Habitat Functions and Representative Common Wildlife Species			
Land Cover Type	Associated Wildlife Groups	Breeding/Nesting	Foraging	Rearing	Roosting
Tidal perennial aquatic	Waterfowl	Common merganser Ruddy duck	Common merganser Ruddy duck	Common merganser Ruddy duck	Common merganser Ruddy duck
	Shorebirds	NA	Western sandpiper Killdeer Black-necked stilt	NA	NA
	Wading and water birds	NA	Great and snowy egret Green heron	NA	NA
	Raptors	NA	Northern harrier Peregrine falcon	NA	NA
	Songbirds	NA	Tree swallows Black phoebe	NA	NA
	Mammals	NA	Muskrat Raccoon	NA	NA
	Amphibians	Bullfrog	Bullfrog	Bullfrog	Bullfrog
	Reptiles	NA	Western garter snake	Western garter snake	Western garter snake
Tidal emergent wetland	Waterfowl	Mallard Ruddy duck	Mallard Ruddy duck	Mallard Ruddy duck	Mallard Ruddy duck
	Shorebirds	NA	NA	NA	NA
	Wading and water birds	NA	Great and snowy egret Green heron	NA	NA
	Raptors	NA	Northern harrier	NA	NA

		Primary Habitat Functions and Representative Common Wildlife Species			
Land Cover Type	Associated Wildlife Groups	Breeding/Nesting	Foraging	Rearing	Roosting
	Songbirds	Red-winged blackbird Marsh wren	Red-winged blackbird Marsh wren Tree swallows Black phoebe	Red-winged blackbird Marsh wren	Red-winged blackbird Marsh wren
	Mammals	Muskrat River otter	Muskrat Raccoon River otter	Muskrat River otter	Muskrat River otter
	Amphibians	Pacific chorus frog Bullfrog	Pacific chorus frog Bullfrog	Pacific chorus frog Bullfrog	Pacific chorus frog Bullfrog
	Reptiles	Western garter snake	Western garter snake	Western garter snake	Western garter snake
Valley foothill riparian (riparian woodland and/or riparian scrub)	Waterfowl	Wood duck	NA	NA	NA
	Shorebirds	NA	NA	NA	NA
	Wading and water birds	Great-blue heron Great and snowy egrets Black-crowned night herons	NA	NA	Great-blue heron Great and snowy egrets Black-crowned night herons
	Raptors	Red-tailed hawk Red-shoulder hawk Great-horned owl	Red-shouldered hawk	Red-tailed hawk Red-shoulder hawk Great-horned owl	Red-tailed hawk Red-shoulder hawk Great-horned owl

		Primary Habitat Functions and Representative Common Wildlife Species			
Land Cover Type	Associated Wildlife Groups	Breeding/Nesting	Foraging	Rearing	Roosting
	Songbirds	Tree swallows Black-headed grosbeak Spotted towhee Bullock's oriole Scrub jay	Tree swallows Black-headed grosbeak Spotted towhee Bullock's oriole Scrub jay Warblers Ash-throated flycatcher	Tree swallows Black-headed grosbeak Spotted towhee Bullock's oriole Scrub jay Ash-throated flycatcher	Tree swallows Black-headed grosbeak Spotted towhee Bullock's oriole Scrub jay Ash-throated flycatcher
	Mammals	Raccoon Western red bat Long-tailed weasel	Raccoon Western red bat Long-tailed weasel	Raccoon Western red bat Long-tailed weasel	Raccoon Western red bat California myotis
	Amphibians		Western toad Pacific chorus frog	Western toad Pacific chorus frog	Western toad Pacific chorus frog
Agricultural land (row crops and pasture land)	Waterfowl	Mallard	Mallard Greater white-fronted goose Snow goose	NA	Greater white-fronted goose Snow goose
	Shorebirds	Killdeer	Killdeer	Killdeer	Killdeer
	Wading and water birds	NA	Sandhill crane Great egret	NA	NA
	Raptors	Burrowing owl	Red-tailed hawk Northern harrier	Burrowing owl	Northern harrier Burrowing owl

		Primary Habitat Functions and Representative Common Wildlife Species			
Land Cover Type	Associated Wildlife Groups	Breeding/Nesting	Foraging	Rearing	Roosting
	Songbirds	Meadowlark Savannah sparrow	Meadowlark Brewer's blackbird	Meadowlark Savannah sparrow	Sparrows
	Mammals	Coyote California vole California ground squirrel	Coyote California vole California ground squirrel	Coyote California vole California ground squirrel	Coyote California vole California ground squirrel
	Amphibians	Western toad	Western toad	Western toad	Western toad California tiger salamander
	Reptiles	Gopher snake	Gopher snake	Gopher snake	Gopher snake
Ruderal land cover type	Waterfowl	Mallard (grasslands adjacent to wetlands)	NA	NA	NA
	Shorebirds	Killdeer	Killdeer	Killdeer	Killdeer
	Wading and water birds	NA	Sandhill crane Great egret	NA	NA
	Raptors	Northern harrier Short-eared owl Burrowing owl	Red-tailed hawk Northern harrier	Northern harrier Short-eared owl Burrowing owl	Northern harrier Short-eared owl Burrowing owl
	Songbirds	Meadowlark Savannah sparrow Horned lark	Meadowlark Savannah sparrow Brewer's blackbird	Meadowlark Savannah sparrow Horned lark	Meadowlark Sparrows Horned lark
	Mammals	Coyote California vole California ground squirrel	Coyote California vole California ground squirrel	Coyote California vole California ground squirrel	Coyote California vole California ground squirrel

		Primary Habitat Functions and Representative Common Wildlife Species			
Land Cover Type	Associated Wildlife Groups	Breeding/Nesting	Foraging	Rearing	Roosting
	Amphibians	Western toad	Western toad	Western toad	Western toad
	Reptiles	Gopher snake	Gopher snake	Gopher snake	Gopher snake
Tidal freshwater emergent	Waterfowl	Mallard Ruddy duck	Mallard Ruddy duck	Mallard Ruddy duck	Mallard Ruddy duck
	Shorebirds	NA	NA	NA	NA
	Wading and water birds	NA	Great and snowy egret Green heron	NA	NA
	Raptors	NA	Northern harrier	NA	NA
	Songbirds	Red-winged blackbird Marsh wren	Red-winged blackbird Marsh wren Tree swallows Black phoebe	Red-winged blackbird Marsh wren	Red-winged blackbird Marsh wren
	Mammals	Muskrat River otter	Muskrat Raccoon River otter	Muskrat River otter	Muskrat River otter
	Amphibians	Pacific chorus frog Bullfrog	Pacific chorus frog Bullfrog	Pacific chorus frog Bullfrog	Pacific chorus frog Bullfrog
	Reptiles	Western garter snake	Western garter snake	Western garter snake	Western garter snake

Table 6.3-3. Existing Land Cover Types in the SDIP Study Area and Project Area

NCCP Community Type	Land Cover Type	Total Acres in Study Area	Acreage at Gate Sites: Middle River Flow Control Gate	Acreage at Gate Sites: Grant Line Canal Flow Control Gate	Acreage at Gate Sites: Old River at DMC Flow Control Gate	Acreage at Gate Sites: Head of Old River Fish Control Gate	Acreage at Dredging Areas: West Canal Conveyance Dredging Area	Acreage at Dredging Areas: Middle River Conveyance Dredging Area	Acreage at Dredging Areas: Old River Conveyance Dredging Area	Acreage at Dredging Areas: Spot Dredging Areas for Agricultural Diversion	Acreage at Dredge Material Disposal Sites
Tidal perennial aquatic	Tidal perennial aquatic	2,225.6	8.3	10.4	3.7	7.6	73.0	72.7	123.5	477.3	0
Tidal freshwater emergent	Tule and cattail tidal emergent wetland	121.2	0.5	0.4	0.4	0	3.3	6.6	8.7	29.04	0
Valley/foothill riparian	Cottonwood-willow woodland (upland and wetland)	384.5	0.4	1.9	0	0	14.2	28.3	69.0	89.7	3.8
	Valley oak riparian woodland	82.6	0	0	0	0	0.1	14.7	23.5	34.5	0.8
	Riparian scrub (upland and wetland)	131.9	0.7	1.0	0.9	0	5.0	28.2	24.2	23.7	2.4
	Willow scrub (upland and wetland)	133.6	0	0.1	0.2	0	4.3	14.4	25.5	22.0	6.6
	Giant reed stand	12.7	0	0	0	0	0.4	0.1	3.7	3.7	0
Upland cropland	Agriculture	125.5	0.5 [1]	2.5 [1]	13.5 [1]	1.6 [1]	0	0	0	0	101.5
Not applicable	Developed land	6.8	– [1]	– [1]	– [1]	– [1]	0	0	0.5	3.5	0
Not applicable	Landscaping	2.4	0	0	0	0	0	0	0.1	1.9	0
Not applicable	Ruderal	526.1	0.2	1.0	0	3.2	29.5	122.7	78.29	77.6	47.4
	Total	**3,572.9**	**10.6**	**17.3**	**18.7**	**12.4**	**129.8**	**287.7**	**356.9**	**757.2**	**162.6**

Notes:

DMC = Delta-Mendota Canal.

[1] Agriculture acreages were planimetered from aerial photographs of the proposed dredge drying areas at the gate sites. Part of the agricultural land acreage included in the gate site dredge drying areas is ruderal vegetation, which has not yet been separately mapped in these areas. Developed land was not mapped at the gate sites.

- identify the functions and values of each land cover type;
- identify associated common wildlife species; and
- identify supporting processes in the project area.

Tidal Perennial Aquatic

The tidal perennial aquatic land cover type is present throughout the study area, including all gate and channel dredging areas (Figures 6.2-2 through 6.2-8). Tidal perennial aquatic habitat includes deepwater, shallow aquatic, and unvegetated intertidal areas within sloughs and channels.

Deepwater areas are largely unvegetated; however, beds of aquatic plants occasionally occur in shallower open-water areas. Deepwater areas provide foraging, roosting, and escape cover for a number of diving ducks, cormorants, grebes, and other waterfowl that are permanent residents or that winter in the project area (CALFED Bay Delta Program 2000b). Deepwater areas provide habitat for several reptiles and amphibians, including western pond turtles and western garter snake. Common mammal species in the deepwater areas include river otter, which use the deepwater areas for foraging and escape cover, and muskrats, which may use deepwater areas as migration corridors between suitable foraging areas.

Shallow aquatic areas may include shallow open-water areas or areas dominated by tidal perennial aquatic plant species, such as water hyacinth or water primrose. Colonies of these aquatic plants are generally infrequent but provide important habitat for a number of species. Shallow aquatic areas provide foraging habitat for diving and dabbling ducks, other waterfowl species, kingfishers, and wading birds. Shallow aquatic areas provide rearing, escape cover, and foraging for reptiles and amphibians and may be used as foraging habitat by river otter and raccoon.

Tidal flats provide important foraging habitat for migratory, resident, and wintering shorebirds, wading birds, and numerous other bird species. Tidal flats typically contain large concentrations of aquatic invertebrate and mollusks that serve as the primary food source of shorebirds.

Tidal Emergent Wetland

Wetlands are considered to be among the most productive wildlife habitats in California. Tule and cattail tidal emergent wetland, herein referred to as tidal emergent wetland, includes portions of the intertidal zones of the Delta that support emergent wetland plant species. Tidal emergent wetlands include all or portions of the tidal and Delta sloughs, and in-channel islands and shoals habitats. Tidal emergent wetland occurs along all channels and most in-channel islands in the study area, including the gate and dredge areas. This habitat typically occurs in small isolated patches or narrow discontinuous bands throughout the study area.

Although tidal emergent wetland does not occur in large continuous patches, this cover type provides important wildlife habitat functions and values. Tidal emergent wetland occurring on or adjacent to in-channel islands provides habitat that is relatively isolated from human disturbance and land-based predators. This land cover type provides nesting and foraging habitat for several songbirds, including red-winged blackbird, song sparrow, common yellowthroat, and marsh wren; provides foraging and nesting habitat for rails, other wading birds, and waterfowl; and provides foraging and cover habitat for common reptiles and amphibians, including western garter snake and bullfrogs.

Riparian Woodland

Riparian habitats are considered to be among the most productive wildlife habitats in California and typically support the most diverse wildlife communities. In addition to providing important nesting and foraging habitat, riparian woodlands function as wildlife movement corridors. Riparian habitat has been designated by DFG as a habitat of special concern in California because of its limited abundance and high value to wildlife.

Riparian woodlands occur throughout the study area, including the gate and dredge areas. Riparian woodlands in the study area are composed of the cottonwood willow riparian and valley oak riparian land cover types. Although the composition of dominant species differs between these two land cover types, the riparian tree species provide similar functions and values for wildlife. Although riparian woodlands in the study area typically occur in narrow or discontinuous patches, this cover type provides important function and values for wildlife. Riparian woodland habitat occurring on in-channel islands provides habitat that is relatively isolated from human disturbance and land-based predators. Also, aside from ornamental or landscape trees associated with farms or isolated trees in fields and along roadsides, riparian woodlands provide the only overstory and midstory vegetation. Overstory trees may be used for nesting and roosting by numerous raptors, including Swainson’s hawk, white-tailed kite, red-tailed hawk, barn owl, great horned owl, and kestrel. Overstory trees also provide suitable habitat for other birds—herons, egrets, and numerous songbirds, such as Bullock’s oriole and swallows. Riparian woodlands also provide important nesting and foraging cover for resident, migratory, and wintering songbirds. Riparian woodlands provide habitat for several species of mammals, including raccoon, Virginia opossum, and striped skunk. Riparian woodland provides cover and foraging habitat for reptiles and amphibians, such as western garter snake, bullfrogs, Pacific chorus frog, and western toad. Suitable areas in the understory may be used as nesting habitat for western pond turtles. Elderberry shrubs also may be associated with this community type.

Riparian Scrub

Riparian scrub occurs throughout the study area, including the gate and dredge areas. Riparian scrub is composed of three land cover types: riparian scrub, willow scrub, and stands of giant reed. Riparian scrub habitat provides functions and values for wildlife similar to riparian woodland; however, riparian scrub habitat lacks an overstory component. Although riparian scrub habitat typically occurs in narrow or discontinuous patches, this cover type provides important function and values for wildlife. Riparian scrub occurring on in-channel islands provides habitat that is relatively isolated from human disturbance and land-based predators. Elderberry shrubs also may be associated with this community type.

Ruderal Land Cover Type

The ruderal land cover type is dominated by herbaceous, nonnative, weedy species. Ruderal vegetation generally occurs in disturbed upland areas, on levee slopes and on the edges of agricultural fields and roads. Ruderal vegetation is typically most extensive on the landside levee faces at the gate sites and at the proposed dredge spoils basins along Middle River. Ruderal vegetation also occurs on the waterside of the levees; however, in these locations it is typically interspersed with riparian woodland and scrub. The ruderal cover type provides nesting and foraging habitat for several species of resident and wintering songbirds, including savanna sparrow and white-crowned sparrow. The ruderal land cover type provides foraging and haul-out areas for several aquatic wildlife species and potential nesting habitat for western pond turtles.

Agricultural Land Cover Type

Agriculture lands, as defined for this analysis, include agricultural lands that are not seasonally flooded. Major crops and cover types in agricultural production include small grains, field crops, truck crops, forage crops, pastures, orchards, and vineyards. The distribution of seasonal crops varies annually, depending on crop-rotation patterns and market forces. Agricultural lands are present in lands adjacent to the channel dredging areas and would be used to house temporary settling basins for dredging operations. Agricultural lands adjacent to the gate sites include row and pasture crops. In areas not intensively cultivated, such as fallow fields, roads, ditches, and levee slopes, regular maintenance precludes the establishment of ruderal vegetation or native vegetation communities.

Agricultural irrigation ditches are part of most of the agricultural fields in the south Delta. Because the habitat provided by agricultural ditches is different from that of agricultural fields, it is described separately. Ditches are present throughout much of the project area on the landside of the levees, but because avoidance of these features is assumed for most project activities, they were mapped only within the proposed dredged material disposal sites on Roberts Island. Ditches are either cement-lined or earth-lined.

Earth-lined agricultural ditches in the project area typically are installed, removed, and maintained periodically as part of routine farming practices. Most of these ditches are shallow and do not intersect the water table. These ditches are generally saturated or ponded for long durations; however, the water is pumped on and off as needed as part of routine farming operations (irrigation). Because water is present for long duration, ditches may exhibit wetland characteristics. Because these features have been excavated and are generally subject to maintenance, they have minimal suitable habitat for wildlife.

Agricultural lands provide foraging areas for many species that occur in the study area. The forage value for species varies seasonally and annually, depending on the crop cycle and on the vegetative cover present at the site. Agricultural and adjacent lands provide foraging areas for several bird species, including resident and wintering raptors, songbirds, shorebirds, and wading birds. Agricultural lands also provide foraging areas for small rodents, coyote, raccoon, opossum, and gopher snakes.

Developed Lands

Developed lands mapped in the study area include areas with roads, buildings, and landscapes but also include barren areas that have been disturbed and are unvegetated. Barren areas occur along riprapped levee faces and at the tops of levees. Developed land is mapped at all of the proposed gate sites and at the head of Old River fish control gate site. A minimal amount of this cover type occurs in the project area on the south bank of Old River west of the Old River gate site. Because of the disturbance related to installation of landscaping and the ongoing maintenance, these areas provide minimal value to wildlife in the study area.

Regulatory Setting

This section provides preliminary information on the major requirements for permitting and environmental review and consultation related to wildlife resources for implementation of the SDIP. Certain state and federal regulations require issuance of permits before project implementation; other regulations require agency consultation but may not require issuance of any entitlements before project implementation. The SDIP's requirements for permits and environmental review and consultation may change during the EIS/EIR review process as discussions with involved agencies proceed.

Federal Requirements

Federal Endangered Species Act

Section 7 of the ESA requires federal agencies, in consultation with USFWS and/or NOAA Fisheries, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of these species. The required steps in the Section 7 consultation process are as follows:

- Agencies must request information from USFWS and/or NOAA Fisheries on the existence in a project area of special-status species or species proposed for listing.
- Following receipt of the USFWS/NOAA Fisheries response to this request, agencies generally prepare a BA to determine whether any special-status species or species proposed for listing are likely to be affected by a proposed action.
- Agencies must initiate formal consultation with USFWS and/or NOAA Fisheries if the proposed action would/may adversely affect special-status species.
- USFWS and/or NOAA Fisheries must prepare a BO to determine whether the action would jeopardize the continued existence of special-status species or adversely modify their critical habitat.
- If a finding of jeopardy or adverse modifications is made in the BO, USFWS and/or NOAA Fisheries must recommend reasonable and prudent alternatives that would avoid jeopardy, and the federal agency must modify project approval to ensure that special-status species are not jeopardized and that their critical habitat is not adversely modified (unless an exemption from this requirement is granted).

In the preparation of the SDIP EIS/EIR, the MSCS approach was used and an ASIP, serving as the equivalent to the CALFED Programmatic SDIP BA, has been prepared in compliance with Section 7 of the ESA (SDIP ASIP).

State Requirements

California Endangered Species Act

The CESA requires a state lead agency to consult formally with DFG when a proposed action may affect state-listed endangered or threatened species. The provisions of ESA and CESA often will be activated simultaneously. The assessment of project effects on species listed under both ESA and CESA is addressed in USFWS's and NOAA Fisheries' BOs. However, for those species listed only under CESA, DWR must formally consult with DFG. DFG will ensure that the project complies with the provisions of CESA.

Special-Status Species

Special-status wildlife species are defined as animals that are legally protected under ESA, CESA, or other regulations and species that are considered sufficiently rare by the scientific community to qualify for such listing. Special-status wildlife include species that are:

- listed or proposed for listing as threatened or endangered under ESA (50 CFR 17.11 [listed wildlife], and various notices in the FR [proposed species]);
- candidates for possible future listing as threatened or endangered under ESA (66 FR 54808, October 30, 2001);
- listed or proposed for listing by the State of California as threatened or endangered under CESA (14 CCR 670.5);
- identified as species of concern that have the potential to occur in the project area because suitable or marginal habitat may exist for those species, as identified in the species list provided by Appendix M); species of special concern to the DFG and Special Animals list (California Department of Fish and Game 2001) (mammals) that have the potential to occur in the project area because suitable or marginal habitat may exist for those species;
- identified as species determined to meet the definitions of rare or endangered under CEQA (State CEQA Guidelines, Section 15380); or
- fully protected under California Fish and Game Code Section 3511(birds), Section 4700 (mammals), Section 5515 (fish), and Section 5050 (reptiles and amphibians).

This section provides a summary of the special-status species analysis for the study area. Special-status species that have the potential to occur in the study area were determined through a review of various sources including a USFWS species list and a review of the CNDDB (Table 6.3-4). Those species that are likely to occur in the study area are further evaluated in this section (Table 6.3-5)

Assessment Methods

This evaluation of impacts on special-status wildlife resources and wildlife habitat was based on:

- an analysis of the project alternatives,
- a review of available data and reports from other surveys performed in the study area,
- habitat mapping provided by DWR; and
- field surveys and literature reviews performed by DWR.

Specific information pertaining to field surveys and literature reviews performed and provided by DWR is provided in the following species accounts.

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Mammals					
Berkeley kangaroo rat *Dipodomys heermanni berkeleyensis*	SC/–	Alameda and Contra Costa Counties.	Open grassy hilltops and open spaces in chaparral and blue oak/foothill pine woodlands. Needs fine, deep well-drained soil for burrowing.	No suitable habitat in the project area.	No
Fringed myotis *Myotis thysanodes*	SC/–	Occurs throughout California except the southeastern deserts and the Central Valley.	Found in a wide variety of habitats, from low desert scrub to high elevation coniferous forests. Day and night roosts in caves, mines, trees, buildings, and rock crevices.	Outside the species known range.	No
Greater western mastiff-bat *Eumops perotis californicus*	SC/CSC	Occurs along the western Sierra primarily at low to mid elevations and widely distributed throughout the southern coast ranges. Surveys have detected the species north to the Oregon border.	Found in a wide variety of habitats from desert scrub to montane conifer. Roosts and breeds in deep, narrow rock crevices, but may also use crevices in trees, buildings, and tunnels.	No suitable habitat in the project area.	No
Long-legged myotis *Myotis volans*	SC/–	Mountains throughout California, including ranges in the Mojave desert.	Most common in woodlands and forests above 4,000 feet, but occurs from sea level to 11,000 feet.	No suitable habitat in the project area.	No
Merced kangaroo rat *Dipodomys heermanni dixoni*	SC/–	Foothills of the Sierra Nevada from Fresno to El Dorado Counties, the Coast Ranges from San Francisco Bay to Point Conception and the San Joaquin Valley.	Occurs in annual grassland, coastal sage scrub, mixed and montane chaparral, and early successional valley foothill hardwood and hardwood-conifer habitats.	No suitable habitat in the project area.	No
Pacific western big-eared bat *Plecotus townsendii pallescens*	SC/CSC	Coastal regions from Del Norte County south to Santa Barbara County.	Roosts in caves, tunnels, mines, and dark attics of abandoned buildings. Very sensitive to disturbances and may abandon a roost after one onsite visit.	Outside the species known range.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
San Joaquin Valley woodrat *Neotoma fuscipes riparia*	E/CSC	Historical distribution along the San Joaquin, Stanislaus, and Tuolumne Rivers, and Caswell State Park in San Joaquin, Stanislaus, and Merced Counties; presently limited to San Joaquin County at Caswell State Park and a possible second population near Vernalis.	Riparian habitats with dense shrub cover, willow thickets, and an oak overstory.	Outside the species known range.	No
Salt marsh harvest mouse *Reithrodontomys raviventris*	E/CE, FP	San Francisco, San Pablo, and Suisun Bays; the Delta.	Salt marshes with a dense plant cover of pickle-weed and fat hen; adjacent to an upland site.	Outside the species known range. No suitable habitat in the project area.	No
Salt marsh vagrant shrew *Sorex vagrans halicoetes*	SC/–	Restricted to southern and northwestern San Francisco Bay.	Midelevation salt marsh habitats with dense growths of pickleweed; requires driftwood and other objects for nesting cover.	Outside the species known range. No suitable habitat in the project area.	No
Riparian brush rabbit *Sylvilagus bachmani riparius*	E/CE	Limited to San Joaquin County at Caswell State Park near the confluence of the Stanislaus and San Joaquin Rivers and Paradise Cut area on Union Pacific right-of-way lands.	Native valley riparian habitats with large clumps of dense shrubs, low-growing vines, and some tall shrubs and trees.	Outside the species known range.	No
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	SC/–	West side of Mount Diablo to coast and San Francisco Bay.	Present in chaparral habitat and in forest habitats with a moderate understory.	Outside the species known range.	No
San Joaquin kit fox *Vulpes macrotis mutica*	E/CT	Principally occurs in the San Joaquin Valley and adjacent open foothills to the west; recent records from 17 counties extending from Kern County to Contra Costa County.	Saltbush scrub, grassland, oak, savanna, and freshwater scrub.	This species is not found in the Delta; however the project area is in or near the species range.	Yes
San Joaquin pocket mouse *Perognathus inornatus*	SC/–	Occurs throughout the San Joaquin Valley and in the Salinas Valley.	Favors grasslands and scrub habitats with fine textured soils.	Potential suitable habitat in portions of the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Small-footed myotis *Myotis ciliolabrum*	SC/–	Occurs in the Sierra Nevada, south Coast, Transverse, and Peninsular Ranges, and in the Great Basin.	Open stands in forests and woodlands, as well as shrub lands and desert scrub. Uses caves, crevices, trees, and abandoned buildings.	No suitable habitat in the project area.	No
Suisun ornate shrew *Sorex ornatus sinuosus*	SC/CSC	Restricted to San Pablo Bay and Suisun Bay, both in Solano County.	Tidal, salt, and brackish marshes containing pickleweed, grindelia, bulrushes, or cattails; requires driftwood or other objects for nesting cover.	Outside the species known range. No suitable habitat in the project area.	No
Yuma myotis *Myotis yumanensis*	SC/–	Common and widespread throughout most of California except the Colorado and Mojave deserts near water bodies.	Found in a wide variety of habitats from sea level to 11,000 feet, but uncommon above 8,000 feet. Optimal habitat is open forests and woodlands.	No suitable habitat in the project area.	No
Birds					
Alameda song sparrow *Melospiza melodia pusillula*	SC/CSC	Found only in marshes along the southern portion of the San Francisco Bay.	Brackish marshes associated with pickleweed; may nest in tall vegetation or among the pickleweed.	Outside the species known range.	No
Allen's hummingbird *Selasphorus sasin*	SC/–	Summer resident along most of the California coast.	Most commonly breeds in coastal scrub, valley foothill hardwoods and valley foothill riparian but may also occur in association with redwood and closed-cone pine habitats and urban areas.	May occur in the project area during migration.	No
American bittern *Botaururs lentiginosus*	SC/–	Widespread in suitable habitats in winter. Breeds locally in the Central Valley, the northeast plateau, the Imperial Valley and the coastal slope south of Monterey.	Occurs in tall, dense stands of emergent wetland vegetation.	Marginal habitat present in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Aleutian Canada goose *Branta canadensis leucopareia*	SC/–	The entire population winters in Butte Sink, then moves to Los Banos, Modesto, the Delta, and East Bay reservoirs; stages near Crescent City during spring before migrating to breeding grounds.	Roosts in large marshes, flooded fields, stock ponds, and reservoirs; forages in pastures, meadows, and harvested grainfields; corn is especially preferred.	Winter resident in the project area. Suitable foraging habitat present in the project area.	No
American peregrine falcon *Falco peregrinus anatum*	D/CE, FP	Permanent resident along the north and south Coast Ranges. May summer in the Cascade and Klamath Ranges and through the Sierra Nevada to Madera County. Winters in the Central Valley south through the Transverse and Peninsular Ranges and the plains east of the Cascade Range.	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large prey populations.	May occur in the project area during migration or winter.	No
Bald eagle *Haliaeetus leucocephalus*	T, PR/CE, FP	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in the Lake Tahoe Basin. Reintroduced into central coast. Winter range includes the rest of California, except the southeastern deserts, very high altitudes in the Sierra Nevada, and east of the Sierra Nevada south of Mono County.	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean.	May occur in the project area during migration or winter.	No
Bank swallow *Riparia riparia*	SC/CT	Occurs along the Sacramento River from Tahama County to Sacramento County, along the Feather and lower American Rivers, in the Owens Valley; and in the plains east of the Cascade Range in Modoc, Lassen, and northern Siskiyou Counties. Small populations near the coast from San Francisco County to Monterey County.	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam.	Outside of the species known range. No suitable habitat in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Bell's sage sparrow *Amphispiza belli belli*	SC/CSC	Western Sierra foothills from El Dorado County south to Mariposa County, inner Coast Ranges from Shasta County southward, extending to vicinity of coast from Marin County to San Diego County; from southern San Benito County to San Bernardino County.	Prefers chaparral habitats dominated by chamise.	Outside the species known range.	No
Black tern *Chlidonias niger*	SC/CSC	Spring and summer resident of the Central Valley, Salton Sea, and northeastern California where suitable emergent wetlands occur.	Freshwater wetlands, lakes, ponds, moist grasslands, and agricultural fields; feeds mainly on fish and invertebrates while hovering over water.	Suitable habitat present in the project area.	No
California black rail *Laterallus jamaicensis coturniculus*	SC/CT, FP	Permanent resident in the San Francisco Bay and east-ward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties.	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations.	Suitable habitat present in the project area.	Yes
California brown pelican *Pelecanus occidentalis californicus*	E/CE, FP	Present along the entire coastline, but does not breed north of Monterey County; extremely rare inland.	Typically in littoral ocean zones, just outside the surf line; nests on offshore islands.	Outside the species known range. No suitable habitat in the project area.	No
California clapper rail *Rallus longirostris obsoletus*	E/CE, FP	Marshes around the San Francisco Bay and east through the Delta to Suisun Marsh.	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickle-weed; feeds on mollusks removed from the mud in sloughs.	Outside the species known range. No suitable habitat in the project area.	No
California horned lark *Eremophila alpestris actia*	–/CSC	Found throughout much of the state, less common in mountainous areas of the north coast and in coniferous or chaparral habitats.	Common to abundant resident in a variety of open habitats, usually where large trees and shrubs are absent. Grasslands and deserts to dwarf shrub habitats above tree line.	Suitable habitat present in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
California least tern *Sterna antillarum browni*	E/CE, FP	Nests on beaches along the San Francisco Bay and along the southern California coast from southern San Luis Obispo County south to San Diego County.	Nests on sandy, upper ocean beaches, and occa-sionally uses mudflats; forages on adjacent surf line, estuaries, or the open ocean.	Outside the species known range. No suitable habitat in the project area.	No
California thrasher *Toxostoma redivivum*	SC/–	Common resident in foothills and lowlands in Cismontane California.	Occurs in dense chaparral habitats and occasionally in thickets of valley foothill riparian habitat.	Outside the species known range. No suitable habitat in the project area.	No
Common loon *Gavia immer*	SC/–	Primarily a winter visitor to California, but an occasional year-round resident; found along the entire coast and large inland bodies of water; formerly nested in northeastern California.	Nearshore coastal waters and bays; less common at large inland bodies of deep water with productive fisheries.	Occasional winter resident in the project area.	No
Cooper's hawk *Accipiter cooperii*	SC/–	Throughout California except high altitudes in the Sierra Nevada. Winters in the Central Valley, southeastern desert regions, and plains east of the Cascade Range.	Nests in a wide variety of habitat types, from riparian woodlands and digger pine-oak woodlands through mixed conifer forests.	Suitable habitat present in the project area.	Yes
Costa's hummingbird *Calypte costae*	SC/–	Most common and widespread in southern California. Breeds locally along the western edge of the San Joaquin Valley north to Santa Clara County and on the east side of the Sierra Nevada in Inyo County.	Occurs in arid habitats including desert washes, desert and valley foothill riparian, chaparral, desert scrub and coastal scrub.	May occur in the project area during migration.	No
Ferruginous hawk *Buteo regalis*	SC/CSC	Does not nest in California; winter visitor along the coast from Sonoma County to San Diego County, east-ward to the Sierra Nevada foothills and south-eastern deserts, the Inyo-White Mountains, the plains east of the Cascade Range, and Siskiyou County.	Open terrain in plains and foothills where ground squirrels and other prey are available.	May occur during migration or winter. Suitable foraging habitat present in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Grasshopper sparrow *Ammodramus savannarum*	SC/–	Uncommon summer resident in foothills and lowlands from Mendocino and Trinity Counties south to San Diego County.	Occurs in dense, dry grasslands with scatter small shrubs.	Outside the species known range. No suitable habitat in the project area.	No
Great blue heron (rookery) *Ardea herodias*	SB/SB	Common throughout most of California, less common mountains above the foothills.	Occurs in shallow estuaries and fresh and saline emergent wetlands, ponds and other slow moving waterways. Nests in colonies in tops of large snags or live trees.	Suitable rookery sites present in the project area.	No
Greater sandhill crane *Grus canadensis tabida*	SC/CT, FP	Breeds in Siskiyou, Modoc, Lassen, Plumas, and Sierra Counties. Winters in the Central Valley, southern Imperial County, Lake Havasu National Wildlife Refuge, and the Colorado River Indian Reserve.	Summers in open terrain near shallow lakes or freshwater marshes. Winters in plains and valleys near bodies of fresh water.	Suitable foraging habitat is present in the project area.	Yes
Hermit warbler *Dendroica occidentalis*	SC/–	Summer resident in major mountain ranges in California, excluding Coastal Ranges south of Santa Cruz County. Rare winter resident.	Occurs in mature coniferous and montane hardwood-conifer habitat. During migration this species may occur in valley foothill hardwood and planted pine stands.	May occur in the project area during migration.	No
Lawrence's goldfinch *Carduelis lawrencei*	SC/–	Erratic and localized in occurrence in foothills surrounding the Central Valley, Santa Clara County, coastal slope south of Monterey County, and along the western edge of the southern California deserts.	Occurs in open oak and other arid woodland and chaparral habitats near water.	May occur in the project area during migration.	No
Lewis' woodpecker *Melanerpes lewis*	SC/–	Breeds locally on eastern slopes of the Coast Ranges and in the Sierra Nevada, Cascade Range, and Klamath an d Warner Mountains. Uncommon winter resident in the Central Valley.	Occurs in open oak savanna, deciduous, and coniferous habitats.	May occur in the project area during migration.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Little willow flycatcher *Empidonax traillii brewsteri*	SC/CE	Summers along the western Sierra Nevada from El Dorado to Madera County, in the Cascade and northern Sierra Nevada in Trinity, Shasta, Tahama, Butte, and Plumas Counties, and along the eastern Sierra Nevada from Lassen to Inyo County.	Riparian areas and large wet meadows with abundant willows. Usually found in riparian habitats during migration.	No suitable breeding habitat in the project area. May occur in the project area during migration.	No
Loggerhead shrike *Lanius ludovicianus*	SC/CSC	Resident and winter visitor in lowlands and foothills throughout California. Rare on coastal slope north of Mendocino County, occurring only in winter.	Prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches.	Suitable habitat present in the project area	No
Long-billed curlew *Numenius americanus*	SC/CSC	Nests in northeastern California in Modoc, Siskiyou, and Lassen Counties. Winters along the coast and in interior valleys west of Sierra Nevada.	Nests in high-elevation grasslands adjacent to lakes or marshes. During migration and in winter; frequents coastal beaches and mudflats and interior grasslands and agricultural fields.	May occur in the project area during migration.	No
Mountain plover *Charadrius montanu*	SC/CSC	Does not breed in California; in winter, found in the Central Valley south of Yuba County, along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties; parts of Imperial, Riverside, Kern, and Los Angeles Counties.	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grainfields.	Winter resident. May forage in agricultural lands.	No
Northern harrier *Circus cyaneus*	–/CSC	Occurs throughout lowland California. Has been recorded in fall at high elevations.	Grasslands, meadows, marshes, and seasonal and agricultural wetlands.	Species known to occur in the project area.	Yes
Nuttall's woodpecker *Picoides nuttallii*	SLC/–	Occurs throughout the Central Valley, the Coast, Transverse, and Peninsular Ranges, and in lower elevations in the Cascade and Sierra Nevada Ranges.	Occurs primarily in oak and riparian habitats and urban areas with suitable foraging and nesting habitat.	Suitable habitat present in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Oak titmouse *Baeolophus inornatus*	SLC/–	Occurs in Cismontane California from the Mexican border to Humboldt County.	Occurs in riparian, montane hardwood, valley foothill hardwood/conifer habitats.	No suitable habitat in the project area.	No
Olive-sided flycatcher *Contopus cooperi*	SC/–	Summer resident in forests and woodland below 9,000 feet, excluding the Central Valley, deserts and other lowland areas. Uncommon transient in lowland areas.	Nests in mixed conifer, montane hardwood-conifer, redwood, Douglas-fir and other coniferous forest cover types.	May occur in the project area during migration.	No
Rufous hummingbird *Selasphorus rufus*	SC/–	Uncommon summer resident in California and a common summer resident in Oregon and Washington. In California this species breeds in the Trinity Mountains of Trinity and Humboldt Counties.	Occurs in a variety of habitats including valley foothill hardwood, riparian, mixed hardwood/pine, chaparral and mountain meadows.	May occur in the project area during migration.	No
Saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	SC/CSC	Found only in the San Francisco Bay Area in Marin, Napa, Sonoma, Solano, San Francisco, San Mateo, Santa Clara, and Alameda Counties.	Freshwater marshes in summer and salt or brackish marshes in fall and winter; requires tall grasses, tules, and willow thickets for nesting and cover.	Outside the species known range.	No
San Pablo song sparrow *Melospiza melodia samuelis*	SC/CSC	Found in San Pablo Bay.	Uses tidal sloughs within pickleweed marshes; requires tall bushes (usually grindelia) along sloughs for cover, nesting, and songposts; forages over mudbanks and in the pickleweed.	Outside the species known range.	No
Short-eared owl *Asio flammeus*	SC/CSC	Permanent resident along the coast from Del Norte County to Monterey County although very rare in summer north of San Francisco Bay, in the Sierra Nevada north of Nevada County, in the plains east of the Cascades, and in Mono County; small, isolated populations.	Freshwater and salt marshes, lowland meadows, and irrigated alfalfa fields; needs dense tules or tall grass for nesting and daytime roosts.	Suitable habitat present in the project area.	Yes

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Snowy egret (rookery) *Egretta thula*	SB/SB	Occurs in the Central Valley, coastal lowlands, on the northeastern plateau and in the Imperial Valley.	Occurs in shallow estuaries and fresh and saline emergent wetlands, ponds and other slow moving waterways. Nests in colonies in tops of large snags or live trees.	No known rookery sites in the project area.	No
Suisun song sparrow *Melospiza melodia maxillaris*	SC/CSC	Restricted to the extreme western edge of the Delta, between the cities of Vallejo and Pittsburg near Suisun Bay.	Brackish and tidal marshes supporting cattails, tules, various sedges, and pickleweed.	Outside the species known range.	No
Swainson's hawk *Buteo swainsoni*	SC/CT	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. Highest nesting densities occur near Davis and Woodland, Yolo County.	Nests in oaks or cottonwoods in or near riparian habitats. Forages in grasslands, irrigated pastures, and grain fields.	Suitable habitat present in the project area.	Yes
Tricolored blackbird *Agelaius tricolor*	SC/CSC	Permanent resident in the Central Valley from Butte County to Kern County. Breeds at scattered coastal locations from Marin County south to San Diego County; and at scattered locations in Lake, Sonoma, and Solano Counties. Rare nester in Siskiyou, Modoc, and Lassen Counties.	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grainfields. Habitat must be large enough to support 50 pairs. Probably requires water at or near the nesting colony.	Suitable habitat present in the project	Yes
Vaux's swift *Chaetura vauxi*	SC/–	Coastal belt from Del Norte County south to Santa Cruz County and in mid elevation forests of the Sierra Nevada and Cascade Range.	Nests in hollow, burned-out tree trunks in large conifers.	May occur in the project area during migration.	No
Western burrowing owl *Athene cunicularia hypugea*	SC/CSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Rare along south coast.	Level, open, dry, heavily grazed or low stature grassland or desert vegetation with available burrows.	Species known to occur in the project area.	Yes

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Western snowy plover *Charadrius alexandrinus nivosus*	T/CSC	Nests at inland lakes throughout northeastern, central, and southern California, including Mono Lake and Salton Sea.	Barren to sparsely vegetated ground at alkaline or saline lakes, reservoirs, ponds and riverine sand bars; also along sewage, salt-evaporation, and agricultural wastewater ponds.	Suitable habitat present in the project area.	No
Western yellow-billed cuckoo *Coccyzus americanus occidentalis*	–/CE	Nests along the upper Sacramento, lower Feather, south fork of the Kern, Amargosa, Santa Ana, and Colorado Rivers.	Wide, dense riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley-oak riparian habitats where scrub jays are abundant.	No suitable habitat in the project area.	No
White-faced ibis *Plegadis chihi*	SC/CSC	Both resident and winter populations on the Salton Sea and in isolated areas in Imperial, San Diego, Ventura, and Fresno Counties; breeds at Honey Lake, Lassen County, at Mendota Wildlife Management Area, Fresno County, and near Woodland, Yolo County.	Prefers freshwater marshes with tules, cattails, and rushes, but may nest in trees and forage in flooded agricultural fields, especially flooded rice fields.	May occur during migration or as a winter resident.	No
White-tailed kite *Elanus leucurus*	SC/FP	Lowland areas west of Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border.	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging.	Species known to occur in the project area.	Yes
Reptiles					
Alameda whipsnake *Masticophis lateralis euryxanthus*	T/CT	Restricted to Alameda and Contra Costa Counties; fragmented into 5 disjunct populations throughout its range.	Valleys, foothills, and low mountains associated with northern coastal scrub or chaparral habitat; requires rock outcrops for cover and foraging.	Outside the species known range.	No
Alameda whipsnake critical habitat				Outside the species known range.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
California horned lizard *Phrynosoma coronatum frontale*	SC/CSC	Found throughout much of the state, less common in mountainous areas of the north coast and in coniferous or chaparral habitats.	Common to abundant resident in a variety of open habitats, usually where large trees and shrubs are absent. Grasslands and deserts to dwarf shrub habitats above tree line.	No suitable habitat in the project area.	No
Giant garter snake *Thamnophis gigas*	T/CT	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno.	Sloughs, canals, low gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.	Potential habitat present in the project area.	Yes
San Joaquin coachwhip *Masticophis flagellum ruddocki*	SC/–	From Colusa county in the Sacramento Valley southward to the grapevine in the San Joaquin Valley and westward into the inner coast ranges. An isolated population occurs at Sutter Buttes. Known elevational range from 20 to 900 meters.	Occurs in open, dry, vegetative associations with little or no tree cover. It occurs in valley grassland and saltbush scrub associations. Often occurs in association with mammal burrows.	Marginal habitat present in the project area.	No
Silvery legless lizard *Anniella pulchra pulchra*	SC/CSC	Along the Coast, Transverse, and Peninsular Ranges from Contra Costa County to San Diego County with spotty occurrences in the San Joaquin Valley.	Habitats with loose soil for burrowing or thick duff or leaf litter; often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas.	No suitable habitat in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Western pond turtle *Clemmys marmorata*	SC/CSC	Northwestern subspecies occurs from the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of Sierra Nevada. Southwestern subspecies occurs along the central coast of California east to the Sierra Nevada and along the southern California coast inland to the Mojave and Sonora Deserts; range overlaps with that of the northwestern pond turtle throughout the Delta and in the Central Valley.	Occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests. Woodlands, grasslands, and open forests; aquatic habitats, such as ponds, marshes, or streams, with rocky or muddy bottoms and vegetation for cover and food.	Species known to occur in the project area	Yes
Amphibians					
California red-legged frog *Rana aurora draytonii*	T/CSC	Found along the coast and coastal mountain ranges of California from Marin County to San Diego County and in the Sierra Nevada from Tehama County to Fresno County.	Permanent and semipermanent aquatic habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation. May aestivate in rodent burrows or cracks during dry periods.	Outside the species known range. No suitable habitat in the project area.	No
California tiger salamander *Ambystoma californiense*	CS/CSC	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to northeastern San Luis Obispo County.	Small ponds, lakes, or vernal pools in grass-lands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy.	No suitable habitat in the project area.	No
Foothill yellow-legged frog *Rana boylii*	SC/CSC	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to northeastern San Luis Obispo County.	Small ponds, lakes, or vernal pools in grass-lands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy.	Outside the species known range.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Western spadefoot *Scaphiopus hammondii*	SC/CSC	Sierra Nevada foothills, Central Valley, Coast Ranges, coastal counties in southern California.	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands.	No suitable habitat in the project area.	No
Invertebrates					
Antioch Dunes anthicid beetle *Anthicus anthiochensis*	SC/–	Population in Antioch Dunes believed extinct; Now known only from Grand Island and in and around Sandy Beach County Park, Sacramento County.	Loose sand on sand bars and sand dunes.	No suitable habitat in the project area.	No
California linderiella *Linderiella occidentalis*	SC/–			No suitable habitat in the project area.	No
Callippe silverspot *Speyeria callippe callippe*	E/–	San Bruno Mountain, San Mateo County, and a single location in Alameda County.	Open hillsides where wild pansy (*Viola penduncul͏ata*) grows; larvae feed on Johnny jump-up plants, whereas adults feed on native mints and non-native thistles.	No suitable habitat in the project area.	No
Ciervo aegialian scarab beetle *Aegialia concinna*	SC/–	Four locations known from Contra Costa, San Benito, Fresno, and San Joaquin Counties.	Sand dunes and sandy substrates.	No suitable habitat in the project area.	No
Conservancy fairy shrimp *Branchinecta conservatio*	E/–	Disjunct occurrences in Solano, Merced, Tehama, Ventura, Butte, and Glenn Counties.	Large, deep vernal pools in annual grasslands.	No suitable habitat in the project area.	No
Curved-foot hygrotus diving beetle *Hygrotus curvipes*	SC/–	Kellogg Creek watershed and one site near Oakley, Contra Costa County and Alameda County.	Aquatic; Small seasonal pools and wetlands and small pools left in dry creek beds, associated with alkaline-tolerant vegetation.	No suitable habitat in the project area.	No
Longhorn fairy shrimp *Branchinecta longiantenna*	E/–	Eastern margin of central Coast Ranges from Contra Costa County to San Luis Obispo County; disjunct population in Madera County.	Small, clear pools in sandstone rock outcrops of clear to moderately turbid clay- or grass-bottomed pools.	No suitable habitat in the project area.	No

Species Name	Status[1] Federal/State	Distribution	Habitat	Likelihood of Occurrence in the Project Area	Proposed for Evaluation in the EIR
Mid-valley fairy shrimp *Brachinecta n.* sp. *Amid-valley*	SC/–			No suitable habitat in the project area.	No
Moestan blister beetle *Lytta moesta*	SC/–	Most records from San Joaquin Valley (Kern, Tulare, San Joaquin, and Stanislaus Counties); a few specimens collected from Santa Cruz County.	Feeds on flowers in the summer and fall, mostly composites.	No suitable habitat in the project area.	No
Sacramento anthicid beetle *Anthicus sacramento*	SC/–	Dune areas at mouth of Sacramento River; western tip of Grand Island, Sacramento County; upper Putah Creek and dunes near Rio Vista, Solano County; Ord Ferry Bridge, Butte County.	Found in sand slip-faces among willows; associated with riparian and other aquatic habitats.	No suitable habitat in the project area.	No
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T/–	Streamside habitats below 3,000 feet throughout the Central Valley.	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant.	Within the species known range. Suitable habitat may be present in the project area.	Yes
Valley elderberry longhorn beetle critical habitat *Desmocerus californicus dimorphus critical habitat*				Project area is not within the area designated as critical habitat.	No
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–	Central Valley, central and south Coast Ranges from Tehama County to Santa Barbara County. Isolated populations also in Riverside County.	Common in vernal pools; also found in sandstone rock outcrop pools.	No suitable habitat in the project area.	No
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–	Shasta County south to Merced County.	Vernal pools and ephemeral stock ponds.	No suitable habitat in the project area.	No
Yellow-banded andrenid bee *Perdita hirticeps luteocincta*	SC/–	Antioch Dunes, Contra Costa County.	Sand dunes.	No suitable habitat in the project area.	No

Notes:

Species listed in table are generated from the U.S. Fish and Wildlife Service (USFWS) project species list, California Department of Water Resources (DWR) field survey data, and California Natural Diversity Database (CNDDB) records. Species shown in highlight are species covered under the CALFED Bay-Delta Program (CALFED) programmatic biological opinions and the Natural Community Conservation Plan (NCCP) determination.

[1] Status:

Federal

E = Listed as endangered under the federal Endangered Species Act (ESA).

T = Listed as threatened under ESA.

PE = Proposed for listing as endangered under ESA.

PT = Proposed for listing as threatened under ESA.

C = Candidate for listing under ESA.

SC = Species of concern under ESA.

SLC = Species of local concern under ESA.

D = Delisted. Status to be monitored for 5 years.

PR = Protected under the Bald and Golden Eagle Protection Act.

– = No federal status.

State

CE = Listed as endangered under the California Endangered Species Act (CESA).

CT = Listed as threatened under CESA.

CCE = Candidate for listing as endangered under CESA.

CCT = Candidate for listing as threatened under CESA.

R = Listed as rare under California Native Plant Protection Act.

CSC = California species of special concern.

FP = Fully protected under California Fish and Game Code.

SB = Specified birds under California Fish and Game Code.

– = No state status.

Table 6.3-5. Special-Status Species Likely to Occur in the Project Area

Species Name	Status[1] Federal	Status[1] State	Distribution	Habitat	Likelihood of Occurrence in Study Area
Mammals					
San Joaquin kit fox *Vulpes macrotis mutica*	E	CT	Principally occurs in the San Joaquin Valley and adjacent open foothills to the west; recent records from 17 counties extending from Kern County north to Contra Costa County.	Saltbush scrub, grassland, oak, savanna, and freshwater scrub.	Suitable habitat present in the portions of the project area.
Birds					
California black rail *Laterallus jamaicensis coturniculus*	SC	CT/FP	Permanent resident in the San Francisco Bay and east-ward through the Delta into Sacramento and San Joaquin Counties; small populations in Marin, Santa Cruz, San Luis Obispo, Orange, Riverside, and Imperial Counties.	Tidal salt marshes associated with heavy growth of pickleweed; also occurs in brackish marshes or freshwater marshes at low elevations.	Suitable habitat present in the project area.
Cooper's hawk *Accipiter cooperii*	SC	–	Throughout California except high altitudes in the Sierra Nevada. Winters in the Central Valley, southeastern desert regions, and plains east of the Cascade Range.	Nests in a wide variety of habitat types, from riparian woodlands and digger pine-oak woodlands through mixed conifer forests.	Suitable habitat present in the project area.
Greater sandhill crane *Grus canadensis tabida*	SC	CT/FP	Breeds in Siskiyou, Modoc, Lassen, Plumas, and Sierra Counties. Winters in the Central Valley, southern Imperial County, Lake Havasu National Wildlife Refuge, and the Colorado River Indian Reserve.	Summers in open terrain near shallow lakes or freshwater marshes. Winters in plains and valleys near bodies of fresh water.	Suitable foraging habitat is present in the study area.
Northern harrier *Circus cyaneus*	–	CSC	Occurs throughout lowland California. Has been recorded in fall at high elevations.	Grasslands, meadows, marshes, and seasonal and agricultural wetlands.	Species known to occur in the study area.
Short-eared owl *Asio flammeus*	SC	CSC	Permanent resident along the coast from Del Norte County to Monterey County although very rare in summer north of San Francisco Bay, in the Sierra Nevada north of Nevada County, in the plains east of the Cascades, and in Mono County; small, isolated populations.	Freshwater and salt marshes, lowland meadows, and irrigated alfalfa fields; needs dense tules or tall grass for nesting and daytime roosts.	Suitable habitat present in the project area.
Swainson's hawk *Buteo swainsoni*	SC	CT	Lower Sacramento and San Joaquin Valleys, the Klamath Basin, and Butte Valley. Highest nesting densities occur near Davis and Woodland, Yolo County.	Nests in oaks or cottonwoods in or near riparian habitats. Forages in grasslands, irrigated pastures, and grain fields.	Species known to occur in the study area.

Species Name	Status[1] Federal	State	Distribution	Habitat	Likelihood of Occurrence in Study Area
Tricolored blackbird *Agelaius tricolor*	SC	CSC	Permanent resident in the Central Valley from Butte County to Kern County. Breeds at scattered coastal locations from Marin County south to San Diego County; and at scattered locations in Lake, Sonoma, and Solano Counties. Rare nester in Siskiyou, Modoc, and Lassen Counties.	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grainfields. Habitat must be large enough to support 50 pairs. Probably requires water at or near the nesting colony.	Suitable habitat present in the study.
Western burrowing owl *Athene cunicularia hypugea*	SC	CSC	Lowlands throughout California, including the Central Valley, northeastern plateau, southeastern deserts, and coastal areas. Rare along south coast.	Level, open, dry, heavily grazed or low stature grassland or desert vegetation with available burrows.	Suitable habitat present in the study area.
White-tailed kite *Elanus leucurus*	SC	FP	Lowland areas west of Sierra Nevada from the head of the Sacramento Valley south, including coastal valleys and foothills to western San Diego County at the Mexico border.	Low foothills or valley areas with valley or live oaks, riparian areas, and marshes near open grasslands for foraging.	Species known to occur in the study area.
Reptiles					
Giant garter snake *Thamnophis gigas*	T	CT	Central Valley from the vicinity of Burrel in Fresno County north to near Chico in Butte County; has been extirpated from areas south of Fresno.	Sloughs, canals, low gradient streams and freshwater marsh habitats where there is a prey base of small fish and amphibians; also found in irrigation ditches and rice fields; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter.	Marginal habitat in the study area.
Western pond turtle *Clemmys marmorata*	SC	CSC	The northern subspecies occurs from the Oregon border of Del Norte and Siskiyou Counties south along the coast to San Francisco Bay, inland through the Sacramento Valley, and on the western slope of Sierra Nevada.	The northern subspecies occupies ponds, marshes, rivers, streams, and irrigation canals with muddy or rocky bottoms and with watercress, cattails, water lilies, or other aquatic vegetation in woodlands, grasslands, and open forests.	Species known to occur in the study area.
			The southern subspecies occurs along the central coast of California east to the Sierra Nevada and along the southern California coast inland to the Mojave and Sonora Deserts; range overlaps with that of the northwestern pond turtle throughout the Delta and in the Central Valley.	The southern subspecies occurs in woodlands, grasslands, and open forests; aquatic habitats, such as ponds, marshes, or streams, with rocky or muddy bottoms and vegetation for cover and food.	Species known to occur in the study area.

Table 6.3-5. Continued

Species Name	Status[1] Federal	State	Distribution	Habitat	Likelihood of Occurrence in Study Area
Invertebrates					
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	T	–	Stream side habitats below 3,000 feet throughout the Central Valley.	Riparian and oak savanna habitats with elderberry shrubs; elderberries are the host plant.	Suitable habitat is present in the study area.

Notes:

Species listed in table are generated from the U.S. Fish and Wildlife Service (USFWS) study species list, California Department of Water Resources (DWR) field survey data, and California Natural Diversity Database (CNDDB) records. Species shown in highlight are species covered under the CALFED Bay-Delta Program (CALFED) programmatic biological opinions and the Natural Community Conservation Plan (NCCP) determination.

[1] Status:

Federal

E = Listed as endangered under the federal Endangered Species Act (ESA).

T = Listed as threatened under ESA.

PE = Proposed for listing as endangered under ESA.

PT = Proposed for listing as threatened under ESA.

C = Candidate for listing under ESA.

SC = Species of concern under ESA.

SLC = Species of local concern under ESA.

D = Delisted. Status to be monitored for 5 years.

PR = Protected under the Bald and Golden Eagle Protection Act.

– = No federal or state status

State

CE = Listed as endangered under California Endangered Species Act (CESA).

CT = Listed as threatened under CESA.

CCE = Candidate for listing as endangered under CESA.

CCT = Candidate for listing as threatened under CESA.

R = Listed as rare under California Native Plant Protection Act.

CSC = California species of special concern.

FP = Fully protected under California Fish and Game Code.

SB = Specified birds under California Fish and Game Code.

Special-Status Species in the Project Area

The following sections describe special-status species that are known or are likely to occur in the project area. The following information is provided for each species:

- habitat requirements;
- suitable land cover types—wildlife habitats available for each species in the project area;
- surveys performed for the species in the study and project area; and
- the status of each species in the project area.

The special-status species listed in Table 6.3-4 were identified by USFWS and DFG as having the potential to occur in the project area. The special-status species listed in Table 6.3-5 includes 13 species that are likely to occur or have been observed in the project area. Several of these species are known to occur in the project area. The other species are not known to occur in the project area, but they occur or historically have occurred in the study area, and the project area contains breeding or nonbreeding habitat for these species.

The 13 species with potential to occur in the study area include:

- San Joaquin kit fox,
- California black rail,
- Cooper's hawk,
- greater sandhill crane,
- northern harrier,
- Swainson's hawk,
- short-eared owl,
- tricolored blackbird,
- western burrowing owl,
- white-tailed kite,
- giant garter snake,
- western pond turtle, and
- valley elderberry longhorn beetle (VELB).

San Joaquin Kit Fox

San Joaquin kit fox occur in open, arid habitats, including alkali desert scrub, grassland, and valley foothill hardwood habitats (U.S. Fish and Wildlife Service 1983). The kit fox requires large expanses of habitat and has a home range of approximately 1 to 2 square miles (Zeiner et al. 1990a). The portion of the study area west and south of Old River provides denning and foraging habitat for kit fox. The lack of migration corridors from suitable habitats makes it unlikely that this species would move into the remainder of the SDIP area north of Old River from the known breeding locations south of CCF.

There are approximately 1,142 acres of ruderal habitat and 13,100 acres of agricultural lands south and west of Old River that could provide foraging habitat for kit fox. Ruderal habitat could also provide denning areas. The ruderal habitats in the project area are linear in nature, are restricted to the levee banks and in-channel islands, and are often dominated by nonnative broadleaf weeds. Ruderal habitat provides low-quality denning and foraging habitat for kit fox. Agricultural lands south of Old River include primarily pastureland and row crops that would provide low-quality foraging habitat for kit fox.

The range of this species does not include most of the Delta; however, Byron Tract and the Old River flow control gate are in or near the species range. There is one USFWS sighting of a kit fox on the levee near the Old River gate site. A CNDDB records search identified five occurrences in the study area. All of these records occurred south of CCF (California Natural Diversity Database 2004). Two of these occurrences were within 2 miles of the proposed Old River gate. There is one record of kit fox (1991) from the south side of Old River approximately 1.5 miles south of the proposed gate. The other nearby occurrence (1992) was from the east side of the DMC approximately 2 miles from the Old River gate site.

No signs of recent kit fox activity were observed during preconstruction surveys performed at the Old River gate site in 1998 (Rooks pers. comm.). Den surveys were performed on several occasions between 1994 and 2001 for maintenance work performed at the previously proposed intake facility area on the northwest side of the CCF. No signs of recent kit fox activity were observed during these surveys. Preconstruction surveys were conducted in 1998 for the Old River at DMC gate because there was one USFWS record of kit fox near that gate site. Although there is a lack of optimal breeding habitat in the project area, some of the occurrences mentioned are very close to the Old River gate and dredging areas. Therefore, it is likely that kit fox could forage in the vicinity of the Old River gate and dredging areas.

California Black Rail

The California black rail occupies tidal emergent wetlands in the study area. The dominant vegetation in marshes inhabited by California black rail is generally dominated by tules or cattails. Nests are built in the lower portions of emergent wetlands. The California black rail nests from mid-March through July. During winter, black rails may be widely distributed in the marshes and may use the upper marsh vegetation for cover, especially during extreme high tides or high flow events (Zeiner et al. 1990b).

DWR mapped approximately 121 acres of tidal emergent wetland in the study area (Table 6.3-3). This land cover type occurs in varying densities throughout the study area and may include small or large patches of emergent wetland vegetation at the toe of the levees or on the perimeter of in-channel islands. The larger patches of wetland vegetation may provide suitable nesting and foraging habitat for this species. There are no CNDDB records of California black rail in the vicinity of the gate sites or channel dredging areas; however, no formal surveys have been conducted for this species in the project area. High flow events during the winter could affect populations of this species if they occur in the project area because suitable high marsh habitat may not be available as refugia from such events.

A CNDDB records search identified seven occurrences in the study area (California Natural Diversity Database 2004). All of these occurrences were located along Old River and Middle River, north of the project area. The closest occurrence to the project area is approximately 3.5 miles north of the proposed Middle River gate. The CNDDB occurrences are from large in-channel islands that consist entirely of or are dominated by emergent wetland vegetation.

Cooper’s Hawk

Cooper’s hawks breed throughout most of California in a variety of woodland habitats, including riparian and oak woodlands. The CNDDB records search did not identify any occurrences of Cooper’s hawk in the study area (California Natural Diversity Database 2004). Formal surveys have not been performed to determine whether this species is present in the project area. However, Cooper’s hawk is expected to be a permanent resident in the study area. This species is also expected to occur as a transient and winter resident in the study area. Cottonwood willow woodland and valley oak riparian woodland provide nesting, roosting and foraging habitat for this species.

DWR mapped approximately 467 acres of cottonwood willow woodland and valley oak riparian woodland in the study area (Table 6.3-3). These land cover types are dominated by native woody riparian tree species that provide potential nest sites for Cooper’s hawk. These land cover types occur in varying densities throughout the study area and may include isolated trees or large patches of riparian vegetation along levees or on in-channel islands. Isolated trees and riparian woodlands that are present throughout most of the study area on in-channel islands, levees, and adjacent lands provide nesting habitat for this species.

Greater Sandhill Crane

Greater sandhill cranes may occur as winter residents; however, the study area is outside of the species’ traditional wintering areas in the Delta. It is estimated that between 3,400 and 6,000 greater sandhill cranes winter in the Sacramento Valley and the Delta (California Department of Fish and Game 2000, Pacific Flyway

Council 1997; Pogson and Lindstedt 1991). Suitable winter foraging habitat is present on agricultural and pasturelands in the study area. During winter, greater sandhill cranes feed on grasses, forbs, waste grains, small mammals, amphibians, snakes, and invertebrates (Zeiner et al. 1990b). They feed and roost in pastures, flooded and unflooded grain fields, and seasonal wetlands.

A CNDDB records search did not identify any occurrences of greater sandhill cranes in the study area (California Natural Diversity Database 2004). Formal surveys have not been performed to determine whether this species is present during the winter months. Agricultural and pasturelands within the study area support foraging habitat for greater sandhill cranes that breed or winter in the Delta. There are approximately 146,000 acres of agricultural and pasture lands in the study area that could provide foraging habitat for this species.

Northern Harrier

The northern harrier nests and roosts in tall grasses and forbs in wetlands and field borders (Zeiner et al. 1990b). It will roost on the ground in shrubby vegetation, often near the marsh edge (Brown and Amadon 1968). The northern harrier is a permanent resident in the project area, and the breeding range of the Delta population includes most of the Central Valley, the Delta, Suisun Marsh, and portions of the San Francisco Bay (Zeiner et al. 1990b).

Although formal surveys have not been performed for this species, northern harriers have been observed in the study area and are known to nest in at least one location near the northeast portion of the CCF (Rooks pers. comm.). A CNDDB records search did not identify any occurrences of northern harrier in the study area (California Natural Diversity Database 2004). In the project area, ruderal and wetland habitats provide suitable nesting and roosting habitat. Foraging habitat in the project area includes agricultural lands, pasturelands, and wetlands.

DWR mapped approximately 526 acres of ruderal habitat and 121 acres of wetlands in the study area (Table 6.3-3). These land cover types are dominated by grasses, forbs, and herbaceous wetland vegetation that provide suitable nesting and foraging habitat for the northern harrier. Ruderal vegetation occurs primarily on the inboard and outboard sides of the levees. Wetland vegetation in the study area typically occurs within or on the margins of the waterways. Wetland vegetation occurs in varying densities and may include small to large patches of vegetation along levees or on in-channel islands.

Short-Eared Owl

Breeding populations of short-eared owls have been extirpated from the San Joaquin Valley (Remsen 1978); however, this species still breeds in the southern portion of the Sacramento Valley (i.e., Yolo and Solano Counties), the Delta, and Suisun Marsh. Short-eared owls are more likely to occur in the project area during the winter months with migrating birds arriving in September and October and leaving in April (Zeiner et al. 1990b). The breeding season is from late March to July (Zeiner et al. 1990b). Nests are built on the ground in tall stands of grasses in lowland habitats near hunting grounds in marshes, meadows, and even agricultural fields (Grinnell and Miller 1944).

Although potential nesting and roosting habitat for short-eared owls occurs in ruderal habitats and seasonal wetlands throughout the study area, this species is not expected to breed in this area because breeding populations have been extirpated from the San Joaquin Valley. Agricultural and pasturelands in the study area provide suitable roosting and foraging areas for this species. There are no known recent nesting occurrences in the study area, and a CNDDB records search did not identify any occurrences of short-eared owl (California Natural Diversity Database 2004).

DWR mapped approximately 526 acres of ruderal habitat in the study area (Table 6.3-3). Ruderal habitat is typically dominated by grasses and forbs that provide suitable roosting and foraging habitat for the short-eared owl. Ruderal vegetation primarily occurs on the inboard and outboard sides of the levees. Seasonal wetland vegetation typically occurs on the margins of the waterways in the study area. Wetland vegetation occurs in varying densities and may include small to large patches of vegetation along levees or on in-channel islands.

Swainson’s Hawk

Swainson’s hawks are summer residents in the project area and small numbers of this species are known to winter in the Delta. In the Central Valley, Swainson’s hawks nest primarily in riparian areas adjacent to agricultural fields or pastures, although they sometimes use isolated trees or roadside trees (California Department of Fish and Game 1994). Swainson’s hawks nest in mature trees, with valley oak, cottonwood, willows, sycamores, and walnuts the preferred tree species. Nest sites typically are located in the vicinity of suitable foraging areas. The primary foraging areas for Swainson’s hawk include open agricultural lands and pastures (California Department of Fish and Game 1994).

DWR mapped approximately 467 acres of cottonwood willow woodland and valley oak riparian woodland in the study area (Table 6.3-3). These land cover types occur in varying densities and may include isolated trees or large patches of riparian vegetation along levees or on in-channel islands. Swainson’s hawks are known to nest throughout the project area, including within the vicinity of the gate sites and the proposed channel dredging areas (California Natural Diversity Database 2004; Bradbury pers. comm.). Isolated trees and riparian woodlands that are present throughout most of the study area on in-channel islands, levees, and adjacent lands provide nesting habitat for this species. Agricultural and pasturelands within support foraging habitat for Swainson’s hawks that breed or winter in the Delta. There are approximately 146,000 acres of agricultural and pasture lands in the study area that could provide foraging habitat for this species.

A CNDDB records search identified 39 occurrences in the SDIP study area (California Natural Diversity Database 2004). Nine of these occurrences occurred within approximately ½ mile of the proposed gate sites and channel dredging areas. Other projects for which Swainson's hawk nest site surveys were conducted include the South Delta Temporary Barriers Project, the Interim South Delta Program, and the Swainson's Hawk Conservation Program. These surveys, which took place from 1993 through 2001, were performed by boat and by car to determine the location of nest sites (Bradbury pers. comm.). Surveys were performed along all waterways that could be affected by the projects. A total of 55 territories were identified in the project area. Most of these territories, and in some cases specific nest trees, have been used for several years (Bradbury pers. comm.).

Tricolored Blackbird

Tricolored blackbirds are permanent residents in the Sacramento–San Joaquin Valley. Historically, tricolored blackbirds nested primarily in emergent wetlands (Neff 1937). Recent studies indicate that an increasing percentage of nest sites are found in areas where the dominant land cover type consists of riparian scrub vegetation, Himalayan blackberry stands, and grain fields, among other cover types (DeHaven et al. 1995). In the study area, suitable nesting habitat is present within extensive stands of emergent wetland vegetation and riparian scrub vegetation. No suitable breeding habitat is present at the gate sites because the wetland and riparian vegetation is frequently disturbed and covers a relatively small area that is unsuitable for nest colonies.

The tricolored blackbird breeding season is from mid-April to late July. Tricolored blackbirds have three basic requirements for selecting their breeding colony sites:

- open, accessible water;
- a protected nesting substrate, including flooded, thorny, or spiny vegetation; and
- a suitable foraging space providing adequate insect prey within a few miles of the nesting colony (Hamilton et al. 1995; Beedy and Hamilton 1997, 1999)

In the study area, tricolored blackbird foraging habitat includes ruderal vegetation dominated by grasses and agricultural fields (such as large tracts of alfalfa with continuous mowing schedules and recently tilled fields). There are approximately 146,000 acres of agricultural and pasture lands in the study area that could provide foraging habitat for this species. Tricolored blackbirds also forage occasionally in riparian scrub habitats and along marsh borders. Most tricolored blackbirds forage within 5 kilometers (3 miles) of their colony sites (Orians 1961) but commute distances of up to 13 kilometers (8 miles) have been reported (Beedy and Hamilton 1999).

DWR mapped approximately 121 acres of tidal emergent wetland and 266 acres riparian scrub in the study area (Table 6.3-3). These land cover types occur in varying densities throughout the study area and may include small or large patches of emergent wetland vegetation at the toe of the levees or on the perimeter of in-channel islands. The larger patches of wetland and riparian vegetation provide suitable nesting and foraging habitat for this species.

Tricolored blackbirds historically nested near the Old River at DMC gate site, and nest colonies likely occurred throughout the study area within suitable habitats. No tricolored blackbirds were observed during incidental surveys performed by DWR between 1992 and 2001 (Rooks pers. comm.). No suitable habitat is available at the gate sites. A CNDDB records search identified 4 occurrences in the study area.

Western Burrowing Owl

The western burrowing owl is a permanent resident throughout the Delta. Suitable habitat for burrowing owls occurs in ruderal habitats and in the vicinity of agricultural lands throughout the study area. The western burrowing owl nests and roosts in abandoned ground-squirrel and other small-mammal burrows (Zeiner et al. 1990b) as well as artificial burrows (e.g., culverts, concrete slabs, and debris piles). The owl's breeding season is from March to August, peaking in April and May.

A CNDDB records search identified 33 occurrences in the study area. Most of these records occurred south or west of CCF (California Natural Diversity Database 2004). Two of these occurrences were within approximately ½ mile of the proposed Old River gate. DWR conducted formal surveys for burrowing owls along CCF.

Nesting burrowing owls have been observed on the northwest side of the forebay (Rooks pers. comm.). No burrowing owls were observed at the gate sites during incidental surveys performed by DWR between 1996 and 2001. DWR performed formal surveys for the Old River at DMC gate in 1998. Although no owls or burrows were observed, this area may provide foraging habitat for this species. Surveys have not been performed at the dredging areas; however, burrowing owls may occur on the inboard and outboard sides of the levees adjacent to the channel dredging areas.

White-Tailed Kite

White-tailed kites inhabit open lowland grassland, riparian woodland, seasonal wetlands, and scrub areas. Some large shrubs or trees are required for nesting. In the project area, cottonwood willow woodland and valley oak riparian woodland provide nesting and roosting habitat for this species. Communal night roosting is common during the non-breeding season. Grasslands, agricultural lands and pasturelands in the study area support foraging habitat for white-tailed kite that breed or winter in the Delta.

Although no formal surveys have been performed for the SDIP, white-tailed kites have been observed in the study area. No nesting activity has been observed; however, suitable nest sites are present throughout the study area. Suitable nest trees occur throughout most of the study area on in-channel islands, on levees and on adjacent lands. White-tailed kites have been observed foraging in the vicinity of CCF (Rooks pers. comm.) and in the vicinity of the Old River channel dredging area (Jones & Stokes field observation). A CNDDB records search identified 1 occurrence in the study area. This record included a nesting pair that was observed along the DMC, approximately 3 miles southwest of the Old River temporary barrier site.

DWR mapped approximately 467 acres of cottonwood willow woodland and valley oak riparian woodland in the study area (Table 6.3-3). These land cover types are dominated by native woody riparian tree species that provide potential nest sites for white-tailed kites. Kites may also nest in trees located in adjacent uplands and near adjacent agricultural lands. There are approximately 146,000 acres of agricultural and pasture lands within the study area that provide foraging habitat for this species.

Giant Garter Snake

The giant garter snake is endemic to emergent wetlands in the Central Valley. Within the San Joaquin Valley, the giant garter snake is still presumed to occur in San Joaquin County at White Slough/Caldoni Marsh, approximately 20 miles north of the study area (U.S. Fish and Wildlife Service 1999a). The species' habitat includes marshes; sloughs; ponds; small lakes; and low-gradient waterways, such as small streams, irrigation and drainage canals, and rice fields (58 FR 54053, October 20, 1993). The giant garter snake is active from approximately May through October and hibernates during the remainder of the year.

The giant garter snake requires adequate water with herbaceous, emergent vegetation for protective cover and foraging habitat. All three habitat components (cover and foraging habitat, basking areas, and protected hibernation sites) are needed. Riparian woodlands and large rivers typically do not support giant garter snakes because these habitats lack emergent vegetative cover, basking areas, and prey populations (Hansen and Brode 1980).

A CNDDB records search identified one occurrence in the study area. This record included an individual that was observed along the Stockton Diverting Canal near the intersection of SRs 88 and 99, approximately 15 miles northeast of the head of Old River fish control gate and approximately 15 miles northeast of the Middle River channel dredging area. DWR performed surveys in the study area to determine the suitability of on-site habitats for giant garter snakes (Rooks pers. comm.). The surveys, which were performed in September 2002, included the Byron Tract–LDS Property, CCF, Grant Line Canal gate site, Old River at DMC gate site, and the Middle River gate site to assess the habitat value for giant garter snakes. The head of Old River fish control gate site was not evaluated because of lack of permission to enter. DWR used a species-specific evaluation method to describe the quality of the potential giant garter snake habitat found on the landside of each site (Hansen 2002).

The study area provides low to moderate value habitat for this species (Rooks pers. comm.). The surveys determined that the exterior levees provide no habitat value to giant garter snakes. The areas of highest value include toe drains and irrigation ditches on the various islands in the study area. Wetland land cover types on the inboard side of the levees have not been mapped so the quantity of suitable giant garter snake habitat in these areas has not yet to be determined.

Western Pond Turtle

Western pond turtles inhabit permanent or nearly permanent waters with little or no current (Behler and King 1998). The channel banks of inhabited waters usually have thick vegetation, but basking sites such as logs, rocks, or open banks must also be present (Zeiner et al. 1988). Rivers, sloughs, ponded water bodies and some agricultural ditches and canals in the study area provide suitable habitat for this species. Eggs are laid in nests along sandy banks of large slow moving streams or in upland areas, including grasslands, woodlands, and savannas. Nest sites are typically found on a slope that is unshaded and has a high clay or silt composition and in soil at least 4-inches deep (Jennings and Hayes 1994).

Western pond turtles occur throughout the study area, including the gate sites and the channel dredging area. A CNDDB records search identified 9 occurrences in the study area. Surveys performed for the ISDP identified numerous occurrences of western pond turtle in the study area. Surveys performed by DWR in summer 2000 and 2001 identified additional occurrences. The DWR surveys were completed by boat at various times throughout the day and during different periods in the tidal cycle. Turtles were observed throughout the study area in varying densities and were found at the gate sites, channel dredging areas and around CCF (Rooks pers. comm.).

Valley Elderberry Longhorn Beetle

Elderberry shrubs are the host plant of the federally listed VELB. Current information on the habitat of the beetle indicates that it is found only with its host plant, the elderberry. Adult VELB feed on foliage and are active from early March through early June. The beetles mate in May and females lay eggs on living elderberry shrubs. Larvae bore through the stems of the shrubs to create an opening in the stem within which they pupate. After metamorphosing into an adult, the beetle chews a circular exit hole through which it emerges (Barr 1991).

Elderberry shrubs in California's Central Valley are commonly associated with riparian habitat but also occur in oak woodlands and savannas and in disturbed areas. Elderberry shrub locations were mapped by DWR in the study area during the 2000–2001 vegetation mapping surveys. A total of 63 elderberry shrubs or shrub clusters were observed during the surveys (Spanglet pers. comm.). The vegetation surveys were performed by slowly moving along the waterways in a boat (Spanglet pers. comm.). When an elderberry shrub or cluster was observed its location was identified using GPS and notes regarding the size of the shrub or shrub cluster were recorded.

Although USFWS protocol surveys have not been conducted, suitable habitat (i.e., elderberry shrubs) occurs throughout the study area. Protocol level surveys will be performed before beginning construction activities to determine the number of shrubs that will be affected and to determine if VELB exit holes are present. Elderberry shrubs were observed along Middle River, Old River, and Grant Line Canal with the highest concentrations occurring along Middle River. Elderberry shrubs on Middle River are located in the vicinity of the channel dredging areas. No elderberry shrubs were observed at the gate sites.

Environmental Consequences

Assessment Methods

Impact Mechanisms

Wildlife resources could be directly or indirectly affected by the SDIP. The following types of activities could cause varying degrees of impacts on these resources:

- vegetation removal, grading, and paving activities during gate construction, building activities, dredging, and siphon extensions;
- channel dewatering or installation of temporary water-diversion structures;
- temporary stockpiling and sidecasting of soil, construction materials, or other construction wastes;
- placement of dredged material in the temporary settling basins that would be constructed on agricultural lands
- temporary disturbance of agricultural lands and ruderal habitat on the landside of levees during dispersal of dredged materials.

Impact Analysis Assumptions

The SDIP would result in temporary and permanent impacts on vegetation resources in the project area. Temporary impacts are those that typically occur only during the construction period or during the maintenance dredging period, which will be conducted one time within 3–5 years after construction. Permanent impacts would be irreversible changes in land cover types.

The project understandings and assumptions used in assessing the magnitude of possible impacts on wildlife and wildlife habitat were the same as those identified in Section 6.2, Vegetation and Wetlands.

Impact Assessment Approach and Methods

This wildlife resources impact analysis is based on the following:

- the most current SDIP alternatives, as developed by DWR and summarized in the above assumptions;
- existing biological resource information (sources are discussed in Affected Environment); and
- current baseline conditions (as of 2000–2001 and 2003 field surveys).

The mitigation measures for impacts on wildlife resources were developed in part through review of the MSCS (CALFED Bay-Delta Program 2000e) and prior environmental impact studies and reports for affected resources.

Impacts in the following sections are grouped into construction-related impacts, which include impacts resulting from construction of the gates and dredging at the gate sites, 3 dredge areas and siphon sites, and by operational impacts, which include impacts resulting from operation of gates (i.e., changes in water elevation/tidal regime). Most construction impacts address all project components, but for clarity some construction impacts are divided into gate construction, dredging at gates, and dredging at the three channel dredging areas and siphon sites.

Significance Criteria

The criteria for determining significant impacts on biological resources were developed by reviewing State CEQA Guidelines and the CALFED Programmatic EIS/EIR (CALFED Bay-Delta Program 2000b). Based on these sources of information, constructing and operating the SDIP may result in a significant impact if it would result in:

- a temporary or permanent loss or degradation of any riparian, wetland or other sensitive natural community identified in local, state, or federal regional plans, policies or regulations;
- a temporary or permanent disruption of wildlife movement or fragmentation or isolation of riparian habitats;
- a temporary or permanent loss or disturbance of important upland land cover types used by wildlife for breeding, roosting or foraging habitat;

- a temporary or permanent loss or disturbance of important agricultural land cover types used by wildlife for breeding, roosting or foraging habitat;
- direct mortality to, or lowered reproductive success of, federally or state-listed wildlife species or loss of habitat of these species, including the loss of occupied or suitable habitat for these species;
- direct mortality to, or lowered reproductive success of, substantial portions of local populations of species that are candidates for federal or state listing or that are California species of special concern, including the loss of occupied or suitable habitat for these species; and
- temporary disturbance or mortality of special-status species resulting from implementation of mitigation measures or habitat management actions.

Beneficial effects include changes that would result in net increases in the extent or quality of native riparian, wetland, or upland wildlife habitats. Substantial beneficial effects are identified as significant effects.

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program.

The discussion of significant impacts and mitigation measures within this section will include a citation of one or more of the following programmatic mitigation measures used to build project-specific mitigation measures to offset significant impacts identified from implementation of the SDIP. These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED programmatic mitigation measures, please refer to Appendix E, “Mitigation Measures Adopted in the CALFED Record of Decision.”

CALFED Programmatic Wildlife Mitigation Measures

1. Avoid direct or indirect disturbance to wetland and riparian communities, special-status species habitat, rare natural communities, significant natural areas, and other sensitive habitat.
2. Restore and enhance sufficient in-kind wetland and riparian habitat or rare natural communities and significant natural areas at off-site locations (near project sites) before or at the time that project impacts are incurred. Replace not only acreage lost, but also habitat value loss.
3. Design Program features to permit on-site mitigation or nearby restoration of wetland, riparian habitat, special-status species habitat, rare natural

communities, and significant natural areas that have been removed by permanent facilities.

4. Phase the implementation of ERP habitat restoration to offset temporary habitat losses and to restore habitat (including special-status species habitat) before, or at the same time that, project impacts associated with the ERP are incurred.

5. Restore wetland and riparian communities, special-status species habitat, and wildlife use areas temporarily disturbed by on-site construction activities immediately following construction. Example actions include direct planting of native plants, controlling nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow for the natural reestablishment of the affected plant community.

11. Avoid important wildlife habitat areas, such as critical deer winter range and fawning habitat.

12. Restore and enhance important wildlife habitat use areas temporarily disturbed by on-site construction activities by planting and maintaining native species immediately following construction.

13. Restore and enhance upland habitat areas within affected watersheds or in other watershed if sufficient habitat 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.

14. Avoid direct or indirect disturbance to areas occupied by special-status species.

15. Avoid construction or maintenance activities within or near occupied special-status species habitat areas or important wildlife use areas when species may be sensitive to disturbance, such as during the breeding season.

16. Restore habitat areas occupied by special-status species that are temporarily disturbed by on-site construction activities immediately following construction.

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

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

20. Avoid direct or indirect disturbances to rare natural communities and significant natural areas.

21. Restore or enhance disturbed rare natural communities or significant natural areas at off-site locations before, or when, Program actions that could affect these communities are incurred.

22. Restore rare natural communities or significant natural areas at or near affected locations after Program activities are completed.
23. Manage recreation-related activities on lands managed under the Program to minimize or avoid potential adverse effects of recreation-related activities on sensitive habitats, important wildlife use areas, and special-status species.
24. Phase ERP to initially restore natural waterfowl foraging on agricultural lands with low forage value while restored habitat with high forage value develops.
25. Phase ERP to initially restore wetland habitat with high forage value to offset the loss of agricultural foraging habitat that may result from the ERP.
26. Restore riparian vegetation disturbed by on-site construction activities immediately following construction.
27. Restore or enhance sufficient in-kind riparian habitat 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.
28. Restore habitat temporarily disturbed by on-site construction activities immediately following construction.
29. Restore rare natural communities, significant natural areas, and wildlife use areas temporarily disturbed by on-site construction activities immediately following construction. Example actions include direct planting of native plants, controlling nonnative plants to improve conditions for reestablishing native plants, and enhancing and restoring the original site hydrology to allow for the natural reestablishment of the affected plant community.
30. Restore and enhance 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.

Alternative 1 (No Action)

Impact WILD-1: Potential for Adverse Effects on Wildlife Species at the Existing Barrier Locations

If the SDIP were not implemented, the fish control and flow control gates, as well as an increase in diversion and pumping would not be built or operated. The State Water Project would also continue to operate under its currently permitted pumping capacity of 6,680 cfs. All of the existing temporary barriers (head of Old River, Middle River, Grant Line Canal, and Old River barriers) would continue to be installed and removed annually. No dredging would occur under Alternative 1.

The effects on existing land cover types and wildlife resources from Alternative 1 would be limited to the existing barrier footprints, which are currently disturbed on an annual basis. No new riparian or wetland habitat would be expected to colonize the barrier footprints during the periods between removal and installation of the barriers. Because effects on land cover types within the barrier footprints would not substantially reduce existing habitat values or change the current conditions that could affect common or special-status wildlife species there would be no increase in adverse effects over existing conditions.

2020 Conditions

Under Future No Action conditions (2020 conditions), SDIP would not be implemented. It is expected that the temporary barriers program would continue. Activities involved with placing and removing fill within perennial aquatic habitat would continue to have a significant impact on water quality, aquatic habitat, and adjacent terrestrial land cover types. These effects have been mitigated as part of the original project. It is expected that the effects on wildlife and wildlife habitat attributable to placement of the temporary barriers would remain the same as existing conditions.

Alternatives 2A, 2B, and 2C

Stage 1 (Physical/Structural Component)

This section summarizes the analysis of project-related effects on wildlife and wildlife habitat as a result of gate construction, channel dredging, and agricultural siphon extension under Alternatives 2A–2C. The alternative analysis has been combined for these four alternatives because the physical and structural components are the same for each of these alternatives.

The following sections address both species impacts and wildlife habitat impacts. Wildlife habitat impacts may affect all species, including special-status species and common wildlife species, whereas species impacts focus on specific special-status species. Mitigation measures were developed for both habitat and species impacts. A mitigation measure may apply to more than one impact.

Impact WILD-2: Loss of Riparian-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Construction of the flow control gates at Middle River, Grant Line Canal, and Old River would result in the permanent loss of up to 0.21 acre of woody riparian communities, including cottonwood-willow riparian woodland, riparian scrub, and willow scrub (Table 6.3-6). No riparian vegetation occurs at the head of Old River fish control gate site. The distribution of riparian impacts at the gate sites is described in Section 6.2, Vegetation and Wetlands.

Permanent impacts on riparian vegetation for each gate site would include all land within the gate footprints, all facilities associated with each gate and the extent of levee upstream and downstream of each gate where slope protection would be placed. Impacts on riparian vegetation may include the complete removal of trees and shrubs, limb pruning and disruption of the root zone as a result of ground disturbing activities.

The loss of riparian habitat as a result of gate construction would also result in fragmentation of existing riparian habitats. Although some of the existing riparian vegetation is fragmented and composed of disjunct patches of vegetation that is separated by the temporary barriers, loss or further fragmentation of riparian habitat in the vicinity of the permanent gate sites is considered to be significant. Gate construction at the Grant Line Canal, Middle River, and Old River sites would result in the permanent removal or fragmentation of riparian habitat in locations that were not previously affected by the temporary barriers. The additional fragmentation of riparian habitat in the study area contributes to the increasing and cumulative degradation of this sensitive natural community.

Channel Dredging. In addition to the dredging required to construct the gates, portions of West Canal, Middle River, and Old River would be dredged to improve conveyance and the operation of private agricultural siphons and pumps (Table 6.3-6). Sealed clamshell dredging at the three flow control gate sites would avoid impacts on riparian vegetation. Dredging at the head of Old River fish control gate would not affect any riparian vegetation.

The use of hydraulic dredging in West Canal, Middle River, and Old River would minimize, but not entirely avoid, temporary impacts on woody riparian vegetation because of the placement of the stationary pipes for dredged material on the levee face. Pockets of riparian vegetation occur on the levees between Middle River and Union and Roberts Islands. The exact locations of stationary pipes to transport dredged material over the levees to dredge disposal areas are currently unknown, but placement of pipes on the levee banks would temporarily affect up to a maximum of 16 locations of woody riparian vegetation throughout the three conveyance dredge areas. Assuming removal of vegetation in a 10-foot-wide band for placement of each of the 16 stationary pipes and an estimated levee face height of 15 feet, up to 0.06 acre (2,400 square feet) of woody riparian vegetation would be removed. DWR would avoid placing pipe in woody riparian vegetation to the extent possible. This impact conservatively assumes the maximum possible impact, and the actual impact would likely be less. This impact would continue for up to 5 years after initial dredging, until the pipes were removed and the banks were revegetated. This impact is considered significant.

Sealed clamshell dredging of channels, if used in the conveyance dredge areas, would avoid direct impacts on all riparian vegetation. Clamshell dredging at siphon locations would not have an impact on woody riparian vegetation.

Temporary indirect impacts of dredging adjacent to the gate sites, at all three conveyance dredge locations, and at siphon extensions could include decreased water quality levels caused by turbidity. Riparian vegetation near the waterline would not likely be significantly affected by the temporarily small increase in water turbidity.

The temporary impacts on up to 0.06 acre of woody riparian vegetation as a result of conveyance dredging would be considered significant. The loss of woody riparian vegetation would reduce the extent of riparian communities,

Table 6.3-6. Land Cover Impacts Associated with Gate Construction and Dredging—Alternatives 2A–2C

Wildlife Habitats	Land Cover Type	Acreages Affected by Gate Construction				Total Permanent Impacts Associated with Gate Construction	Acreages Affected by Dredging[1]				Total Temporary Impacts Associated with Dredging	Temporary Impacts Associated with Agricultural Diversions	Permanent Impacts Associated with Agricultural Diversions	Impacts Associated with Dredge Material Disposal[4]
		Middle River Flow Control Gate	Grant Line Canal Flow Control Gate	Old River at DMC Flow Control Gate	Head of Old River Fish Gate		Gate Sites	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area				
Tidal perennial aquatic habitat	Tidal perennial aquatic	0.16	0.32	0.26	0.14	0.88	29.82	73.02	72.67	123.46	298.97	0.06	<0.01	0
Tidal freshwater emergent marsh habitat	Tule and cattail tidal emergent wetland	0.07	<0.01	<0.01	0	<0.08	0	0	0	0	0	0	0	0
Riparian Woodland	Cottonwood-willow woodland	0	0.03	0	0	0.03	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
	Valley oak riparian woodland	0	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian Scrub	Riparian scrub	0.02	0.03	0.12	0	0.17	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
	Willow scrub	0	0	<0.01	0	<0.01	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
	Willow scrub wetland	0	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Agricultural Land	Agricultural land	0.50	0.25	2.00	0	2.75	4.80[3]	0	0	0	0	0	0	101.50
Ruderal	Ruderal	0	0.02	0	0.02	0.04	0	0	0	0	0	0	0	47.40

DMC = Delta-Mendota Canal.

[1] Dredge impacts assumed impacts on all tidal perennial aquatic habitat within the dredge area. Actual loss of tidal perennial aquatic habitat will probably be less as a result of confining dredge activities to the center of the channel.

[2] Dredge impacts on individual riparian land cover types are not yet determined because the exact placement of the stationary pipes has not been identified. The riparian impact will total up to 0.06 acre at the three dredge areas.

[3] The acreage for the gate site agricultural impact includes the areas used for dredge drying areas at all four gate sites, which was assumed to require 1.2 acres at each site. This represents a permanent impact.

[4] The acreage for dredge drying areas at the three conveyance dredging areas is a temporary impact.

which are rare natural communities. Implementation of the mitigation measures listed below and environmental commitments (Chapter 2) would reduce this impact to a less-than-significant level.

Siphon Extensions. Hydraulic dredging at siphon locations would not require placement of additional stationary pipes for removal of dredged material. No additional impact on woody riparian vegetation would occur.

The permanent impacts on 0.21 acre and the temporary impacts on 0.06 acre of woody riparian vegetation as a result of gate construction and channel dredging, respectively, are considered significant. The loss of up to 0.21 acre of woody riparian vegetation as a result of project construction would be considered a significant impact because it would result in the loss of woody riparian vegetation and the reduction in the extent of riparian communities, which are rare natural communities. Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2, and WILD MM-3 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-1: Replace Riparian Land Cover Types. Impacts on riparian habitat will be mitigated by implementing Mitigation Measure VEG-MM-2: Compensate for unavoidable temporary and permanent loss of riparian habitats, as described in Section 6.2, Vegetation and Wetlands. This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 2, 3, 4, and 5.

Mitigation Measure WILD-MM-2: Avoid and Minimize Effects on Nesting Birds during Construction and Maintenance. The study area is located in and adjacent to habitat that supports nesting birds protected under the Migratory Bird Treaty Act (MBTA). Protective fencing will be used to protect nesting habitat outside of the construction and maintenance areas. DWR will perform preconstruction surveys to determine whether nesting birds, including migratory birds, raptors, and special-status bird species, are present within or immediately adjacent to the gate sites and associated staging and storage areas.

DWR will remove all woody and herbaceous vegetation from the construction areas during the nonbreeding season (September 1–February 1) to minimize effects on nesting birds. During the breeding season all vegetation will be maintained to a height of approximately 6 inches to minimize the potential for nesting. If construction occurs during the breeding season and all affected vegetation has not been removed, a qualified biologist will survey the construction area for active nests and young migratory birds immediately before construction. If active nests or migratory birds are found within the boundaries of the construction area, DWR will develop appropriate measures and will inform DFG of its actions. Inactive migratory bird nests (excluding raptors) located outside of the construction areas will be preserved. If an inactive migratory bird nest is located in these areas, it will be removed before the start of the breeding season (approximately February 1).

If an active raptor nest is found outside of the construction areas, a buffer zone will be created around the nest tree. The recommended buffer, as identified by DFG, is 250 feet (Sections 3503 and 3503.5 of the California Fish and Game Code). A larger buffer zone shall be established around Swainson's hawk nest sites, as described under Mitigation Measure WILD-MM-10: Avoid and Minimize Construction-Related Disturbances within ½ Mile of Active Swainson's Hawk Nest Sites.

Mitigation Measure WILD-MM-3: Minimize Impacts on Sensitive Biological Resources. DWR will include the following measures to minimize indirect impacts on wildlife and wildlife habitat:

1. DWR will provide an on-site biologist/environmental monitor who will be responsible for monitoring implementation of the conditions in the state and federal permits (CWA Section 401, 402, and 404; ESA Section 7; "Fish and Game Code Section 1601"; project plans (SWPPP); and EIS/EIR mitigation measures).
2. The on-site biologist/environmental monitor will determine the location of environmentally sensitive areas adjacent to each gate site and channel dredge areas based on existing land cover type and special-status plant species mapping (Figures 6.2-2 through 6.2-9), unless actual field conditions warrant a modification of the environmentally sensitive area boundaries. To avoid construction-phase disturbance to sensitive habitats immediately adjacent to the project site, the monitor will identify their boundaries and add a 50-foot buffer where feasible with orange construction barrier fencing. The fencing will be mapped on the project construction drawings. Erosion control fencing will also be placed at the edges of construction where the construction activities are upslope of wetlands and channels to prevent washing of sediments from the construction site into surrounding environmentally sensitive areas. The environmentally sensitive area and erosion-control fencing will be installed before any construction activities begin and will be maintained throughout the construction period.
3. DWR will provide a worker environmental training program for all construction personnel prior to the start of construction activities. The program will educate workers about special-status species, riparian habitats, and waters of the United States present on and adjacent to the site, and the regulations and penalties for unmitigated effects on these sensitive biological resources.
4. Landing on in-channel islands, anchoring boats and/or barges to these islands, and construction personnel encroaching on the islands will be prohibited. The exception to this measure is at Grant Line Canal where the utility lines will cross the island and construction personnel will have to access the utility corridor during installation.
5. Where feasible, construction will avoid and minimize trimming or complete removal of vegetation.
6. Following construction at the gate sites, the construction contractor will remove all trash and construction debris and implement a revegetation plan

for temporarily disturbed vegetation in the construction zones. The elements that should be included in the revegetation of these sites are described in Mitigation Measures VEG-MM-2 and VEG-MM-7.

This mitigation measure is consistent with CALFED Mitigation Measures 2, 3, 4, 5, and 6.

Impact WILD-3: Loss of Tidal Emergent Wetland–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Gate construction would result in the permanent loss of 0.08 acre of tidal emergent wetland, including the permanent loss of 0.07 acre associated with the Middle River flow control gate and less than 0.01 acre at both the Grant Line and Old River at DMC gates (Table 6.2-6). No tidal emergent wetland occurs at the head of Old River fish control gate site. Construction would avoid impacts on tidal emergent wetland located on the in-channel island in the project area.

Channel Dredging. Sealed clamshell dredging at the three flow control gate sites and the siphon extension locations and hydraulic or clamshell dredging in the three conveyance dredge areas would not result in any additional direct impacts on tidal emergent wetland (Table 6.2-6). Indirect impacts of dredging adjacent to the gate sites, at all three conveyance dredge locations and at the siphon extension locations could include decreased water quality levels caused by turbidity. Tidal emergent wetland vegetation would not be significantly affected by the temporary, small increase in channel water turbidity.

The permanent impact on up to 0.08 acre of tidal emergent wetland would be considered significant because the wetlands are waters of the United States and are regulated under Section 404 of the CWA. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, and WILD-MM-4 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-4: Replace Wetland Land Cover Types. Impacts on wetlands will be mitigated by implementation of Mitigation Measure VEG-MM-7: Compensate for Unavoidable Impacts on Tule and Cattail Tidal Emergent Wetlands, as described in Section 6.2, Vegetation and Wetlands. Where impacts on wetlands cannot be avoided, the area of effect will be kept to the minimum possible. Loss of, or impacts on, these habitats will be compensated for as part of compliance with the state and federal wetland permitting process.

Impact WILD-4: Loss of Tidal Perennial Aquatic–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate construction would result in the permanent removal of 0.88 acre of tidal perennial aquatic habitat within the gate footprints. Tidal perennial aquatic habitat at the four gate sites is currently affected each year by the placement of fill material to build temporary barriers in the spring and the subsequent removal of the material in the fall. The proposed construction of gates would permanently remove this aquatic habitat within the gate footprint. Structures within the footprint would vary at each gate site but would include gate structures, boat passages, and fish passages. During construction, additional area upstream and downstream of the permanent gate would be temporarily affected by placement of sheetpile-braced cofferdams and channel dredging associated with gate construction.

Temporary disturbance of tidal perennial aquatic habitat would occur during construction of the three flow control gates and the fish control gate, channel dredging, and construction of siphon extensions. Temporary disturbance would occur as a result of any dewatering activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. Temporary impacts on tidal perennial aquatic habitat are discussed in more detail as they relate to sedimentation and scouring (Section 5.6, Impact SS-1) and fish (Section 6.1, Impacts Fish-1, Fish-14, and Fish-21).

Tidal perennial aquatic habitat in the gate dredging and conveyance dredging areas includes deepwater aquatic, shallow aquatic, and unvegetated intertidal zones. A total of 298.97 acres of tidal perennial aquatic habitat occurs in the gate site and conveyance dredging areas. However, impacts from dredging would be temporary and would affect primarily water quality. The actual dredged area footprint is expected to be less than 298.97 acres because not all of the tidal perennial aquatic habitat in these areas will be dredged. However, because the exact boundaries of dredging have not been identified, it is assumed that the entire area will be affected.

Temporary construction staging for the 24 siphon extensions would occupy approximately 100 square feet of channel at each location (Figure 2-11), for a project wide impact of approximately 0.06 acre (2,400 square feet) of perennial tidal aquatic habitat. Siphon extensions at up to 24 locations would result in a small amount (0.007 acre) of permanent fill of tidal perennial aquatic habitat. Each siphon would be extended to a depth of –3 to –5 feet msl. The pipe extensions would be a maximum of 2 feet in diameter and 6 feet long, for a total of 12 square feet each. The total of 24 siphon extensions placed within the tidal aquatic area would fill a maximum of 288 square feet (0.007 acre) of the channel bed. Spot dredging for maintenance of existing agricultural diversions has been addressed in the BO issued by USFWS for the South Delta Temporary Barriers Project. NOAA Fisheries issued BOs for the South Delta Diversions Dredging and Modification Project and the South Delta Temporary Barriers Project (U.S. Fish and Wildlife Service 2001 and National Marine Fisheries 2003 and 2001 respectively). A streambed alteration agreement (# BD-2002-0002) was issued by the DFG for Dredging and Modification of Selected Diversions in the South Delta. These documents address impacts related to both the dredging and modification of the existing agricultural siphons and pumps in the south Delta. Therefore, there will be no additional consultation related to this impact.

Gate operations would not result in an overall loss of tidal perennial aquatic habitat, but zone types could change between deepwater, shallow water, and tidal flats in the area upstream of the gates (e.g., more tidal flat because of the increased tidal range caused by gate operation). The individual acreage of each of these three zones has not been determined; therefore, the potential variation in abundance cannot be determined. The operations-related effect on tidal perennial aquatic habitat, overall, would not be considered significant because these zones would be expected to reestablish as the system adapts to new water level fluctuations. Fish and other aquatic wildlife occupy this habitat.

Permanent loss of up to 0.88 acre of tidal perennial aquatic habitat would be a significant impact. Implementation of Mitigation Measures WILD-MM-3 and WILD-MM-5, below, would reduce this impact to a less-than-significant level. No mitigation would be required for the temporary disturbance of tidal perennial aquatic habitat resulting from channel dredging.

Mitigation Measure WILD-MM-5: Compensate for Loss of Tidal Perennial Aquatic Habitat. DWR will compensate for the permanent loss of up to 0.88 acre of tidal perennial aquatic habitat caused by construction of the gates at a ratio of 2 to 3 acres for each acre affected, for a total of up to 1.76 to 2.64 acres. This mitigation is consistent with the MSCS Conservation Measure for tidal perennial aquatic habitat to "restore or enhance 2 to 5 acres of additional in-kind habitat for every acre of affected habitat near where impacts on habitat are incurred" (CALFED Bay-Delta Program 2000e).

The 1.76 to 2.64 acres of tidal perennial aquatic habitat would be purchased as mitigation credits from an appropriate mitigation bank in the project vicinity. One potential site is the Kimball Island Mitigation Bank.

Impact WILD-5: Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Temporary disturbance of agricultural land and ruderal habitat would occur during construction of the gates, channel dredging, and siphon extension construction. Temporary disturbance would occur as a result of any dewatering activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. The effects of gate construction, channel dredging, and siphon extensions are described below.

Gate Construction. Construction at the four gate sites would result in the permanent removal of up to 2.75 acres of agricultural land and 0.04 acre of ruderal vegetation. Agricultural land impacts include an approximately 2.0-acre area at the Old River at DMC gate site. An additional 0.50 and 0.25 acre of agricultural land would also be affected at Middle River and Grant Line Canal gate sites, respectively. Approximately 4.80 acres of agricultural land would be permanently affected by construction of the permanent settling basins adjacent to each gate.

Conveyance Dredging. Approximately 165 acres of settling ponds or runoff management basins would be constructed as part of the conveyance dredging action. The potential locations of the settling ponds or runoff management basins have been identified and mapped, although specific sites have not been selected. It is assumed, however, that all dredged material disposal areas would be constructed on agricultural land adjacent to the dredge operations. DWR is committed to minimizing impacts on sensitive habitats, including wetlands, and special-status species, and will construct the ponds or basins on agricultural land. These factors will play a major role in the determination of the dredged material disposal sites. These dredge ponds or basins would remain in use for up to 7 years and then would be returned to agricultural use.

Siphon Extensions. Dredge spoils associated with siphon extensions would be placed in the settling basins described above.

The effect on common and special-status wildlife species from loss of this agricultural land and ruderal habitat is considered less than significant because these land cover types are common in the project area. No mitigation is required. Implementation of environmental commitments (see Chapter 2) and Mitigation Measures WILD-MM-2 and WILD-MM-3 from above would restore the preproject habitat values of these sites following the completion of construction and dredging activities.

Potential effects on special-status species from the loss of agricultural land and ruderal habitat, as well as associated mitigation measures, are described below under the sections related to individual species.

Impact WILD-6: Temporary Disturbance and Possible Mortality of Common Wildlife Species as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The operation of heavy equipment during construction activities could affect wildlife species that are unable to relocate, such as small mammals, amphibians, reptiles, and nesting birds. Construction activities could result in direct mortality to common wildlife species. Construction activities would also temporarily disturb the use of affected or adjacent land cover types by wildlife.

The potential for temporary disturbance and possible mortality of common wildlife species is considered less than significant because temporary and periodic use of heavy equipment would not substantially change the amount of disturbance currently occurring in the area. Additionally, vegetation protection measures will be incorporated as an environmental commitment and preconstruction surveys will be performed before starting construction activities. No mitigation is required.

Impact WILD-7: Disruption of Wildlife Movement Corridors as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Under existing conditions the temporary barriers are in place between approximately April and October each year. During other times of the year, the barriers are removed and water flows unimpeded. The seasonal barriers were constructed of rock and had no facilities on top of the barrier.

Terrestrial and aquatic wildlife could pass over or around these barriers to move across the waterways or to move upstream and downstream of these structures.

Construction of the gates would result in the placement of permanent structures in the waterways at the sites of the temporary barriers. The permanent gates would be constructed of concrete and would consist of vertical walls, road surfaces, parking areas, and facilities and would be impassable to some wildlife species that may have moved across the temporary barriers. The permanent gates may result in a disruption of wildlife movement corridors compared to the temporary barriers.

Although terrestrial species will move around the gates via the levees, movement of some aquatic wildlife may be impeded during those periods when the gates are closed. Initial gate construction activities may result in a disruption of movement between breeding and rearing habitat and established feeding areas for individuals or family groups. Once the gates are operational, it is unlikely that wildlife species will frequently pass through the gates.

Channel Dredging. Channel dredging may have a temporary effect on aquatic wildlife movement corridors or individuals while dredging activities are in progress; however, most individuals are expected to move through the dredging areas or into other aquatic habitats during working and non-working periods.

The effects of gate construction and operation on wildlife movement corridors are considered less than significant because once the gates are operational, it is unlikely that wildlife species will frequently pass through the gates, and passage will become available when the gates reopen. No mitigation is required.

Impact WILD-8: Loss of Valley Elderberry Longhorn Beetle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Elderberry shrub locations were mapped by DWR in the study area during 2000–2001. Elderberry shrubs and areas of suitable habitat for elderberry shrubs occur throughout the study area. Elderberry shrubs occur at scattered locations throughout the study area, including Middle River, Old River, and Grant Line Canal, with the highest concentrations occurring along Middle River. Most of the shrubs and shrub clusters in the study area are located on the levees. No elderberry shrubs occur within the gate construction sites. Access roads associated with gate construction would be restricted to the top of the levee of existing farm roads on the inboard side of the levee. Vehicle access could occur within the USFWS's recommended 100-foot buffer zone.

Channel Dredging. Elderberry shrub locations were mapped by DWR in the study area during 2000–2001. Elderberry shrubs and areas of suitable habitat for elderberry shrubs occur throughout Middle River channel dredging area. A small number of elderberry shrubs were observed in the vicinity of the Old River channel dredging area. No elderberry shrubs were observed along the West Canal.

Most of the shrubs and shrub clusters are located on levees. Dredging vehicle and equipment access could occur in the vicinity of elderberry shrubs. Hydraulic channel dredging would include use of a stationary pipe braced to the waterside of the levee, extended across the top, and down the landside of the levee into the primary basin of a settling pond. Clamshell dredging would occur from a barge or from a dredge sitting atop the levee. A 100-foot-long bucket assembly arm would scoop material from the channel and deposit it into a runoff basin on the landside of the levee. It is anticipated that some elderberry shrubs may occur close to dredging areas and that dredging activities may occur within the preferred avoidance zone established by USFWS. No soil disturbing activities are anticipated, and DWR will take special precautions to ensure that elderberry shrubs are not affected by dredging or other activities. Although no effects are anticipated at this time, elderberry shrubs and associated habitat could be inadvertently damaged by channel dredging activities.

The potential effects on VELB habitat are considered significant. Implementation of Mitigation Measures WILD-MM-6, WILD-MM-7, and WILD-MM-8 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-6: Perform Preconstruction and Postconstruction Surveys for Elderberry Shrubs. A qualified biologist will perform an elderberry shrub survey before starting gate construction, channel dredging, and sediment disposal activities and mitigation site implementation to ensure that elderberry shrubs, if present, are identified. The on-site biologist will field stake the locations of elderberry shrubs and shrub clusters, if present, before construction begins. Orange exclusion fencing will be installed around each elderberry shrub and shrub cluster. DWR will attempt to perform construction and dredging operations without affecting elderberry shrubs and to maintain a 100-foot buffer zone around all elderberry shrubs, to the greatest extent possible. However as a result of the dimensions of the work areas, it is anticipated that work could occur within the 100-foot buffer zone.

The surveys will be performed according the USFWS VELB compensation guidelines (U.S. Fish and Wildlife Service 1999b). During the preconstruction and postconstruction surveys the following information will be recorded for each shrub or shrub cluster:

- the number of stems greater than 1-inch in diameter;
- the number of stems less than 1-inch in diameter;
- the approximate height and width of the elderberry shrub or shrub cluster;
- the presence of VELB exit holes; and
- the dominant vegetation that is associated with the elderberry shrub or shrub cluster.

The location of each elderberry shrub will be mapped using GPS, and a site map will be prepared identifying the location and size of each shrub and shrub cluster. DWR will use this site map to determine vehicle and equipment haul routes and work areas. Following completion of dredging activities DWR will perform a postconstruction evaluation of the elderberry shrubs to determine if any shrubs were damaged by construction activities. If damage occurs to elderberry shrubs, DWR will consult with USFWS on appropriate mitigation.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-7: Avoid and Minimize Impacts on Elderberry Shrubs. Wherever feasible, DWR and Reclamation will avoid and minimize effects on elderberry shrubs. Avoidance and minimization efforts will be performed according to the USFWS VELB compensation guidelines (U.S. Fish and Wildlife Service 1999b). If elderberry shrubs with one or more stems measuring 1 inch or greater in diameter at ground level or plants with visible evidence of exit holes are located within or adjacent to proposed construction or dredging areas, DWR and Reclamation will implement the following actions:

- Install exclusion fencing around each elderberry shrub and shrub cluster.
- Avoid disturbance to VELB by establishing and maintaining, to the maximum extent feasible, a 100-foot buffer around elderberry plants identified as suitable habitat. If a 100-foot buffer cannot be maintained, DWR and Reclamation will consult and gain approval from the USFWS for measures that would minimize disturbance and promptly restore the damaged area.
- Fence and flag all buffer areas and place signs every 50 feet along the edge of the avoidance area, as described in the VELB compensation guidelines (U.S. Fish and Wildlife Service 1999b).
- Train construction personnel to recognize elderberry shrubs and to determine the presence of VELB from exit holes on stems. All construction personnel should receive USFWS–approved environmental awareness training prior to undertaking work at construction sites.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-8: Compensate for Unavoidable Impacts on Elderberry Shrubs. If avoidance and minimization of effects on VELB habitat are not possible, DWR and Reclamation will compensate for unavoidable effects based on the VELB conservation guidelines (U.S. Fish and Wildlife Service 1999b). Mitigation efforts may include transplanting elderberry shrubs, planting additional elderberry and associated plant species at an on-site or off-site mitigation area, or purchasing VELB mitigation credits at a USFWS–approved mitigation bank.

This mitigation measure is consistent with CALFED Mitigation Measures 2, 5, 12, 16, 22, and 27.

Impact WILD-9: Loss or Disturbance of Swainson's Hawk Nests or Foraging Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Effects on Swainson's hawk include the loss or disturbance of active nests and the loss or disturbance of foraging habitat. Noise and visual disturbances associated with operation of equipment and other construction- and maintenance-related activities within up to ½ mile of occupied nest sites could adversely affect nesting Swainson's hawks. Noise and visual disturbances of sufficient magnitude could result in the nest abandonment, a reduction in the level of care provided by adults (e.g., duration of brooding, frequency of feeding), or forced fledging. If these situations occur, it could result in reducing the likelihood for successful production of young during the year of disturbance. The number of nests or young that could be affected will be determined annually during the preconstruction surveys and active construction period surveys, as described below.

Nest-site removal or disturbance will occur only if Swainson's hawks are nesting at the time the trees are removed or the area around the nest is disturbed by these activities. Because Swainson's hawk nest sites may vary from year to year, the number of nest sites that could be affected by the project may vary annually. Preconstruction surveys will be performed throughout the spring months to determine whether nest sites are located within ½ mile of proposed project activities.

Approximately 0.03 acre of riparian woodland, which provides nesting habitat for Swainson's hawk, would be affected by gate construction. Riparian woodland at the gate sites occurs on the in-channel island at the Grant Line gate site. Approximately 0.06 acre of riparian woodland would be affected by channel dredging. Siphon extension is not expected to affect riparian habitat. Swainson's hawk nests have been observed in the vicinity of the gate sites; however, no nest sites were observed at the existing temporary barrier sites (i.e., the proposed permanent gate sites).

The temporary loss or disturbance of agricultural land could result in the temporary loss of Swainson's hawk foraging habitat. The acreage of foraging habitat that is temporarily affected will be quantified once the footprints for the settling ponds and runoff management basins have been finalized. These temporary losses would not substantially reduce available foraging habitat for Swainson's hawk in the study area. The conversion of agricultural land to gate site facilities would result in the permanent loss of approximately 7.55 acres of agricultural land.

The potential loss or disturbance of nesting Swainson's hawk from channel dredging is considered significant because these actions could affect the nesting success of a special-status species. Settling basins associated with channel dredging would result in the temporary loss of up to 165 acres of foraging habitat.

The temporary and permanent disturbance to agricultural lands is considered significant. Although the loss of foraging habitat is relatively small compared to the total suitable foraging habitat in the study area, DFG requires compensation for loss of foraging habitat in the vicinity of active Swainson's hawk nest. Implementation of Mitigation Measures WILD-MM-1, WILD-MM-3, WILD-MM-9, WILD-MM-10, WILD-MM-11, and WILD-MM-12 would reduce impacts on nesting and foraging habitat for Swainson's hawks to a less-than-significant level.

Mitigation Measure WILD-MM-9: Perform Preconstruction Surveys for Nesting Swainson's Hawks prior to Construction and Maintenance. Preconstruction surveys for Swainson's hawk will be conducted at and adjacent to all locations to be disturbed by gate construction, channel dredging, and spoils deposition to ensure that this species is not nesting in these locations. Surveys will also be performed at all mitigation sites prior to implementation of the mitigation features. Preconstruction surveys will consist of surveying all potential nest sites within ½ mile of proposed construction features, sediment removal areas, and mitigation sites. Surveys will be performed several times during the breeding season to avoid and minimize effects on late nesting birds. Nest sites will be marked on an aerial photograph, and the position will be recorded using GPS. This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-10: Avoid and Minimize Construction-Related Disturbances within ½ Mile of Active Swainson's Hawk Nest Sites. Portions of the gate construction would occur throughout the year and would overlap with the Swainson's hawk breeding season. To the greatest extent practicable, major construction activities that would occur within ½ mile of an active Swainson's hawk nest will be avoided during the breeding season. If practicable, construction or dredging activities that would result in the greatest disturbance to an active nest site will be deferred until after or as late in the breeding season as possible. DWR will provide the locations of active nest sites identified during the preconstruction surveys to DFG and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.

DFG requires that a ½-mile buffer be established around all active Swainson's hawk nests between March 1 and August 15 (California Department of Fish and Game 1994). Potential nesting trees within the gate construction footprint will be removed prior to construction. Potential nest trees outside the construction footprint will be retained. Vegetation will be removed prior to the nesting season for migratory birds and Swainson's hawk (i.e., removal will occur between September 1 and February 1).

Because of the relatively narrow width of the project area and the location and dimensions of the proposed work areas and access roads to riparian vegetation that could provide nesting habitat for Swainson's hawk, a ½-mile buffer may not be feasible in all areas. DWR will maximize the buffer width around active nest sites on a site-by-site basis and will consult with DFG on the buffer widths before commencing construction activities. If possible, DWR will delay construction and maintenance around individual raptor nests until after the young have fledged. DWR will immediately cease work and contact DFG if a young bird has prematurely fledged the nest as a result of construction or maintenance activities.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Mitigation Measure WILD-MM-11: Replace or Compensate for the Loss of Swainson's Hawk Foraging Habitat. To compensate for the loss of foraging habitat, DWR will mitigate the loss of Swainson's hawk foraging habitat, as required by DFG. Based on recorded nest site observations in the project area, it can be assumed that gate construction, sediment removal, and mitigation activities will occur within 1 mile of active nest sites. As a result, DWR shall provide mitigation for foraging habitat at one of the following ratios (California Department of Fish and Game 1994):

- Provide 1 acre of suitable foraging habitat (e.g.; Habitat Management [HM] lands) for each acre of affected habitat (1:1 ratio). At least 10% of these lands shall include a fee title acquisition or conservation easement allowing for active management of the land to manage for active prey production. The remaining 90% of the HM lands will be protected by a conservation easement on agricultural or other lands that provide suitable foraging habitat for Swainson's hawks; or
- Provide ½ acre of HM land, with a fee title acquisition or conservation easement allowing for active management of the land to manage for active prey production (0.5:1 ratio).

DWR will also provide funding to ensure that these lands will be managed to provide Swainson's hawk foraging habitat. This funding will consist of a site management endowment at a rate to be determined by DFG.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 2, 5, 12, 16, 17, 22, 23, and 29.

Mitigation Measure WILD-MM-12: Avoid Removal of Occupied Nest Sites. As stated under WILD-MM-9, preconstruction surveys will be performed to identify active nest sites before implementing construction, dredging, or mitigation activities. DWR and Reclamation will remove suitable nest trees in locations where trees are scheduled for removal before the start of the nesting season. Additionally, before February 15 of each construction season, DWR and Reclamation will remove all suitable nesting habitat for migratory birds in areas where vegetation is scheduled to be cleared. Removal of vegetation before the nesting season will ensure that occupied nests are not removed. If construction, dredging, or mitigation activities require the removal of additional vegetation not previously designated for removal, DWR and Reclamation will perform clearance surveys to determine whether nesting hawks are present. If additional tree removal is required, it will be deferred until after the breeding season.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Impact WILD-10: Loss or Disturbance of San Joaquin Kit Fox or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Effects on San Joaquin kit fox include the loss or disturbance of active dens and the loss or disturbance of foraging habitat. Gate construction would result in the permanent loss of 3.2 acres of agricultural land in the vicinity of the Old River gate. These actions would not significantly affect denning or foraging habitat for the San Joaquin kit fox because the affected areas occur primarily in areas that are already subject to disturbance during placement and removal of the existing temporary barriers. Kit fox have not been observed at the gate sites during previous surveys performed by DWR. Temporarily disturbed areas will be reseeded following construction as stated under Impact WILD-5 (Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions).

Although this species is not expected to occur at the gate sites or channel dredging area, the kit fox has a relatively large home range and could be affected by gate construction. The potential for effects on kit fox is considered significant but would be reduced to a less-than-significant level following implementation of Mitigation Measures WILD-MM-13, WILD-MM-14, and WILD-MM-15.

Mitigation Measure WILD-MM-13: Perform Preconstruction Surveys for San Joaquin Kit Fox. Preconstruction surveys for kit fox will be conducted at and adjacent to all locations to be disturbed by gate construction to ensure that this species is not present in these locations. Preconstruction surveys will consist of surveying all potential denning habitat in the vicinity of proposed construction features, as well as along all haul roads located on levees. Because kit fox sightings are known within 10-miles of the project area, surveys will be performed according to USFWS guidelines (U.S. Fish and Wildlife Service 1999c). Surveys will include walking transects (at least one between May 1 and September 30), spotlighting surveys for 10 nights over a 15-day period, camera stations, and scent stations. The survey methods will be determined in coordination with USFWS.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-14: Minimize Construction-Related Disturbances near Active Den Sites. If kit fox dens are found at the gate construction sites or along access roads, major construction and dredging activities that would result in the greatest disturbance to an active den site will be deferred until after or as late in the breeding season as possible. DWR will provide the locations of active den sites identified during the preconstruction surveys to USFWS and will coordinate with USFWS on appropriate avoidance and minimization measures on a case-by-case basis.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Mitigation Measure WILD-MM-15: Replace Lost San Joaquin Kit Fox Habitat. If it is determined that occupied habitat is present in the project area, DWR will implement one of the following actions, pending direction from USFWS:

1. acquire, protect, and manage 1–3 acres of existing occupied habitat for every acre within the same area of occupied habitat affected by the project; or
2. enhance or restore 1–3 acres of suitable habitat near affected areas for every acre of occupied habitat affected.

Based on known project effects (i.e., 3.2 total acres of agricultural lands), DWR will acquire, protect, or manage 3.2 acres of suitable kit fox habitat in the study area, or pending approval of USFWS, purchase mitigation or conservation bank credits at an approved bank.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 2, 5, 12, 16, 17, 22, 23, and 29.

Impact WILD-11: Loss of Giant Garter Snake or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Construction in areas adjacent to irrigation ditches associated with agricultural land could cause direct mortality of, or remove habitat for, the giant garter snake. Direct impacts on individuals of this species could also occur during construction. Because the giant garter snake is a special-status species, this impact would be significant.

Implementation of Mitigation Measures WILD-MM-4, WILD-MM-16, and WILD-MM-17 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-16: Conduct Preconstruction Surveys for Giant Garter Snake. Preconstruction surveys for giant garter snake will be conducted in all suitable breeding and foraging habitat in the vicinity of project or mitigation activities to ensure that this species is not present in these locations. Surveys will also be performed at all mitigation sites prior to implementation of the mitigation features. Surveys will be performed during the active period of the snake (May 1–October 1). If surveys must be conducted during the species inactive period, DWR will contact USFWS to determine whether additional measures are necessary to minimize and avoid take (U.S. Fish and Wildlife Service 1997). Preconstruction surveys will be performed by a qualified biologist within 24-hours of commencement of construction or dredging activities. The survey results will be provided to USFWS before starting construction activities.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-17: Minimize Construction-Related Disturbances in the Vicinity of Occupied Habitat. Gate construction and settling basin activities would occur throughout the year and would overlap the giant garter snake active and inactive periods. To the greatest extent practicable, major construction activities that would affect giant garter snake breeding and foraging habitat will be avoided during the active period. If project construction activities necessitate dewatering wetland habitat during the snake's active period, that habitat will remain dry for at least 15 consecutive days before excavation or refilling (U.S. Fish and Wildlife Service 1997). If construction activities will be conducted during the species' inactive period, DWR will contact USFWS to determine whether additional measures are necessary to minimize and avoid take.

Clearing of wetland vegetation will be confined to the minimal area necessary to complete the desired activities. The movement of heavy equipment will be restricted to established roadways or constructed haul roads to minimize habitat disturbance.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Impact WILD-12: Loss of Western Pond Turtle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate construction, channel dredging, and siphon extension in areas within or adjacent to wetland and aquatic habitats, including tidal perennial aquatic, tidal emergent wetland, off-channel ponds, marshes, and irrigation ditches, could cause direct mortality of, or remove habitat for, western pond turtles.

Most habitat effects would be temporary because most of the affected habitats would be restored following gate installation. Permanent impacts would include all land within the footprint of the gate site and the extent of levee toes upstream and downstream of each gate where rock slope protection would be placed. Impacts on wetland vegetation may include the complete removal of vegetation as a result of channel bed excavation, cutting of vegetation, or the placement of fill material on existing wetlands. Impacts on individuals of this species could also occur during gate construction or channel dredging.

Because the western pond turtle is designated as a federal and state species of concern, this impact would be significant. Implementation of Mitigation Measures WILD-MM-4 and WILD-MM-18 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-18: Avoid and Minimize Construction-Related Disturbances in the Vicinity of Occupied Habitat. Western pond turtles are known to occur in Middle River, Old River, and Grant Line Canal and are expected to occur in suitable off-channel habitats. Because these waterways are large, open systems, it is not feasible to clear and permanently exclude all western pond turtles from the gate construction sites. Preconstruction surveys will be conducted by a qualified biologist to determine the approximate population density of turtles in the construction areas. DWR will install sheetpiles, cofferdams, or other measures to minimize sedimentation between the in-channel construction zones and adjacent waterways at the gate sites. This system will minimize the degradation of aquatic habitats outside of the construction zone and inhibit the movement of some turtles into the construction zone. These measures will not be used at the channel dredging sites because these sites will be continually moving along the channels during the dredging process, and such measures would not be feasible. Turtles occurring within the work area will be captured and relocated to a nearby location outside of the work area.

To avoid the loss of western pond turtle and eggs as a result of construction, DWR will install plastic orange mesh exclusion fencing or silt exclusion fencing on the channel banks to prevent turtles from nesting in the work areas. The fencing will be installed to a depth of 6 inches below the ground surface to prevent turtles from going under the fence. Fences will be installed before the nesting season (i.e., March 1) and shall remain in place through August. The fencing may be removed prior to grading.

An on-site biologist will be present during all in-channel activities to relocate western pond turtles outside of construction zones.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Impact WILD-13: Loss or Disturbance of Raptor Nest Sites as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The study area is known to provide nesting habitat for northern harriers, white-tailed kites, Cooper's hawk, and several other raptor species. Construction could result in loss or disturbance of raptor nests. Because disturbance of an active raptor nest would violate Sections 3503 and 3503.5 of the California Fish and Game Code, this impact is significant. Implementation of Mitigation Measures WILD-MM-2 and WILD-MM-3 would reduce this impact to a less-than-significant level.

Impact WILD-14: Loss of Tricolored Blackbirds or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate construction and channel dredging could result in loss or disturbance of tricolored blackbird nests or potential nesting habitat and the temporary loss of foraging habitat. Impacts on riparian scrub, tidal emergent wetland, agricultural land, and ruderal vegetation that provides potential nesting habitat are described above under Impacts WILD-2, WILD-3, and WILD-5. Permanent impacts on wetland and riparian scrub vegetation for the gate sites would include all land within the footprint of the gate site and the extent of levee toes upstream and downstream of each gate where rock slope protection would be placed. Impacts on wetland vegetation may include the complete removal of vegetation as a result of excavating channel beds, cutting vegetation, or the placing fill material on existing wetlands.

Because tricolored blackbirds are a federal and state species of concern, the loss of nests or potential nesting habitat is significant. The loss of foraging habitat is not considered significant because the ruderal habitats and agricultural lands in which this species may forage are abundant in the study area. For example, there are approximately 146,000 acres of agricultural lands (excluding orchards and vineyards) in the study area. The temporary loss of up to 165 acres of agricultural land for the settling basins represents a substantially small percent of the overall potential agricultural land foraging habitat for tricolored blackbirds.

Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2, WILD-MM-3, WILD-MM-4, WILD-MM-19, and WILD-MM-20 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-19: Conduct Preconstruction Surveys for Tricolored Blackbird. Preconstruction surveys for tricolored blackbird will be conducted at and adjacent to all locations to be disturbed by construction, channel dredging, and spoils deposition to ensure that this species is not nesting in these locations. Surveys will also be performed at all mitigation sites prior to implementation of the mitigation features.

Preconstruction surveys will consist of surveying all suitable breeding habitat in the vicinity of project or mitigation activities. Pedestrian survey transects will be used to provide 100% visual coverage of the suitable breeding habitat. Nest colony surveys are recommended to begin at the end of April with subsequent surveys occurring throughout the breeding season (Beedy and Hamilton 1997). If a nesting colony is observed, the location will be marked on an aerial photograph, and the position will be recorded using GPS.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-20: Minimize Construction-Related Disturbances in the Vicinity of Active Tricolored Blackbird Colonies. Portions of the gate construction and sediment removal activities would occur throughout year and would overlap the tricolored blackbird breeding season (mid-April–July). To the greatest extent practicable, major construction activities that occur within ¼ mile of tricolored blackbird nest sites will be avoided during the breeding season. If practicable, construction or dredging activities that would result in the greatest disturbance to an active nest sites will be deferred until after or as late in the breeding season as possible. DWR will provide the locations of active nest sites identified during the preconstruction surveys to DFG and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Impact WILD-15: Loss or Disturbance of Nesting or Wintering Western Burrowing Owls as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Construction in areas containing occupied burrowing owl burrows could cause direct mortality of nesting owls or nest abandonment. Gate construction activities affect 0.04 acre of ruderal vegetation and the placement of temporary settling basins for channel dredging will affect up to 47.40 acres of ruderal vegetation. Permanent impacts on ruderal vegetation for each gate site would include all land within the footprint of the gate and the extent of levee upstream and downstream of each gate where slope protection would be placed. Temporary impacts on ruderal vegetation would include temporary construction easements adjacent to the permanent impact areas and the dredge disposal areas. Impacts on ruderal vegetation may include the complete removal or cutting (e.g., mowing) of vegetation.

Because the burrowing owl is a federal species of concern and a state species of special concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, WILD-MM-21, WILD-MM-22, WILD-MM-23, WILD-MM-24, and WILD-MM-25 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-21: Conduct Preconstruction Surveys for Burrowing Owls. Preconstruction surveys for western burrowing owls will be conducted at and adjacent to all locations to be disturbed by construction, channel dredging, and spoils deposition, to ensure that this species is not nesting or roosting in these locations. Surveys will also be performed at all mitigation sites prior to implementation of the mitigation features. Preconstruction surveys will be performed according to the DFG guidelines for this species (California Department of Fish and Game 1995b). Surveys will consist of surveying all suitable nesting and roosting habitat within 500 feet of proposed construction features, dredging and deposition areas, and mitigation sites, as well as along all haul roads located on levees or at the toe of the levees.

Surveys will be conducted during both the wintering and nesting seasons, unless the species is detected during the first survey. The winter survey will be conducted between December 1 and January 31 (if possible). Nesting surveys will be conducted between April 15 and July 15 to correspond with the peak of the breeding season. Surveys will be performed in the early morning and evening as specified in the DFG guidelines. Pedestrian survey transects will be spaced to provide 100% visual coverage of the ground surface. Disturbance of occupied burrows during the surveys will be avoided to the greatest extent practicable. In addition to the seasonal surveys, a preconstruction survey will be conducted within 30 days prior to construction to ensure that no additional owls have established territories since the initial surveys.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-22: Minimize Construction-Related Disturbances near Occupied Nest Sites. Burrowing owls may use the nest burrows as roosting sites throughout the year or may move into other burrows not used for nesting outside of the breeding season. Major construction and dredging activities that would result in the greatest disturbance to an active nest or roost sites will be deferred until after or as late in the breeding season as possible.

The following activities are considered impacts on western burrowing owls (California Department of Fish and Game 1995b):

- disturbance within approximately 160 feet (50 meters), which may result in harassment of owls at occupied burrows;
- destruction of natural and artificial burrows; and
- destruction or degradation of foraging habitat within 330 feet (100 meters) of an occupied burrow.

DWR will provide the locations of occupied burrows identified during the preconstruction surveys to DFG and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Mitigation Measure WILD-MM-23: Avoid or Minimize Disturbance to Active Nest and Roost Sites. If practicable, active nest and roost sites will be avoided during project implementation. To avoid impacts during the nonbreeding season (September 1–January 31), no activities should occur within 160 feet of occupied burrows. To avoid impacts during the breeding season (February 1–August 31) no activities should occur within 250 feet of occupied burrows. Avoidance of occupied burrows also requires that a minimum of 6.5 acres of foraging habitat be permanently preserved around each occupied burrow (California Department of Fish and Game 1995b).

If active burrows are identified during the preconstruction surveys, DWR will coordinate with DFG to identify the appropriate avoidance and minimization measures and to determine the configuration of the foraging habitat to be permanently preserved.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Mitigation Measure WILD-MM-24: Mitigation of Impacts on Occupied Burrows. If the destruction of occupied burrows is unavoidable, existing unsuitable burrows will be enhanced or new burrows will be created in accordance with the DFG guidelines (California Department of Fish and Game 1995b). New or enhanced burrows will be provided at a ratio of 2:1 and located on lands that will be preserved and maintained by DWR. DWR will provide funding for the long-term management and monitoring of these lands and will prepare a monitoring plan for the burrowing owl mitigation site.

Passive relocation techniques will be used to clear burrowing owls from occupied burrows. These techniques are described in the DFG guidelines for this species. Passive relocation techniques and artificial burrow designs will be approved by DFG prior to implementing this mitigation measure. Passive relocation will not be allowed until after the breeding season if it is determined that eggs or nestlings are present.

This mitigation measure is consistent with CALFED Mitigation Measures 17 and 31.

Mitigation Measure WILD-MM-25: Replace Lost Burrowing Owl Foraging Habitat. If it is determined that occupied burrows are present in the project area, DWR will mitigate the loss or disturbance of foraging habitat by implementing the following measures:

1. Permanently preserve 6.5 acres of foraging habitat around each occupied burrow that is avoided. The 6.5 acres may include an approximately 300-foot radius around each burrow or an alternate configuration totaling 6.5 acres, as approved by DFG.
2. Permanently preserve 6.5 acres of foraging habitat around each newly constructed or enhanced burrow. The 6.5 acres may include an approximately 300-foot radius around each burrow or an alternate configuration totaling 6.5 acres, as approved by DFG.

Based on the preconstruction survey results, DWR will avoid and minimize impacts on burrowing owls and acquire, protect, or manage suitable burrowing owl foraging habitat in the project vicinity or, pending approval of DFG, purchase mitigation or conservation bank credits at an approved bank.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 5, 16, 17, 23, 29, and 31.

Impact WILD-16: Loss or Disturbance of California Black Rail or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate construction could result in loss or disturbance of California black rail nests or potential nesting habitat. Impacts on tidal emergent wetland vegetation include permanent impacts (see Section 6.2, Vegetation and Wetlands). Permanent impacts on wetland vegetation for the gate sites would include all land within the footprint of the gate site and the extent of levee toes upstream and downstream of each gate where rock slope protection would be placed. Impacts on wetland vegetation may include the complete removal of vegetation as a result of excavating channel beds, cutting vegetation, or placing fill material on existing wetlands.

Because this species is a federal and state species of concern, and is a fully protected state species, this impact is significant. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, WILD-MM-4, WILD-MM-26, and WILD-MM-27 would reduce this impact to a less-than-significant level.

Mitigation Measure WILD-MM-26: Conduct Preconstruction Surveys for California Black Rail. Preconstruction surveys for California black rail will be conducted at and adjacent to all locations to be disturbed by construction, channel dredging, and spoils deposition to ensure that this species is not nesting in these locations. Surveys will also be performed at all mitigation sites prior to implementation of the mitigation features. Preconstruction surveys will consist of surveying all suitable breeding habitat in the vicinity of project or mitigation activities.

Surveys will be performed to record species presence and density and abundance. Surveys will be performed in all tidal emergent wetlands that are greater than 0.5 hectare in total area and have shallow water or moist soil conditions (Arizona Game and Fish Department 2002). Fixed, permanent survey points will be selected and marked in the field and by using a GPS receiver. Surveys will be performed several times during the breeding season to avoid and minimize effects on late nesting birds. The surveys will be performed during periods of good weather (e.g., clear to cloudy skies, no precipitation, minimal wind). The survey points will be surveyed in either the early morning or evening. Morning surveys will begin within 30 minutes of sunrise and will be completed within 4 hours after sunrise. Evening surveys will begin 4 hours before sunset and be completed before dark (Arizona Game and Fish Department 2002). A recording of a black rail call will be played at varying intervals and records of responses will be recorded. The playback interval will follow the guidelines identified in the black rail monitoring protocol (Arizona Game and Fish Department 2002). If a response is heard, the location will be marked on an aerial photograph, and the position will be recorded using GPS.

This mitigation measure is consistent with CALFED Programmatic Mitigation Measures 1, 11, and 14.

Mitigation Measure WILD-MM-27: Minimize Construction-Related Disturbances in the Vicinity of Active California Black Rail Nest Sites. Portions of the gate construction and dredging activities would occur throughout year and would overlap the California black rail breeding season (mid-March–July). To the greatest extent practicable, major construction activities that would be near expected California black rail nest sites will be avoided during the breeding season. If practicable, construction or dredging activities that would result in the greatest disturbance to an active nest site will be deferred until after or as late in the breeding season as possible. DWR will provide the locations of active nest sites identified during the preconstruction surveys to DFG and will coordinate with DFG on appropriate avoidance and minimization measures on a case-by-case basis.

This mitigation measure is consistent with CALFED Mitigation Measures 1, 11, 15, and 21.

Impact WILD-17: Potential Effects on Greater Sandhill Crane as a Result of Loss of Agricultural Lands

The removal of agricultural land as a result of gate construction and channel dredging would result in the permanent and temporary loss of sandhill crane foraging habitat. This loss would have a relatively minor effect on sandhill crane because agricultural land is common throughout the study area and sandhill cranes are not expected to occur in the project area. Most of the impact on agricultural lands would be temporary and most of the disturbed area, except for the gate footprint and runoff management basins, would be restored following construction. The effect on greater sandhill crane from loss of agricultural land during construction and maintenance of the gate sites is considered less than significant.

No mitigation is required.

Impact WILD-18: Potential for Adverse Effects on Common Wildlife Species and Wildlife Habitat Associated with Gate Operations

Under Alternatives 2A–2C, gate operation is not expected to have a significant impact on wildlife or wildlife habitat.

Because the tidal range during operation of the gates would not change substantially from existing conditions, gate operation would not be expected to have a significant impact on the tidal emergent wetland or riparian vegetation (refer to Section 6.2, Vegetation and Wetlands).

These elevation changes are relatively minor and are not expected to adversely affect existing land cover types in the project area. Upstream vegetation adjacent to the channels would tolerate longer periods of inundation, and downstream vegetation could potentially spread into the new lower tide elevation. Because the high tide during project operations would not substantially change from existing conditions and low tide changes would not be expected to significantly affect vegetation, gate operation would not be expected to have a significant impact on the wildlife habitat (i.e., riparian, tidal emergent wetland, and tidal perennial aquatic). This impact is less than significant. No mitigation is required.

2020 Conditions

The impacts on wildlife resulting from operation of Alternatives 2A–2C under 2020 conditions would be similar to those described above under Alternative 1 (No Action Alternative). The same mitigation would apply.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on wildlife resulting from operation of Alternatives 2A–2C under 2020 conditions would be similar to those described above under Alternative 1 (No Action Alternative). The same mitigation would apply.

Interim Operations

Interim operations in south Delta would have similar effects on south Delta waterways and north- and south-of-Delta storage facilities. Therefore, the impacts on wildlife and wildlife habitat in these areas would be similar to those described for permanent operations of the SDIP. The same mitigation would apply.

Alternative 3B

Stage 1 (Physical/Structural Component)

Under Alternative 3B, the effects of the structural and physical components and channel dredging on wildlife resources are similar to those discussed under Alternatives 2A–2C. The only difference is that the Grant Line Canal gate would not be constructed under this alternative. The fish control gate at the head of Old River and the flow control gates in Old River and Middle River would be constructed in the same locations and in the same manner as discussed under Alternatives 2A–2C.

Impact WILD-2: Loss of Riparian-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Under Alternative 3B, impacts on approximately 0.17 acre of riparian habitat from construction-related activities at the Middle River and Old River at DMC flow control gate sites would result in the reduction of riparian habitat area and values in the project area (Table 6.3-7). For the purpose of this evaluation for Alternative 3B, riparian habitat is composed of the riparian scrub and willow scrub land cover types. No riparian habitat is present at the head of Old River fish control gate site.

The loss of riparian habitat as a result of gate construction would also result in fragmentation of existing riparian habitats. Although some of the existing riparian vegetation is fragmented and composed of disjunct patches of vegetation that is separated by the temporary barriers, loss or further fragmentation of riparian habitat in the vicinity of the permanent gate sites is considered to be significant.

Channel Dredging. The effects of channel dredging at the three channel dredging sites under Alternative 3B would be the same as those described under Alternatives 2A–2C.

Siphon Extensions. Siphon extensions are not expected to result in effects on riparian habitat.

The permanent loss of up to 0.17 acre of woody riparian vegetation as a result of gate construction and the temporary loss of to 0.06 acre of woody riparian vegetation as a result of channel dredging would be considered a significant impact because it would result in the loss of woody riparian vegetation and a reduction in the extent of riparian communities, which are rare natural communities. Implementation of the mitigation measures listed below would reduce this impact to a less-than-significant level.

Implementation of the Mitigation Measures WILD-MM-1, WILD-MM-2, and WILD-MM-3 would reduce this impact to a less-than-significant level.

Impact WILD-3: Loss of Tidal Emergent Wetland–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Under Alternative 3B, impacts on approximately 0.08 acre of tidal emergent wetland habitat from construction- and operations-related activities at the gate sites would result in the reduction in wetland habitat area and values in the study area (Table 6.3-7). Wetland habitat that would be affected occurs primarily at the Middle River flow control gate site, and less than 0.01 acre would be affected at the Old River at DMC gate site. These wetlands are relatively small patches (Figure 6.2-5). No tidal emergent wetland habitat is present at the head of Old River fish control gate site.

Removal of tidal emergent wetland vegetation would result in the loss of foraging, breeding, and roosting habitat for common wildlife species in the study area. The loss of tidal emergent wetland habitat would not result in significant fragmentation of existing tidal emergent wetland habitat because these habitats are relatively fragmented under existing conditions, being composed of patches of vegetation. Although some of the existing wetland vegetation is fragmented and composed of disjunct patches of vegetation that are separated by the temporary barriers, loss or further fragmentation of wetland habitat in the vicinity of the permanent gate sites is considered to be significant.

Channel Dredging. The effects of channel dredging at the three channel dredging sites under Alternative 3B would be the same as those described under Alternatives 2A–2C.

Siphon Extensions. The effects of channel dredging at the siphon extension sites under Alternative 3B would be the same as those described under Alternatives 2A–2C.

The permanent impact on up to 0.08 acre of tidal emergent wetland under Alternative 3B would be considered a significant impact because the wetland is a water of the United States and is regulated under Section 404 of the CWA. These activities would result in reducing the amount of a sensitive natural community on which wildlife species in the study area depend for foraging,

Table 6.3-7. Land Cover Impacts Associated with Gate Construction and Dredging—Alternative 3B

Land Cover Type	Acreages Affected by Gate Construction			Total Permanent Impacts Associated with Gate Construction	Acreages Affected by Dredging[1]				Total Temporary Impacts Associated with Dredging	Temporary Impacts Associated with Agricultural Diversions	Permanent Impacts Associated with Agricultural Diversions	Impacts Associated with Dredge Material Disposal [4]
	Middle River Flow Control Gate	Old River at DMC Flow Control Gate	Head of Old River Fish Gate		Gate Sites	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area				
Tidal perennial aquatic	0.16	0.26	0.14	0.56	19.42	73.02	72.67	123.46	288.57	0.06	<0.01	0
Tule and cattail tidal emergent wetland	0.07	<0.01	0	<0.08	0	0	0	0	0	0	0	0
Cottonwood-willow woodland	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Cottonwood-willow woodland wetland	0	0	0	0		–[2]	–[2]	–[2]	<0.06[2]			0
Valley oak riparian woodland	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub	0	0	0	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub wetland	0.02	0.12	0	0.14		–[2]	–[2]	–[2]	<0.06[2]			0
Willow scrub	0	0.3	0	0.3	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub wetland	0	0	0	0		–[2]	–[2]	–[2]	<0.06[2]			0
Agricultural land	0.50	2.00	0	2.50	3.60 [3]	0	0	0	0	0	0	101.50
Ruderal	0	0	0.02	0.02	0	0	0	0	0	0	0	47.40

DMC = Delta-Mendota Canal.

1 Dredge impacts assumed impacts on all tidal perennial aquatic habitat within the dredge area. Actual loss of tidal perennial aquatic habitat will probably be less as a result of confining dredge activities to the center of the channel.

2 Dredge impacts on individual riparian land cover types are not yet determined because the exact placement of the stationary pipes has not been identified. The riparian impact will total up to 0.06 acre at the three dredge areas.

3 The acreage for the gate site agricultural impact includes the areas used for dredge drying areas at all three gate sites, which was assumed to require 1.2 acres at each site. This represents a permanent impact.

4 The acreage for dredge drying areas at the 3 conveyance dredging areas is a temporary impact.

breeding, and roosting. Implementation of the mitigation below would reduce this impact to a less-than-significant level.

Implementation of the Mitigation Measures WILD-MM-2, WILD-MM-3, and WILD-MM-4 would reduce this impact to a less-than-significant level.

Impact WILD-4: Loss of Tidal Perennial Aquatic–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, permanent and temporary impacts on approximately 19.98 acres of tidal perennial aquatic habitat from construction- and maintenance-related activities at the flow control gate sites would result in a reduction in tidal perennial aquatic habitat area and values in the study area (Table 6.3-7). Tidal perennial aquatic habitat would be affected at each of the gate sites. Project effects on tidal perennial aquatic habitat include permanent and temporary effects. Permanent effects would include the permanent loss of 0.56 acre of tidal perennial aquatic habitat in the gate footprint. Temporary effects would include the temporary loss of 19.42 acres of tidal perennial aquatic habitat in the construction and gate dredging zone.

Channel dredging and siphon extension effects and mitigation measures would be the same as those identified under Alternatives 2A–2C.

Permanent loss of up to 0.56 acre of tidal perennial aquatic habitat would be a significant impact. Implementation of Mitigation Measures WILD-MM-3 and WILD-MM-5 would reduce this impact to a less-than-significant level. No mitigation would be required for the temporary disturbance of tidal perennial aquatic habitat resulting from channel dredging.

Impact WILD-5: Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Temporary disturbance of agricultural land and ruderal habitat would occur during construction of the gate, channel dredging, and siphon extension construction. Temporary disturbance would occur as a result of any dewatering activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. The effects of gate construction, channel dredging, and siphon extensions are described below.

Gate Construction. Construction at the three gate sites would result in the removal of up to 2.50 acres of agricultural land and 0.02 acre of ruderal vegetation. Impacts on agricultural land include 2.0 acres at the Old River at DMC gate site and 0.50 acre at the Middle River gate site.

Channel Dredging. A total of 3.60 acres of agricultural land, approximately 1.2 acres of agricultural land at each gate site, would be permanently lost for construction of disposal settling ponds or runoff management basins associated with gate site dredging.

Conveyance dredging and siphon extension impacts and mitigation measures would be the same as those identified under Alternatives 2A–2C.

The effect on common and special-status wildlife species from loss of this agricultural land and ruderal habitat is considered less than significant because these land cover types are common in the project area. No mitigation is required because implementation of environmental commitments (see Chapter 2) and Mitigation Measures WILD-MM-2 and WILD-MM-3 from above would restore the preproject habitat values of these sites following the completion of construction and dredging activities.

Potential effects on special-status species from the loss of agricultural land and ruderal habitat, as well as associated mitigation measures, are described below under the sections related to individual species.

Impact WILD-6: Temporary Disturbance and Possible Mortality of Common Wildlife Species as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The potential for temporary disturbance and possible mortality to common wildlife species is described under Alternatives 2A–2C. The potential effects under Alternative 3B would be the same as those identified for Alternatives 2A–2C.

The potential for temporary disturbance and possible mortality to common wildlife species is considered less than significant because temporary and periodic use of heavy equipment would not substantially change the amount of disturbance currently occurring in the area, vegetation protection measures will be incorporated as an environmental commitment, and preconstruction surveys will be performed prior to commencing construction activities. Daily operation of the gates is not expected to disturb or cause mortality to wildlife.

No mitigation is required.

Impact WILD-7: Disruption of Wildlife Movement Corridors as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The potential for disruption of movement corridors for common wildlife species from gate construction is described above under Alternatives 2A–2C. This potential effect is considered less than significant because most terrestrial wildlife species will be able to move around the gate.

No mitigation is required.

Impact WILD-8: Loss of Valley Elderberry Longhorn Beetle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, the potential effects on VELB habitat from gate construction, channel dredging, and siphon extension are described above in Impact WILD-8, under Alternatives 2A–2C above. These potential effects on

VELB habitat are considered significant. Implementation of Mitigation Measures WILD-MM-6, WILD-MM-7, and WILD-MM-8 would reduce these effects to less than significant.

Impact WILD-9: Loss or Disturbance of Swainson's Hawk Nests or Foraging Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, potential effects on Swainson's hawk include the permanent and temporary loss of foraging habitat and construction-related disturbance to nesting Swainson's hawks. No riparian woodland, which provides potential nesting habitat for Swainson's hawk, would be affected under Alternative 3B. Swainson's hawk nests have been observed in the vicinity of the gate sites; however, no known nests sites were observed at the gate sites.

Temporary disturbance of agricultural land adjacent to the gate construction sites and associated access roads could result in temporary loss of Swainson's hawk foraging habitat. These temporary losses would not substantially reduce available foraging habitat for Swainson's hawk in the study area. The conversion of agricultural land to gate site facilities would result in the permanent loss of approximately 6.10 acres of agricultural land.

The loss of suitable nesting habitat and the potential disturbance of nesting Swainson's hawk during the construction phase of the project are considered significant. The temporary and permanent loss of foraging habitat is not expected to affect the value of these forage areas for Swainson's hawk because the affected areas would be small in comparison to overall foraging habitat available for this species in the study area. Although the loss of foraging habitat is relatively small, DFG requires compensation for loss of foraging habitat in the vicinity of active Swainson's hawk nests. Therefore, the temporary and permanent disturbance to agricultural lands is considered significant.

Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2, WILD-MM-3, WILD-MM-9, WILD-MM-10, WILD-MM-11, and WILD-MM-12 would reduce impacts on nesting and foraging habitat for Swainson's hawks to a less-than-significant level.

Impact WILD-10: Loss or Disturbance of San Joaquin Kit Fox or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, effects on San Joaquin kit fox include the loss or disturbance of active dens and the loss or disturbance of foraging habitat. Gate construction would result in the permanent loss of 3.2 acres of agricultural land in the vicinity of the Old River gate. These actions would not significantly affect denning or foraging habitat for the San Joaquin kit fox because the affected areas occur primarily in areas that are already subject to disturbance during placement and removal of the existing temporary barriers. Kit fox have not been observed at the gate sites during previous surveys performed by DWR. Temporarily disturbed areas will be reseeded following construction as stated under Impact

WILD-5 (Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions).

Although this species is not expected to occur at the gate sites or channel dredging area, the kit fox has a relatively large home range and could be affected by gate construction. The potential for effects on kit fox is considered significant but would become less than significant following implementation of the Mitigation Measures WILD-MM-13, WILD-MM-14, and WILD-MM-15.

Impact WILD-11: Loss of Giant Garter Snake or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, construction in areas adjacent to irrigation ditches associated with agricultural land could cause direct mortality of, or remove habitat for, the giant garter snake. Direct impacts on individuals of this species could also occur during construction. Because the giant garter snake is a federal and state special-status species, this impact would be significant.

Implementation of Mitigation Measures WILD-MM-4, WILD-MM-16, and WILD-MM-17 would reduce this impact to a less-than-significant level.

Impact WILD-12: Loss of Western Pond Turtle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, gate construction, channel dredging, and siphon extension in areas within or adjacent to wetland and aquatic habitats, including tidal perennial aquatic, tidal emergent wetland, off-channel ponds, marshes, and irrigation ditches, could cause direct mortality of, or remove habitat for, western pond turtles.

Most habitat effects would be temporary because most of the affected habitats would be restored following gate installation. Permanent impacts would include all land within the footprint of the gate site and the extent of levee toes upstream and downstream of each gate where rock slope protection would be placed. Impacts on wetland vegetation may include the complete removal of vegetation as a result of channel bed excavation, cutting of vegetation, or the placement of fill material on existing wetlands. Impacts on individuals of this species could also occur during gate construction or channel dredging. Impacts on tidal perennial aquatic habitat and tidal emergent wetland that provide potential habitat are described above under Impacts WILD-3 and WILD-4 for Alternative 3B.

Because the western pond turtle is designated as a federal and state species of concern, this impact would be significant. Implementation of Mitigation Measures WILD-MM-4 and WILD-MM-18 would reduce this impact to a less-than-significant level.

Impact WILD-13: Loss or Disturbance of Raptor Nest Sites as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The study area is known to provide nesting habitat for northern harriers, white-tailed kites, Cooper's hawk, and several other raptor species. Construction could result in loss or disturbance of raptor nests. Because disturbance of an active raptor nest would violate Sections 3503 and 3503.5 of the California Fish and Game Code, this impact is significant. Implementation of Mitigation Measures WILD-MM-2 and WILD-MM-3 would reduce this impact to a less-than-significant level.

Impact WILD-14: Loss of Tricolored Blackbirds or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, gate construction and channel dredging would result in the loss of tidal emergent wetland, riparian scrub, agricultural lands, and ruderal vegetation. These impacts could result in the loss or disturbance of tricolored blackbird nests or potential nesting habitat and the temporary loss of foraging habitat. Impacts on riparian scrub, tidal emergent wetland, agricultural land, and ruderal vegetation that provide potential nesting habitat are described above under Impacts WILD-2, WILD-3, and WILD-5 for Alternative 3B. Permanent impacts on wetland and riparian scrub vegetation for the gate sites would include all land within the footprint of the gate site and the extent of levee toes upstream and downstream of each gate where rock slope protection would be placed. Impacts on wetland vegetation may include the complete removal of vegetation as a result of excavating channel beds, cutting vegetation, or placing fill material on existing wetlands.

Because tricolored blackbirds are a federal and state species of concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2, WILD-MM-3, WILD-MM-4, WILD-MM-19, and WILD-MM-20 would reduce this impact to a less-than-significant level.

Impact WILD-15: Loss or Disturbance of Nesting or Wintering Western Burrowing Owls as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, construction in areas containing occupied burrowing owl burrows could cause direct mortality of burrowing owls or disturb nesting birds, which could result in nest abandonment. Impacts on ruderal vegetation that provides potential habitat are described above under Impact WILD-5 for Alternative 3B. Because the burrowing owl is a federal species of concern and a state species of special concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, WILD-MM-21, WILD-MM-22, WILD-MM-23, WILD-MM-24, and WILD-MM-25 would reduce this impact to a less-than-significant level.

Impact WILD-16: Loss or Disturbance of California Black Rail or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 3B, construction would result in loss of tidal emergent wetland habitat and the loss or disturbance of California black rail nests or potential nesting habitat. Impacts on tidal emergent wetland are described above under Impact WILD-3 for Alternative 3B. Because this species is a federal and state species of concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, WILD-MM-4, WILD-MM-26, and WILD-MM-27 would reduce this impact to a less-than-significant level.

Impact WILD-17: Potential Effects on Greater Sandhill Crane as a Result of Loss of Agricultural Lands

The removal of agricultural land would result in the temporary loss of wildlife foraging, breeding, and roosting habitat. This loss would have a relatively minor effect on wildlife because this land cover type is not considered a sensitive natural community and is common throughout the study area. Most of the impact on agricultural lands would be temporary and most of the disturbed area, except for the gate footprint and runoff management basins would be restored following construction.

The effect on greater sandhill crane from loss of agricultural land during construction and maintenance of the gate sites is considered a less-than-significant impact.

No mitigation is required.

Impact WILD-18: Potential for Adverse Effects on Common Wildlife Species and Wildlife Habitat Associated with Gate Operations

Under Alternative 3B, gate operation is not expected to have a significant impact on wildlife or wildlife habitat.

Because the tidal range during operation of the gates would not change substantially from existing conditions, gate operation would not be expected to have a significant impact on the tidal emergent wetland or riparian vegetation (refer to Section 6.2, Vegetation and Wetlands).

These elevation changes are relatively minor and are not expected to adversely affect existing land cover types in the project area. Upstream vegetation adjacent to the channels would tolerate longer periods of inundation, and downstream vegetation could potentially spread into the new lower tide elevation. Because the high tide during project operations would not substantially change from existing conditions and low tide changes would not be expected to significantly affect vegetation, gate operation would not be expected to have a significant impact on the wildlife habitat (i.e., riparian, tidal emergent wetland, and tidal perennial aquatic). This impact is less than significant. No mitigation is required.

2020 Conditions

The impacts on wildlife resulting from operation of Alternative 3B under 2020 conditions would be similar to those described above. The same mitigation would apply.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on wildlife resulting from operation of Alternative 3B under 2020 conditions would be similar to those described above. The same mitigation would apply.

Alternative 4B

Stage 1 (Physical/Structural Component)

Under Alternative 4B, the only gate to be constructed would be the fish control gate at the head of Old River. Dredging of south Delta channels would be the same as described under Alternatives 2A–2C. As a result, the impacts and mitigation measures for dredging under Alternative 4B would be the same as those identified above for Alternatives 2A–2C.

Impact WILD-2: Loss of Riparian-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Under Alternative 4B, there would be no effect on riparian habitat because there is no riparian habitat present at the proposed location for the head of Old River fish control gate.

Channel Dredging. The effects of channel dredging head of Old River fish control gate under Alternative 4B would be the same as those described under Alternatives 2A–2C.

Siphon Extensions. Siphon extensions are not expected to result in effects on riparian habitat.

The temporary loss of up to 0.06 acre of woody riparian vegetation as a result of channel dredging would be less than significant because the areas would be small inclusions that would be allowed to revegetate with volunteers from adjacent riparian vegetation after construction and dredging are completed.

Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2 and WILD-MM-3 would ensure that this impact is maintained at a less-than-significant level.

Impact WILD-3: Loss of Tidal Emergent Wetland–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Gate Construction. Under Alternative 4B, there would be no effect on tidal emergent wetland habitat because there is no wetland habitat present at the proposed location for the head of Old River fish control gate.

Channel Dredging. The effects of channel dredging at the three channel dredging sites under Alternative 4B would be the same as those described under Alternatives 2A–2C.

Siphon Extensions. The effects of channel dredging at the siphon extension sites under Alternative 4B would be the same as those described under Alternatives 2A–2C.

No temporary or permanent impacts on tidal emergent wetland or jurisdictional riparian wetlands would occur under Alternative 4 because of the construction of the head of Old River fish control gate or dredging. No mitigation is required.

Impact WILD-4: Loss of Tidal Perennial Aquatic–Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, permanent and temporary impacts on approximately 7.72 acres of tidal perennial aquatic habitat from construction -related activities at the head of Old River fish control gate site would result in the reduction of open habitat area and values in the study area (Table 6.3-8). Project effects on tidal perennial aquatic habitat include permanent and temporary effects. Permanent effects would include the permanent loss of 0.14 acre of tidal perennial aquatic habitat in the gate footprint. Temporary effects would include the temporary disturbance of 7.58 acres of tidal perennial aquatic habitat within the gate construction zone and gate dredging area but outside of the permanent footprint of the gate. Areas of temporary effects have not been mapped or quantified.

Permanent loss of up to 0.14 acre of tidal perennial aquatic habitat would be a significant impact. Implementation of Mitigation Measures WILD-MM-3 and WILD-MM-5 would reduce this impact to a less-than-significant level. No mitigation would be required for the temporary disturbance of tidal perennial aquatic habitat resulting from channel dredging.

Impact WILD-5: Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Temporary disturbance of agricultural land and ruderal habitat would occur during construction of the gate, channel dredging, and siphon extension construction. Temporary disturbance would occur as a result of any dewatering

Table 6.3-8. Land Cover Impacts Associated with Gate Construction and Dredging—Alternative 4B

Land Cover Type	Permanent Impacts Associated with Gate Construction	Acreages Affected by Dredging[1]				Total Temporary Impacts Associated with Dredging	Temporary Impacts Associated with Agricultural Diversions	Permanent Impacts Associated with Agricultural Diversions	Impacts Associated with Dredge Material Disposal[4]
		Head of Old River Fish Gate Site	West Canal Conveyance Dredging Area	Middle River Conveyance Dredging Area	Old River Conveyance Dredging Area				
Tidal perennial aquatic	0.14	7.58	73.02	72.67	123.46	276.73	0.06	<0.01	0
Tule and cattail tidal emergent wetland	0	0	0	0	0	0	0	0	0
Cottonwood-willow woodland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Cottonwood-willow woodland wetland			–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Valley oak riparian woodland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Riparian scrub wetland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Willow scrub wetland	0	0	–[2]	–[2]	–[2]	<0.06[2]	0	0	0
Agricultural land	0	1.20[3]	0	0	0	0	0	0	101.50
Ruderal	0.02	0	0	0	0	0	0	0	47.40

Notes:

1 Dredge impacts assumed impacts on all tidal perennial aquatic habitat within the dredge area. Actual loss of tidal perennial aquatic habitat will probably be less as a result of confining dredge activities to the center of the channel.

2 Dredge impacts on individual riparian land cover types are not yet determined because the exact placement of the stationary pipes has not been identified. The riparian impact will total up to 0.06 acre at the three dredge areas.

3 The acreage for the gate site agricultural impact includes the area used for dredge drying areas at all the gate site, which was assumed to require 1.2 acres. This represents a permanent impact.

4 The acreage for dredge drying areas at the 3 conveyance dredging areas is a temporary impact.

activities required for gate construction, as well as work in the channel associated with dredging and placement of additional siphon pipeline. The effects of gate construction, channel dredging, and siphon extensions are described below.

Gate Construction. Construction at the head of Old River fish control gate would not result in the loss of agricultural land. Construction at the head of Old River gate would result in the permanent loss of 0.02 acre of ruderal vegetation.

Channel Dredging. A total of 1.20 acres of agricultural land would be permanently lost for construction of runoff management basins associated with gate site dredging.

Conveyance dredging and siphon extension impacts and mitigation measures would be the same as those identified under Alternatives 2A–2C.

The effect on common and special-status wildlife species from loss of this agricultural land and ruderal habitat is considered less than significant because these land cover types are common in the project area. No mitigation is required because implementation of environmental commitments (see Chapter 2) and Mitigation Measures WILD-MM-2 and WILD-MM-3 from above would restore the preproject habitat values of these sites following the completion of construction and dredging activities.

Potential effects on special-status species from the loss of agricultural land and ruderal habitat, as well as associated mitigation measures, are described below under the sections related to individual species.

Impact WILD-6: Temporary Disturbance and Possible Mortality of Common Wildlife Species as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The potential for temporary disturbance and possible mortality to common wildlife species is described in detail under Alternatives 2A–2C above. The potential effects under Alternative 4B would be the same as those identified for Alternatives 2A–2C.

The potential for temporary disturbance and possible mortality to common wildlife species is considered less than significant because temporary and periodic use of heavy equipment would not substantially change the amount of disturbance currently occurring in the area, vegetation protection measures will be incorporated as an environmental commitment, and preconstruction surveys will be performed before starting construction activities. Daily operation of the gates is not expected to disturb or cause mortality to wildlife.

No mitigation is required.

Impact WILD-7: Disruption of Wildlife Movement Corridors as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The potential for disruption of movement corridors for common wildlife species from gate construction is described above under Alternatives 2A–2C. The potential for disruption of movement corridors for common wildlife species is considered less than significant because most terrestrial wildlife species will be able to move around the gate.

No mitigation is required.

Impact WILD-8: Loss of Valley Elderberry Longhorn Beetle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, the potential effects on VELB habitat from gate construction, channel dredging, and siphon extension are described above in Impact WILD-8, under Alternatives 2A–2C. These potential effects on VELB habitat are considered significant. Implementation of Mitigation Measures WILD-MM-6, WILD-MM-7, and WILD-MM-8 would reduce these effects to less than significant.

Impact WILD-9: Loss or Disturbance of Swainson's Hawk Nests or Foraging Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, potential effects on Swainson's hawk include construction-related disturbance to nesting Swainson's hawks. Approximately 0.06 acre of riparian woodland, which provides potential nesting habitat for Swainson's hawk, would be affected by channel dredging. Swainson's hawk nest have been observed in the vicinity of the gate sites; however, no known nests sites were observed at the gate sites.

The conversion of agricultural land to gate site facilities would result in the permanent loss of approximately 1.20 acres of agricultural land. Temporary disturbance of agricultural land adjacent to the gate construction sites and associated access roads could result in temporary loss of Swainson's hawk foraging habitat. These temporary losses would not substantially reduce available foraging habitat for Swainson's hawk in the study area.

The potential loss or disturbance of nesting Swainson's hawk from channel dredging is considered significant because these actions could affect the nesting success of a special-status species. Settling basins associated with channel dredging would result in the temporary loss of up to 165 acres of foraging habitat. The loss of suitable nesting habitat and the potential disturbance of nesting Swainson's hawk during the construction phase of the project are considered significant. The temporary and permanent loss of foraging habitat is not expected to affect the value of these forage areas for Swainson's hawk because the affected areas would be small in comparison to overall foraging habitat available for this species in the study area. Although the loss of foraging habitat is relatively small, DFG requires compensation for loss of foraging habitat in the vicinity of active Swainson's hawk nest. Therefore, the temporary and permanent disturbance to agricultural lands is considered significant.

Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2, WILD-MM-3, WILD-MM-9, WILD-MM-10, WILD-MM-11, and WILD-MM-12 would reduce impacts on nesting and foraging habitat for Swainson's hawks to a less-than-significant level.

Impact WILD-10: Loss or Disturbance of San Joaquin Kit Fox or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, the potential effects on San Joaquin kit fox include the loss or disturbance of active dens and the loss or disturbance of foraging habitat from conveyance dredging in Old River. Temporarily disturbed areas will be reseeded following construction as stated under Impact WILD-5 (Loss of Agricultural Land and Ruderal-Associated Wildlife Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions).

Although this species is not expected to occur at the Old River channel dredging area, the kit fox has a relatively large home range and could be affected by channel dredging in this area. The potential for effects on kit fox is considered significant but would become less than significant following implementation of Mitigation Measures WILD-MM-13, WILD-MM-14, and WILD-MM-15.

Impact WILD-11: Loss of Giant Garter Snake or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, construction in areas adjacent to irrigation ditches associated with agricultural land could cause direct mortality of, or remove habitat for, the giant garter snake. Direct impacts on individuals of this species could also occur during construction.

Because the giant garter snake is a federally and special-status species, this impact would be significant. Implementation of Mitigation Measures WILD-MM-4, WILD-MM-16, and WILD-MM-17 would reduce this impact to a less-than-significant level.

Impact WILD-12: Loss of Western Pond Turtle or Suitable Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, gate construction, channel dredging, and siphon extension in areas within or adjacent to wetland and aquatic habitats, including tidal perennial aquatic, tidal emergent wetland, off-channel ponds, marshes, and irrigation ditches, could cause direct mortality of, or remove habitat for, western pond turtles.

Most habitat effects would be temporary because most of the affected habitats would be restored following gate installation. However, direct impacts on individuals of this species could occur during construction. Because the western pond turtle is designated as a federal and state species of concern, this impact would be significant. Implementation of Mitigation Measures WILD-MM-4 and WILD-MM-18 would reduce this impact to a less-than-significant level.

Impact WILD-13: Loss or Disturbance of Raptor Nest Sites as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

The study area is known to provide nesting habitat for northern harriers, white-tailed kites, Cooper's hawk, and several other raptor species. Construction could result in loss or disturbance of raptor nests. Because disturbance of an active raptor nest would violate Sections 3503 and 3503.5 of the California Fish and Game Code, this impact is significant. Implementation of Mitigation Measures WILD-MM-2 and WILD-MM-3 would reduce this impact to a less-than-significant level.

Impact WILD-14: Loss of Tricolored Blackbirds or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, gate construction and channel dredging would result in the loss of agricultural lands and ruderal vegetation. These impacts could result in the loss or disturbance of tricolored blackbird nests or potential nesting habitat and the temporary loss of foraging habitat. Impacts on agricultural land and ruderal vegetation that provide potential nesting habitat are described above under Impacts WILD-2, WILD-3, and WILD-5 for Alternative 4B.

Construction and dredging could result in loss or disturbance of tricolored blackbird nests or potential nesting habitat. Because tricolored blackbirds are a federal and state species of concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-1, WILD-MM-2, WILD-MM-3, WILD-MM-4, WILD-MM-19, and WILD-MM-20 would reduce this impact to a less-than-significant level.

Impact WILD-15: Loss or Disturbance of Nesting or Wintering Western Burrowing Owls as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, construction in areas containing occupied burrowing owl burrows could cause direct mortality of burrowing owls or disturb nesting birds, which could result in nest abandonment. Impacts on ruderal vegetation that provides potential habitat are described above under Impact WILD-5 for Alternative 4B.

Because the burrowing owl is a federal species of concern and a state species of special concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, WILD-MM-21, WILD-MM-22, WILD-MM-23, WILD-MM-24, and WILD-MM-25 would reduce this impact to a less-than-significant level.

Impact WILD-16: Loss or Disturbance of California Black Rail or Suitable Nesting Habitat as a Result of Gate Construction, Channel Dredging, and Siphon Extensions

Under Alternative 4B, construction and dredging would not result in loss of tidal emergent wetland habitat; however, it could result in the loss or disturbance of California black rail nests or potential nesting habitat.

Because this species is a federal and state species of concern, this impact is significant. Implementation of Mitigation Measures WILD-MM-2, WILD-MM-3, WILD-MM-4, WILD-MM-26, and WILD-MM-27 would reduce this impact to a less-than-significant level.

Impact WILD-17: Potential Effects on Greater Sandhill Crane as a Result of Loss of Agricultural Lands

The removal of agricultural land would result in the temporary loss of wildlife foraging, breeding, and roosting habitat. This loss would have a relatively minor effect on wildlife because this land cover type is not considered a sensitive natural community and is common throughout the study area. Most of the impact on agricultural lands would be temporary, and most of the disturbed area, except for the gate footprint and runoff management basins would be restored following construction.

The effect on greater sandhill crane from loss of agricultural land during construction and maintenance of the gate sites is considered a less-than-significant impact. No mitigation is required.

Impact WILD-18: Potential for Adverse Effects on Common Wildlife Species and Wildlife Habitat Associated with Gate Operations

Under Alternative 4B, gate operation is not expected to have a significant impact on wildlife or wildlife habitat.

Because the tidal range during operation of the gates would not change substantially from existing conditions, gate operation would not be expected to have a significant impact on the tidal emergent wetland or riparian vegetation (refer to Section 6.2, Vegetation and Wetlands).

These elevation changes are relatively minor and are not expected to adversely affect existing land cover types in the project area. Upstream vegetation adjacent to the channels would tolerate longer periods of inundation, and downstream vegetation could potentially spread into the new lower tide elevation. Because the high tide during project operations would not substantially change from existing conditions and low tide changes would not be expected to significantly affect vegetation, gate operation would not be expected to have a significant impact on the wildlife habitat (i.e., riparian, tidal emergent wetland, and tidal perennial aquatic). This impact is less than significant. No mitigation is required.

2020 Conditions

The impacts on wildlife resulting from operation of Alternative 4B under 2020 conditions would be similar to those described above. The same mitigation would apply.

Stage 2 (Operational Component)

Diversions of 8,500 cfs to CCF is not anticipated to result in noticeable changes beyond those described under Stage 1. There would be no additional impacts associated with implementation of Stage 2, and no mitigation is required.

2020 Conditions

The impacts on wildlife resulting from operation of Alternative 4B under 2020 conditions would be similar to those described above. The same mitigation would apply.

Cumulative Evaluation of Impacts

Cumulative impacts on wildlife are analyzed in Chapter 10, “Cumulative Impacts.” This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

Chapter 7
Land and Water Use, Social Issues, and Economics

This chapter provides environmental analyses relative to social parameters of the project area. Components of this study include a setting discussion, impact analysis criteria, project effects and significance, and applicable mitigation measures. This chapter is organized as follows:

- Section 7.1, Land and Water Use;
- Section 7.2, Social and Economic Conditions;
- Section 7.3, Utilities and Public Services;
- Section 7.4, Recreation Resources;
- Section 7.5, Power Production and Energy;
- Section 7.6, Visual/Aesthetic Resources;
- Section 7.7, Cultural Resources;
- Section 7.8, Public Health and Environmental Hazards;
- Section 7.9, Environmental Justice; and
- Section 7.10, Indian Trust Assets.

7.1 Land and Water Use

Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on land use and the availability of water for agricultural purposes. The primary concerns related to land and water use are incompatible land and water uses, conversion of farmland to nonagricultural use, and effects on existing agricultural operations.

Summary of Significant Impacts

There are no significant impacts on land and water use as a result of implementation of any of the alternatives.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- California Department of Conservation Farmland Mapping and Monitoring Program, Unpublished digital information for San Joaquin County, 2000;
- California Department of Water Resources Bulletin 132-01: Management of the California State Water Project, December 2002;
- California Department of Water Resources Bulletin 132-00: Management of the California State Water Project, December 2001;
- California Department of Water Resources Bulletin 132-99: Management of the California State Water Project, March 2001;
- California Department of Water Resources Bulletin 132-98: Management of the California State Water Project, November 1999;
- California Department of Water Resources Bulletin 132-97: Management of the California State Water Project, December 1998;
- Contra Costa County General Plan 1995-2010, July 1996;
- Response Plan for Water Level Concerns in the South Delta Under Water Rights Decision 1641, January 2002;
- San Joaquin County Development Title, 1997;
- San Joaquin County General Plan 2010 Review, March 2000;
- San Joaquin County General Plan 2010, July 1992, as amended; and
- site visits conducted on April 16, 2002, and July 1, 2003.

South Delta Region

The south Delta region consists primarily of agricultural lands within a network of waterways and levees. Farmers divert water from the Delta channels to irrigate crops. Diversion methods include siphons, pumps, and a tidal pump control structure at Tom Paine Slough (California Department of Water Resources and Bureau of Reclamation 1996a

Agricultural lands in the south Delta region are typically of high quality. (California Department of Conservation 2001a.) Farmland classes in the SDIP area are shown in Figure 7.1-1. Most lands are cultivated and are in agricultural production and produce high-value crops such as asparagus in addition to alfalfa, corn, cabbage, and other grain, hay, and field crops.

Approximately 160 pumps and siphons divert water to agricultural lands bordering Old River, Middle River, Grant Line Canal, and other channels in the south Delta. As a result of a 1982 lawsuit and settlement, temporary flow control barriers were installed on the Old River, Middle River, and Grant Line Canal to protect water surface elevations and local diversion capability.

Contra Costa County

The east county area of Contra Costa County is predominantly rural and includes agriculture, recreation, and open-space uses. Agriculture is the predominant land use in the east county area. Many of the Delta islands in the county, and the tracts adjacent to the Delta, currently produce dry-farmed grain and specialty crops suited to the soils and climate, such as asparagus (Contra Costa County 1996).

According to the 1998–2000 Farmland Mapping and Monitoring Program (FMMP) Farmland Conversion Report, approximately 20% of the 514,020 acres mapped in Contra Costa County was farmland, 33% was grazing land, 28% was urban and less than 1% was “other” land. The remaining 19% was classified as water.

Contra Costa County has adopted an Urban Limit Line; the Delta is outside the urban limit line because of flood hazards, soil subsistence, lack of infrastructure, and lack of services. The areas to the north and east are designated a special Delta Recreation and Resources area in the General Plan. The plan also designates Delta islands and nearby tracts as a special Delta Recreation and Resources area. The designation recognizes the location in the 100-year flood plain, limited public services, and the value of this area for agricultural uses, wildlife habitat, and low intensity recreation. (Contra Costa County 1996.) Portions of the Primary Zone are designated General Agriculture.

The county plan specifies allowable land uses within the East County area. This area includes: Holland, Palm, Orwood, and Coney Islands. Uses allowed include: public and private outdoor recreation (including docks and marinas), equestrian facilities, wind energy systems, single-family residences on larger lots, quarries, oil and gas wells, pipelines and transmission lines, and public uses including airports, reservoirs, and landfills. Uses in the East County area, that also lie within the Primary Zone of the Delta, are required to be consistent with the goals, policies and provisions of the Delta Protection Commission's Land Use and Resource Management Plan for the Primary zone of the Delta. (Contra Costa County 1996.) There has been a great deal of suburban, residential development in the former agricultural lands in the Brentwood and Oakley areas along SR 4.

San Joaquin County

Of the 912,600 acres mapped by FMMP in San Joaquin County, approximately 70% was classified as farmland, 17% as grazing land, 8% as urban land, 5% as other land, and the remainder as water (Department of Conservation 2002a). In San Joaquin County, *other land* is a category that includes wetlands, low-density "ranchettes," and brush or timberlands unsuitable for grazing. (Department of Conservation 2002b.)

In 2001, 486,970 acres of San Joaquin County farmland were covered by the Williamson Act contract. (Department of Conservation 2002c.) San Joaquin County also provides Farmland Security Zones (FSZ) as another program to protect farmland. In 2001, 55,945 acres of farmland in San Joaquin County were protected through FSZ contracts. Of this total acreage, 47,313 acres were transferred from Williamson Act contracted land into FSZ contracts (in 1999) (Department of Conservation 2002b).

Local

The existing land uses at and adjacent to the SDIP project facilities are described below.

Head of Old River Gate at San Joaquin River

The predominant land use in the vicinity of the proposed head of Old River gate is agriculture. Land immediately north of the gate is identified as Agricultural Preserve and zoned Permanent Agricultural Extensive Land Use Zone, minimum parcel size 80 acres (AG-80). Land south of the gate is currently identified as Agricultural Preserve (San Joaquin County 2000) but is currently proposed for development.

Middle River at North Canal

Land use in the vicinity of the proposed Middle River gate is predominantly agricultural, with one residence located close to the south side of the proposed gate. Lands immediately north of, and south of, the gate are identified as FSZ and zoned AG-80 (San Joaquin County 2000).

Grant Line Canal at Delta-Mendota Canal

The predominant land use in the vicinity of the proposed Grant Line Canal gate is agriculture. Lands immediately north of, and south of, the gate are under Williamson Act contract and zoned AG-80 (San Joaquin County 2000).

Old River at Delta-Mendota Canal Gate

The predominant land use in the vicinity of the Old River at DMC gate is agriculture. The new town of Mountain House is being constructed south of the Old River levee in unincorporated San Joaquin County. Land use immediately north of and adjacent to the Old River at DMC gate site is under Williamson Act contract and zoned AG-80 (San Joaquin County 2000). South of the Old River at DMC gate site, the area is designated Medium–High Density Residential for residential and commercial development associated with Mountain House, and is zoned Agriculture–Urban Reserve, minimum parcel size 20 acres (AU-20) as an agricultural holding zone for future urbanization (San Joaquin County 2003).

West Canal

CCF and a levee are located along the west side of the West Canal. Land east of the West Canal (Coney Island) is in agricultural production and rural residential land uses. The west side of the West Canal is designated as Parks and Recreation according to the Contra Costa County General Plan, and the east side of the West Canal (Coney Island) is designated as Delta Recreation and Resources and as Agricultural Core (Contra Costa County 1996). Crops typically grown on Coney Island include safflower, alfalfa, grains, and hay (California Department of Water Resources 2003g).

Middle River

Land uses in the vicinity of the Middle River between the head of Middle River (at Old River) and its confluence with North Canal include agriculture and rural residential. Several residences are located along Wing Levee Road. Crops in this area include alfalfa, tomatoes, melons, squash, cucumbers, corn, grain, and hay. Many agricultural lands adjacent to Middle River are currently idle.

The area is designated as General Agriculture and is zoned Agriculture (San Joaquin County 1992). Most parcels adjacent to the Middle River are under Williamson Act contract, with some parcels under FSZ contract (San Joaquin County 2000).

Old River

Land uses in the vicinity of Old River include agriculture, rural residential, and recreation (marina) facilities. Crops cultivated in this area include asparagus, corn, beans, safflower, alfalfa, and grain and hay (California Department of Water Resources 2003g).

The dredging area is designated as General Agriculture in the San Joaquin County General Plan. In-channel islands are designated as Open Space. The area is zoned Agriculture (San Joaquin County 1992). Most parcels on the north side of Old River are under Williamson Act contract and zoned AG-80. Lands on the south side of Old River vary between Williamson Act contract and Agricultural Preserve designations, and are zoned primarily Permanent Agricultural Intensive Land Use Zone, minimum parcel size 40 acres (AG-40), with some AU-20 and Residential (San Joaquin County 2000).

Environmental Consequences

Assessment Methods

Land use impacts were assessed based on the compatibility of constructing and operating the project on adjacent land uses and the compatibility with local land use plans and policies. The assessment of the compatibility of the project with adjacent land uses was based on project site visits (April 16, 2002, and July 1, 2003) and review of aerial photographs. The project's compatibility with local land use plans and policies was assessed by reviewing the San Joaquin County General Plan (San Joaquin County 1992) and the Contra Costa County General Plan (Contra Costa County 1996).

The location and acres of farmland classes (e.g., prime, unique, and state and locally important farmland) in the project area were based on data provided by the Department of Conservation's Farmland Monitoring Program. San Joaquin County identifies all farmland that does not meet the state definitions for "prime," "statewide importance," or "unique," as "locally important." This designation includes land that is or has been used for irrigated pasture, dryland farming, confined livestock or dairy facilities, aquaculture, poultry facilities, and dry grazing. Contra Costa County identifies lands located in the Tassajara area, extending eastward to the county boundary and bordered on the north by the Black Hills; the Deer, Lone Tree, and Briones Valleys; the Antioch area; and the Delta as locally important farmland (Department of Conservation 2002a).

The SDIP includes the extension of agricultural diversions, the operation of flow control gates, and conveyance dredging as described in Chapter 2. Extending agricultural diversions and operating the flow control gates would ensure that changes in water levels do not affect the ability of the diversions to function properly. Consequently, the SDIP would not adversely affect the ability to divert water from Delta channels. The environmental effects of changing the amount of water exported south of the Delta is addressed in Section 5.1, Water Supply, and Chapter 9, "Growth-Inducing Impacts."

Regulatory Setting

Farmland Protection Policy Act

The purpose of the Farmland Protection Policy Act (FPPA) is to minimize the extent to which federal programs contribute to irreversible conversion of farmland to nonagricultural uses, and to ensure that federal programs are administered in a manner that would be compatible with state and local government and private farmland protection programs and policies. The FPPA directs federal agencies to consider the effects of federal programs or activities on farmland. The agencies are to consider alternative actions, as appropriate, that could lessen such adverse effects, and ensure that such federal programs, to the extent practicable, are compatible with state, local, and private farmland protection programs and policies.

California Land Conservation Act of 1965

The California Land Conservation Act of 1965 (Williamson Act) helps preserve agricultural and open space lands by discouraging conversion to urban uses. The act creates an arrangement whereby private landowners enter into a 10-year contract with counties and cities to maintain their land in agricultural and compatible open-space uses in exchange for a reduction in property taxes. The contract is automatically renewed each year for 1 additional year unless it is not renewed or cancelled.

1992 Delta Protection Act

The State's 1992 Delta Protection Act designates the Delta primary zone as an area for protection from intrusion of nonagricultural uses (Section 29703a) and establishes the Delta Protection Commission (DPC). In 1995, the DPC adopted its regional plan, *Land Use and Resource Management Plan for the Primary Zone of the Delta*.

Local

Contra Costa County

The Contra Costa County General Plan incorporates policies developed by the DPC under the Delta Protection Act. The General Plan allows construction of public facilities regardless of underlying General Plan or zoning designations. Government Code Section 53091 states that county zoning ordinances "shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water."

San Joaquin County

The San Joaquin County General Plan includes the incorporation of policies developed by the DPC under the Delta Protection Act. The Community Development Section (IV) of the General Plan addresses protection of open space and natural resources. Section VI of the General Plan addresses the protection of resources, including agricultural lands. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091.

The proposed gate sites in San Joaquin County would be adjacent to areas designated General Agriculture (40-acre and 80-acre) and Open Space/Resource Conservation (Riparian Habitat, Significant Vegetation, and Mineral Resources) on the General Plan 2010 map of San Joaquin County. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit.

Because public water supply and treatment facilities are exempt from zoning requirements, as set forth in California Government Code Section 53091, the SDIP is not subject to the requirements of the Chapter 9 County Development Title, which serves as the County Zoning Code.

Significance Criteria

For the purposes of this analysis, impacts on land use are considered significant if implementation of the alternatives would:

- result in a substantial alteration of the present or planned land use patterns of an area, including physical disruption or division of an established community;
- conflict with adopted environmental plans and goals of local jurisdictions, or state or federal regulatory agencies, including general plans, community plans, and zoning; or
- convert a substantial amount of important farmland to nonagricultural use, or impair the agricultural productivity of important agricultural land.

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project-specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program. These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED programmatic mitigation measures, please refer to Appendix E, "Mitigation Measures Adopted in the CALFED Record of Decision."

Agricultural Land and Water Use

1. Site and align Program features to avoid or minimize effects on agriculture.
3. Implement features that are consistent with local and regional land use plans.
20. In implementing levee reconstruction measures, work with landowners to establish levee reconstruction methods that avoid or minimize the use of agricultural land.
21. Work with landowners to establish levee subsidence BMPs that avoid effects on land use practices. Through adaptive management, further modify BMPs to reduce effects on agricultural land.
22. Implement erosion control measures to the extent possible during and after project construction activities. These erosion control measures can include grading the site to avoid acceleration and concentration of overland flows, using silt fences or hay bales to trap sediment, and revegetation areas with native riparian plants and wet meadow grasses.
23. Protect exposed soils with mulches, geotextiles, and vegetative ground covers to the extent possible during and after project construction activities in order to minimize soil loss.
25. When it appears that land within an agricultural preserve may be acquired from a willing seller by a state CALFED agency for a public improvement as used in Government Code Section 51920, advise the Director of Conservation and the local governing body responsible for the administration of the preserve of the proposal.
28. Dredged materials will be analyzed, dredged, and handled in accordance with permit requirements. Permits will incorporate mitigation strategies identified in Section 5.3, Water Quality, to prevent release of contaminants of concern.
30. Implement seepage control measures.

Alternative 1 (No Action)

As described in the affected environment section, the Middle River, Grant Line Canal, and Old River temporary barriers are currently installed on a yearly basis to raise water surface elevations upstream of the barriers, and the head of Old River barrier is installed to prevent fish migration into the south Delta. Implementing Alternative 1 would continue to provide the same level of diversion reliability to agricultural water diverters; no change relative to existing conditions is expected.

Under Alternative 1, statewide and federal programs to preserve open space and agricultural lands would continue to be implemented. The trend of land conversion from agricultural uses to urbanization and nonagricultural uses would likely continue.

Constructing and removing the temporary barriers require worker trips to and from the barriers sites and the use of heavy construction equipment. Because the temporary barriers are located on the waterside of the levees and access to the barrier sites is over existing roads, no impacts on farmland or other land uses at or adjacent to the temporary barriers would occur.

2020 Conditions

Under future no action conditions (2020 conditions) the SDIP would not be implemented. It is expected that the temporary barriers program would continue and that existing state and federal programs to preserve open space would remain in effect. It is expected that rates of conversion of land from agricultural to urbanization and nonagricultural uses would likely be similar to current trends, and that the land uses in the south Delta would be similar to those of today.

Alternatives 2A, 2B, and 2C

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact LW-1: Conflicts with Existing Land Uses as a Result of Constructing the Permanent Fish and Flow Control Gates. The proposed gate sites located in San Joaquin County would be constructed adjacent to, and partially within, areas designated General Agriculture (40-acre and 80-acre) and Open Space/Resource Conservation (Riparian Habitat, Significant Vegetation, and Mineral Resources) (San Joaquin County 2000). A 50,000-square-foot area adjacent to each of the gates would be acquired for dredge spoil disposal purposes. New access roads would also be constructed at three of the four gate sites. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091.

Construction of the fish control and flow control gates would not result in substantial changes in existing land uses. The effects on existing land uses at each gate site are described below.

Head of Old River Fish Gate

Constructing the head of Old River gate would result in the conversion of approximately 1.16 acres of agricultural land. This includes land required for operation and maintenance facilities and the 50,000-square-foot settling pond/runoff management basin adjacent to the gate. The footprint of the gate would not significantly affect adjacent land uses because it would be constructed primarily between the existing levees (refer to Figure 2-4b).

Access to the north side of the gate would be over an existing private roadway. Although the road would be widened to 16 feet and graveled, it would not require a wider easement. This road would be used primarily for maintenance purposes upon completion of construction. Cohen/San Joaquin Road would provide access to the south side of the gate. No improvements to this road would be required.

Middle River Flow Control Gate

Constructing the Middle River gate would result in the conversion of approximately 2.54 acres of agricultural land as a result of widening the levees to accommodate the new gate and constructing the settling pond/runoff management basin adjacent to the gate. Access to the Middle River gate would occur from both the north and south sides of the gate. No improvements to these access routes would be required.

Grant Line Canal Flow Control Gate

The Grant Line Canal gate would require conversion of approximately 10.7 acres of agricultural land as a result of setting back the north levee to accommodate the new gate and constructing operation and maintenance facilities, a settling pond/runoff management basin adjacent to the gate, and two new access roads. One access road would be 15,250 feet long by 16 feet wide and located on the north side of Grant Line Canal; the other access road would be 10,000 feet long by 16 feet wide and would be on the south side of Fabian and Bell Canal.

One seasonal residence is located in the median island between the Grant Line Canal and the Fabian and Bell Canal, approximately 300 yards from the location of the gate. No other residences are located in the vicinity of the gate. Construction and operation of the gate are not expected to affect this residence because of its distance from the gate.

Old River Flow Control Gate

The Old River at DMC gate would require conversion of up to 6 acres of agricultural land adjacent to the gate.

Access to the north and south sides of the Old River at DMC gate would be over existing private roads. These roads would be improved but would not require additional right-of-way and would not result in the conversion of additional land. (California Department of Water Resources 2003b.)

As described above, no significant land use conflicts would result from the construction of the permanent operable gates because most land use conversions would occur immediately adjacent to the gates and would result in the conversion of only a small amount of farmland. A total of approximately 21 acres would be converted in the south Delta region. Land uses adjacent to and in the vicinity of the gates would not be affected during construction of the gates. This impact is less than significant. No mitigation is required.

Impact LW-2: Conversion of Important Farmland to Nonagricultural Use as a Result of Constructing the Permanent Fish and Flow Control Gates. Constructing the gates would result in the permanent conversion of approximately 20 acres of farmland classified as *prime*, and less than 1 acre classified as *unique* (Table 7.1-1). Estimated agricultural conversion under Alternatives 2A–2C is shown in Table 7.1-1. Conversion of farmland is estimated to range from 1.16 acres at the head of Old River gate to 10.7 acres at the Grant Line Canal gate.

Table 7.1-1. Agricultural Conversion Estimates (acres)

	Alternatives 2A–2C		Alternative 3B		Alternative 4B	
Farmland Category	Permanent Conversion of Farmlands—Gates	Temporary Conversion of Farmlands—Spoils Ponds	Permanent Conversion of Farmlands—Gates	Temporary Conversion of Farmlands—Spoils Ponds	Permanent Conversion of Farmlands—Gates	Temporary Conversion of Farmlands—Spoils Ponds
Prime	20.3		9.6		1.16	
Unique	0.045		0.045			
Total Farmlands	20.35	205	9.65	205	1.16	205

Placement of spoils ponds for channel dredging activities has not yet been determined. However, most lands in the vicinity of the channels are prime and unique.

Total important farmlands in San Joaquin County in 2001: 630,990.

Total irrigated farmlands in Contra Costa County in 2001: 55,904.

Source: California Department of Conservation 2000.

The 21 acres of land that would be removed from agricultural production as a result of implementation of Alternatives 2A–2C represent substantially less than 1% of the approximately 630,990 acres of important farmland in San Joaquin County (Department of Conservation 2002a). The 21 acres that would be converted by Alternatives 2A–2C would include 20.3 acres of prime farmland (as defined by the NRCS) and 0.045 acre of unique farmland.

A Farmland Conversion Impact Rating form, NRCS Form AD-1600, has been submitted to the NRCS for completion and review for consistency with FPPA (Appendix N). According to FPPA, if a project alternative site has an impact rating of less than 160 points, the site should be considered only minimally for protection, and no additional alternative project sites need to be evaluated. For

Alternatives 2A–2C to exceed the 160-point standard established on the Farmland Conversion Impact Rating Form, the NRCS would need to assign at least 73 points to the relative value of the land to be converted.

Factors considered by NRCS in the evaluation of the relative value of the land to be converted are: total acres of prime and unique farmland affected by the project; total acres statewide and local important farmland affected by the project; percentage of farmland in county or local government unit to be converted; and percentage of farmland in government jurisdiction with the same or higher relative value. Because the total acreage of prime, unique, and local important farmland that would be converted is approximately 21 acres, and the total acreage to be converted represents substantially less than 1% of the total important farmland in San Joaquin County, the NRCS has determined that the relative value of the land to be converted will be 68 points and would not significantly contribute to the irreversible conversion of farmland to nonagricultural uses or be inconsistent with FPPA.

Because the total acreage of lands to be converted from important farmland to nonagricultural use would be spaced apart over a large geographical area, the remaining farmlands would continue to be usable for agriculture, and the relative value of the land would not exceed the NRCS threshold, this impact is considered less than significant. No mitigation is required.

Impact LW-3: Conflict with Williamson Act and Farmland Security Zone Contract Lands as a Result of Constructing the Permanent Fish and Flow Control Gates. Under Alternatives 2A–2C, 17.8 acres of the 21 affected by Alternatives 2A–2C are subject to Williamson Act contracts; 2.54 acres are currently under FSZ contract. Certain uses are considered compatible uses of land under Williamson Act contracts (contracted lands), including agricultural, open space, and recreational uses, and uses determined by the agency administering the contract to be consistent with the intent of the Williamson Act. Uses of contracted land other than agricultural and open space uses are typically considered incompatible. Conversion to public facility uses would require Williamson Act and FSZ contracts to be terminated only for the portions of contracted land acquired for the SDIP.

A total of up to 20.3 acres of contracted land would be acquired for SDIP. Because the acquisition of lands for public facilities would result in the automatic termination of Williamson Act and FSZ contracts for the land area acquired, and the remaining lands within contracted parcels would remain under contract and viable for agricultural use, this impact is considered less than significant. No mitigation is required.

Impact LW-4: Incompatibility with Local Land Use Plans and Policies as a Result of Constructing and Operating the Permanent Fish and Flow Control Gates. Construction and operation of the permanent operable gates is exempt from the San Joaquin County Zoning Code pursuant to San Joaquin County policy. Furthermore, Government Code Section 53091 states that county zoning ordinances "shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water." The proposed gates are not specifically identified as an allowable or conditional use according to the San Joaquin County Zoning Code; however, operation of the proposed gates would not be incompatible with the San Joaquin County zoning and General Plan designations. This impact is less than significant. No mitigation is required.

Dredging

Impact LW-5: Conflict with Existing Land Uses as a Result of Dredging in South Delta Channels. The proposed spoils pond sites in Contra Costa County and San Joaquin County would be constructed adjacent to the channel dredging areas, and in areas designated General Agriculture (80-acre) (San Joaquin County 2000). Under Alternatives 2A–2C, up to eight spoils ponds up to 80 acres each (total of 205 acres) would be located on farmlands adjacent to the dredging areas of West Canal and Middle River, and on the western end of Paradise Island next to Old River. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091.

Dredging activities would occur entirely within the south Delta channels, including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, and would therefore not conflict with existing land uses. However, the use of spoils ponds to dry the dredged material would result in the temporary conversion of approximately 205 acres of agricultural lands in San Joaquin County and Contra Costa County for approximately 5 years. Because the conversion of existing land use would be temporary, surrounding land uses would not change, and public water supply and treatment facilities are exempt from General Agriculture land use limitations, this impact is less than significant. No mitigation is required.

Impact LW-6: Incompatibility with Local Land Use Plans and Policies as a Result of Dredging in South Delta Channels. Dredging activities within south Delta channels, including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, and the construction and use of up to eight spoils ponds, are exempt from the San Joaquin County Zoning Code pursuant to San Joaquin County policy. Furthermore, Government Code Section 53091 states that county zoning ordinances "shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water." Dredging activities and spoils ponds are not specifically identified as an allowable or conditional use according to the San Joaquin County Zoning Code; however, the proposed dredging and spoils ponds would not be incompatible with the San Joaquin County zoning and General Plan designations as they are a part of a water transmission program. Therefore, this impact is less than significant. No mitigation is required.

Impact LW-7: Temporary Conversion of Important Farmland to Nonagricultural Use from the Construction of Spoils Settling Ponds

for Channel Dredging. Dredging in south Delta channels, including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, would result in the production of approximately 294,000 cubic yards (cy) of spoils material. The dredge spoils would be decanted in up to eight spoils ponds measuring up to 80 acres each; total combined acreage would be approximately 205 acres. The spoils ponds would be located on farmlands adjacent to the dredging areas of West Canal and Middle River, and on the western end of Paradise Island next to Old River.

Construction of the spoils ponds would occur within each 80-acre perimeter, using local soils as pond berms. The spoils ponds could be used several times over a period of up to 5 years. After the final use, the spoils ponds would be decommissioned, which would involve the complete excavation of remaining spoils, site leveling, and the return of the sites to as close to preproject conditions as possible.

The total acreage to be used by the project for spoils ponds, approximately 205 acres, for up to 5 years, is a considerable amount of farmland, and could be considered nonfarmland by the Department of Conservation's FMMP for up to three update cycles (6 years). However, because the spoils ponds are temporary facilities, would not result in permanent conversion of farmland to nonagricultural use, and would be returned to preproject conditions to the maximum extent practicable, this impact is considered less than significant. No mitigation is required.

Impact LW-8: Conversion of Important Farmland to Nonagricultural Use as a Result of Spoils Disposal from Channel Dredging. After the spoils from dredging south Delta channels are decanted in the spoils ponds, the spoils would be disposed of by either of two methods. Approximately 5% of the total spoils would be placed at sites on the land side of levees in the project area that are in need of additional reinforcing material. The second method of disposal proposed is the dispersal of approximately 95% of the spoils over farmlands adjacent to one or more of the project area channels.

The first method, levee reinforcement, would not involve disturbance to farmlands, would include CALFED Programmatic Mitigation Measure 20, and would therefore not result in the conversion of important farmland to nonagricultural use. Studies conducted during dredging in Old River for the ISDP conclude that the materials dredged were suitable for levee reinforcement purposes, under the 1997 State Water Board regulations (California Department of Water Resources 1997).

The remaining spoils, if suitable, would be spread up to 12 inches thick on farmlands in the south Delta. As described in the project description, the soils would be tested prior to any placement on farmland to ensure that the spoils would not adversely affect the composition of the farmland soils. Therefore, there would be no conversion of land resulting from the disposal of the spoils. This impact is considered less than significant.

2020 Conditions

Implementation of Alternatives 2A–2C under 2020 conditions would result in physical/structural component impacts similar to those described above. The south Delta region would remain primarily agriculture and similar amounts of land would be converted. Therefore, the impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Implementation of the SDIP likely would allow for increases in water delivery and transfers south of the Delta. The reliability and availability of additional water in these areas may result in changes in land use. Because the exact locations and types of land use changes cannot be determined, the anticipated environmental effects of changing the amount of water exported south of the Delta is addressed in Section 5.1, Water Supply; Section 7.2, Social and Economic Conditions; and Chapter 9, "Growth-Inducing Impacts."

2020 Conditions

Implementation of Alternatives 2A–2C under 2020 conditions would result in operational component impacts similar to those described above. The south Delta region would remain primarily agriculture, and similar amounts of land would be converted. Therefore, the impacts are less than significant, and no mitigation is required.

Interim Operations

Interim operations would not result in the conversion or use of any land, as there would be no physical changes. The south Delta region would remain primarily agriculture, and similar amounts of land would be converted. Therefore, there would be no impact, and no mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact LW-1: Conflicts with Existing Land Uses as a Result of Constructing the Permanent Fish and Flow Control Gates. Under Alternative 3B, the proposed head of Old River fish control gate and the Middle River and Old River at DMC flow control gates would be constructed adjacent to, and partially within, areas designated General Agriculture (40-acre and 80-acre) and Open Space/Resource Conservation (Riparian Habitat, Significant Vegetation, and Mineral Resources) (San Joaquin County 2000). A 50,000-square-foot area adjacent to each gate would be acquired for dredge spoils disposal purposes. New access roads would be constructed at two of the three gate sites. Refer to Impact LW-1 under the analysis of Alternatives 2A–2C for the specific effects on existing land uses at the head of Old River, Middle River, and Old River at DMC gate sites. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091.

Construction of the fish control and flow control gates would not result in substantial changes in existing land uses. No significant land use conflicts would result from the construction of the permanent operable gates. Therefore, this impact is less than significant. No mitigation is required.

Impact LW-2: Conversion of Important Farmland to Nonagricultural Use as a Result of Constructing the Permanent Fish and Flow Control Gates. Under Alternative 3B, construction of the head of Old River fish control gate, and the Middle River and Old River at DMC flow control gates would affect an estimated 9.67 acres through the acquisition of land for the gates and for settling ponds/runoff management basins adjacent to each proposed gate. Acquiring this land for the proposed improvements would result in the conversion of important farmland that supports asparagus, alfalfa, grains, and hay crops to nonagricultural use (California Department of Water Resources 1993, 2003g). Individual acquisitions of portions of agricultural parcels would not exceed 6 acres and would average less than 1.6 acres. The remaining acreage in each parcel would remain viable for agricultural use.

The estimated 9.67 acres of land that would be removed from agricultural use by the SDIP represent substantially less than 1% of the 630,990 acres of irrigated farmland in San Joaquin County (Department of Conservation 2002a). The estimated 9.67 acres that would be converted by the proposed action would include 9.6 acres of prime farmland (as defined by the NRCS), and 0.05 acre of unique farmland.

A Farmland Conversion Impact Rating form, NRCS Form AD-1600, has been submitted to the NRCS for completion and review for consistency with FPPA (Appendix N). According to FPPA, if a project alternative site has an impact rating of less than 160 points, the site should be considered only minimally for protection, and no additional alternative project sites need to be evaluated. For Alternative 3B of the SDIP to exceed the 160-point standard established on the Farmland Conversion Impact Rating form, the NRCS would need to assign at least 68 points to the relative value of the land to be converted.

Factors considered by NRCS in the evaluation of the relative value of the land to be converted are: total acres of prime and unique farmland affected by the project; total acres statewide and local important farmland affected by the project; percentage of farmland in county or local government unit to be converted; and percentage of farmland in government jurisdiction with the same or higher relative value. Because the total acreage of prime, unique, and local important farmland is 8.3 acres, and the total acreage to be converted represents substantially less than 1% of the total important farmland in San Joaquin County, the relative value of the land to be converted is below the 68-point threshold and would not significantly contribute to the irreversible conversion of farmland to nonagricultural uses or be inconsistent with FPPA.

Because the total acreage of lands to be converted from important farmland to nonagricultural use would be spaced apart over a large geographical area, the remaining farmlands would continue to be usable for agriculture, and the relative value of the land would not exceed the NRCS threshold, this impact is considered less than significant. No mitigation is required.

Impact LW-3: Conflict with Williamson Act and Farmland Security Zone Contract Lands as a Result of Constructing the Permanent Fish and Flow Control Gates. Under Alternative 3B, 7.06 acres affected by the SDIP are subject to Williamson Act contracts; 2.54 acres are currently under FSZ contract. Certain uses are considered compatible uses of land under Williamson Act contracts (contracted lands), including agricultural, open space, and recreational uses, and uses determined by the agency administering the contract to be consistent with the intent of the Williamson Act. Uses of contracted land for other than agricultural and open space uses are typically considered incompatible. Conversion to public facility uses would require Williamson Act and FSZ contracts to be terminated for the portions of contracted land acquired for the SDIP.

The SDIP would require terminating Williamson Act contract and FSZ protections for contracted lands acquired; however, contract protections would remain in place for the remaining portions of the affected parcels. A total of up to 9.6 acres of contracted land would be acquired for the SDIP. Because the acquisition of lands for public facilities would result in the automatic termination of Williamson Act and FSZ contracts for the land area acquired, and the remaining lands in contracted parcels would remain under contract and viable for agricultural use, this impact is considered less than significant. No mitigation is required.

Impact LW-4: Incompatibility with Local Land Use Plans and Policies as a Result of Constructing and Operating the Permanent Fish and Flow Control Gates. Construction and operation of the permanent operable gates is exempt from the San Joaquin County Zoning Code pursuant to San Joaquin County policy. Furthermore, Government Code Section 53091 states that county zoning ordinances “shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water.” Therefore, implementation of the SDIP would not be incompatible with local plans and policies. This impact is less than significant. No mitigation is required.

Dredging

Impact LW-5: Conflict with Existing Land Uses as a Result of Dredging in South Delta Channels. The proposed spoils pond sites in Contra Costa County and San Joaquin County would be constructed adjacent to the channel dredging areas and in areas designated General Agriculture (80-acre) (San Joaquin County 2000). Under Alternative 3B, up to eight spoils ponds measuring up to 80 acres each would be located on farmlands adjacent to the dredging areas of West Canal and Middle River, and on the western end of Paradise Island next to Old River. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091.

Dredging activities would occur entirely within the south Delta channels, including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, and would therefore not result in a conflict with existing land uses. However, the use of spoils ponds to dry the dredged material would result in the temporary conversion of approximately 205 acres of agricultural lands in San Joaquin County and Contra Costa County for approximately 5 years. Because the conversion of existing land use would be temporary, surrounding land uses would not change, and public water supply and treatment facilities are exempt from General Agriculture land use limitations, this impact is less than significant. No mitigation is required.

Impact LW-6: Incompatibility with Local Land Use Plans and Policies as a Result of Dredging in South Delta Channels. Dredging activities within south Delta channels, including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, and the construction and use of up to eight spoils ponds, are exempt from the San Joaquin County Zoning Code pursuant to San Joaquin County policy. Furthermore, Government Code Section 53091 states that county zoning ordinances "shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water." Dredging activities and spoils ponds are not specifically identified as an allowable or conditional use according to the San Joaquin County Zoning Code; however, the proposed dredging and spoils ponds would not be incompatible with the San Joaquin County zoning and General Plan designations as they are a part of a water transmission program. Therefore, this impact is less than significant. No mitigation is required.

Impact LW-7: Temporary Conversion of Important Farmland to Nonagricultural Use from the Construction of Spoils Settling Ponds for Channel Dredging. Dredging in south Delta channels including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, would result in the production of approximately 294,000 cy of spoils material. The dredge spoils would be decanted in up to six spoils ponds measuring up to 80 acres each; total combined acreage would be approximately 205 acres. The spoils ponds would be located on farmlands adjacent to the dredging areas of West Canal and Middle River, and on the western end of Paradise Island next to Old River.

Construction of the spoils ponds would occur within each 80-acre perimeter, using local soils as pond berms. The spoils ponds could be used several times over a period of up to 5 years. After the final use, the spoils ponds would be decommissioned, which would involve the complete excavation of remaining spoils, site leveling, and the return of the sites to as close to preproject conditions as possible.

The total acreage to be used by the project for spoils ponds, approximately 205 acres, for up to 5 years, is a considerable amount of farmland, and could be considered nonfarmland by the Department of Conservation's FMMP for up to three update cycles (6 years). However, because the spoils ponds are temporary facilities, would not result in permanent conversion of farmland to nonagricultural use, and would be returned to preproject conditions to the maximum extent practicable, this impact is considered less than significant. No mitigation is required.

Impact LW-8: Conversion of Important Farmland to Nonagricultural Use as a Result of Spoils Disposal from Channel Dredging. After the spoils from dredging south Delta channels are decanted in the spoils ponds, the spoils would be disposed of by one of two methods. Approximately 5% of the total spoils would be placed at sites on the landside of levees in the project area that are in need of additional reinforcing material. The second method of disposal proposed is the dispersal of approximately 95% of the spoils over farmlands adjacent to one or more of the project area channels.

The first method, levee reinforcement, would not involve disturbance to farmlands, would include CALFED Programmatic Mitigation Measure 20, and would therefore not result in the conversion of important farmland to nonagricultural use. Studies conducted during dredging in Old River for the ISDP conclude that the materials dredged were suitable for levee reinforcement purposes, under the 1997 State Water Board regulations (California Department of Water Resources 1997).

The remaining spoils, if suitable, would be spread up to 12 inches thick on farmlands in the south Delta. As described in the project description, the soils would be tested prior to any placement on farmland to ensure that the spoils would not adversely affect the composition of the farmland soils. Therefore, there would be no conversion of land resulting from the disposal of the spoils. This impact is considered less than significant. No mitigation is required.

2020 Conditions

Implementation of Alternative 3B under 2020 conditions would result in impacts similar to those described above. The south Delta region would remain primarily agriculture, and similar amounts of land would be converted. Therefore, the impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Implementation of the SDIP would likely allow for increases in water delivery and transfers south of the Delta. The reliability and availability of additional water in these areas may result in changes in land use. Because the exact locations and types of land use changes cannot be determined, the anticipated environmental effects of changing the amount of water exported south of the Delta is addressed in Section 5.1, Water Supply; Section 7.2, Social and Economic Conditions; and Chapter 9, “Growth-Inducing Impacts.”

2020 Conditions

Implementation of Alternative 3B under 2020 conditions would result in impacts similar to those described above. The south Delta region would remain primarily agriculture, and similar amounts of land would be converted. Therefore, the impacts are less than significant, and no mitigation is required.

Alternative 4B

Stage 1 (Physical/Structural Component)

Fish Control Gate

Impact LW-1: Conflicts with Existing Land Uses as a Result of Constructing the Permanent Fish Control Gate. Under Alternative 4B, only the proposed head of Old River fish control gate would be constructed adjacent to, and partially within, lands designated AG-80 General Agriculture (80-acre) (San Joaquin County 2000). A 50,000-square-foot area adjacent to, and south of, the gate would be acquired for use as a settling pond/runoff management basin, and a new access road for maintenance would be constructed north of the gate. Approximately 1.16 acres of agricultural land would need to be acquired and converted to public facility use.

Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091.

Construction of the fish control gate would not result in substantial changes in existing land uses. No significant land use conflicts would result from the construction of the permanent operable gate. Therefore, this impact is less than significant. No mitigation is required.

Impact LW-2: Conversion of Important Farmland to Nonagricultural Use as a Result of Constructing the Permanent Fish Control Gate. Constructing the gate would result in the permanent conversion of approximately 1.16 acres of prime farmland to nonagricultural uses (Table 7.1-1). Because the remaining farmlands would continue to be usable for agriculture, and the relative value of the land would not exceed the NRCS threshold, this impact is considered less than significant. No mitigation is required.

Impact LW-3: Conflict with Williamson Act and Farmland Security Zone Contract Lands as a Result of Constructing the Permanent

Fish Control Gate. Under Alternative 4B, all of the acres affected are subject to Williamson Act contracts; none are currently under FSZ contract. Certain uses are considered compatible uses of land under Williamson Act contracts (contracted lands), including agricultural, open space, and recreational uses, and uses determined by the agency administering the contract to be consistent with the intent of the Williamson Act. Uses of contracted land other than agricultural and open space uses typically are considered incompatible. Conversion to public facility uses would require Williamson Act contracts to be terminated for the portions of contracted land acquired for the SDIP.

The SDIP would require terminating Williamson Act contract; however, contract protections would remain in place for the remaining portions of the affected parcels. A total of up to 1.16 acres of contracted land would be acquired for the SDIP. Because the acquisition of lands for public facilities would result in the automatic termination of Williamson Act contracts for the land area acquired, and the remaining lands in contracted parcels would remain under contract and viable for agricultural use, this impact is considered less than significant. No mitigation is required.

Impact LW-4: Incompatibility with Local Land Use Plans and Policies as a Result of Constructing and Operating the Permanent Fish Gate. Construction and operation of the permanent operable gate at the head of Old River is exempt from the San Joaquin County Zoning Code pursuant to San Joaquin County policy. Furthermore, Government Code Section 53091 states that county zoning ordinances "shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water." Therefore, implementation of SDIP would not be incompatible with local plans and policies. This impact is less than significant. No mitigation is required.

Dredging

Impact LW-5: Conflict with Existing Land Uses as a Result of Dredging in South Delta Channels. The proposed spoils pond sites in Contra Costa County and San Joaquin County would be constructed adjacent to the channel dredging areas and in areas designated General Agriculture (80-acre) (San Joaquin County 2000). Under Alternative 4B, up to eight spoils ponds measuring up to 80 acres each would be located on farmlands adjacent to the dredging areas of West Canal and Middle River, and on the western end of Paradise Island next to Old River. A new access road for maintenance purposes would be constructed north of the gate. Development in areas designated General Agriculture is restricted to agricultural and related uses; other uses generally would require a conditional-use permit. However, public water supply and treatment facilities are exempt from these requirements as set forth in California Government Code Section 53091. Because the conversion of existing land use would be temporary, surrounding land uses would not change, and public water supply and treatment facilities are exempt from General Agriculture land use limitations, this impact is less than significant. No mitigation is required.

Impact LW-6: Incompatibility with Local Land Use Plans and Policies as a Result of Dredging in South Delta Channels. Dredging activities within south Delta channels, including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, and the construction and use of up to eight spoils ponds, are exempt from the San Joaquin County Zoning Code pursuant to San Joaquin County policy. Furthermore, Government Code Section 53091 states that county zoning ordinances "shall not apply to the location or construction of facilities for the production, generation, storage, or transmission of water." Dredging activities and spoils ponds are not specifically identified as an allowable or conditional use according to the San Joaquin County Zoning Code; however, the proposed dredging and spoils ponds would not be incompatible with the San Joaquin County zoning and General Plan designations as they are a part of a water transmission program. Therefore, this impact is less than significant. No mitigation is required.

Impact LW-7: Temporary Conversion of Important Farmland to Nonagricultural Use from the Construction of Spoils Settling Ponds for Channel Dredging. Dredging in south Delta channels including Old River, Middle River, West Canal, Grant Line Canal, and Victoria and North Canals, would result in the production of approximately 294,000 cy of spoils material. The dredge spoils would be decanted in up to eight spoils ponds measuring approximately 80 acres each; total combined acreage would be approximately 205 acres. The spoils ponds would be located on farmlands adjacent to the dredging areas of West Canal and Middle River, and on the western end of Paradise Island next to Old River.

Construction of the spoils ponds would occur within each 80-acre perimeter, using local soils as pond berms. The spoils ponds could be used several times over a period of up to 5 years. After the final use, the spoils ponds would be decommissioned, which would involve the complete excavation of remaining spoils, site leveling, and the return of the sites to as close to preproject conditions as possible.

The total acreage to be used by the project for spoils ponds, approximately 205 acres, for up to 5 years, is a considerable amount of farmland, and could be considered nonfarmland by the Department of Conservation's FMMP for up to three update cycles (6 years). However, because the spoils ponds are temporary facilities, would not result in permanent conversion of farmland to nonagricultural use, and would be returned to preproject conditions to the maximum extent practicable, this impact is considered less than significant. No mitigation is required.

Impact LW-8: Conversion of Important Farmland to Nonagricultural Use as a Result of Spoils Disposal from Channel Dredging. After the spoils from dredging south Delta channels are decanted in the spoils ponds, the spoils would be disposed of by one of two methods. Approximately 5% of the total spoils would be placed at sites on the landside of levees in the project area that are in need of additional reinforcing material. The second method of disposal proposed is the dispersal of approximately 95% of the spoils over farmlands adjacent to one or more of the project area channels.

The first method, levee reinforcement, would not involve disturbance to farmlands, would include CALFED Programmatic Mitigation Measure 20, and would therefore not result in the conversion of important farmland to nonagricultural use. Studies conducted during dredging in Old River for the ISDP conclude that the materials dredged were suitable for levee reinforcement purposes, under the 1997 State Water Board regulations (California Department of Water Resources 1997).

The remaining spoils, if suitable, would be spread up to 12 inches thick on farmlands in the south Delta. As described in the project description, the soils would be tested prior to any placement on farmland to ensure that the spoils would not adversely affect the composition of the farmland soils. Therefore, there would be no conversion of land resulting from the disposal of the spoils. This impact is considered less than significant. No mitigation is required.

2020 Conditions

Implementation of Alternative 4B under 2020 conditions would result in impacts similar to those described above. The south Delta region would remain primarily agriculture, and similar amounts of land would be converted. Therefore, the impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Implementation of Alternative 4B would likely allow for increases in water delivery and transfers south of the Delta. The reliability and availability of additional water in these areas may result in changes in land use. Because the exact locations and types of land use changes cannot be determined,the anticipated environmental effects of changing the amount of water exported south of the Delta is addressed in Section 5.1, Water Supply; Section 7.2, Social and Economic Conditions; and Chapter 9, “Growth-Inducing Impacts.”

2020 Conditions

Implementation of Alternative 4B under 2020 conditions would result in impacts similar to those described above. The south Delta region would remain primarily agriculture, and similar amounts of land would be converted. Therefore, the impacts are less than significant, and no mitigation is required.

Cumulative Evaluation of Impacts

Cumulative impacts on Land and Water Use are analyzed in Chapter 10, “Cumulative Impacts.” This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

7.2 Social and Economic Conditions

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on social and economic conditions. Specifically, it evaluates and discusses the consequences associated with construction and operation of the project and recommends measures to mitigate significant impacts. Significance of impacts is determined by using significance criteria set forth in the State CEQA Guidelines.

The primary concerns related to social and economic conditions are effects on employment, housing, and businesses.

Summary of Significant Impacts

No significant impacts on social and economic conditions are expected to occur as a result of constructing or operating the SDIP. Social and economic impacts are discussed in detail in the Environmental Consequences section.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- California Department of Finance databases;
- California Department of Water Resources Bulletins;
- California Employment Development Department databases;
- United States Census Bureau databases; and
- United States Department of Agriculture, National Agricultural Statistics Service database.

Local Setting

This section describes the social and economic conditions in the counties that would be directly affected by constructing and operating the SDIP. These counties are San Joaquin, Contra Costa, and Alameda.

Population

Population is growing in San Joaquin, Contra Costa, and Alameda Counties because of lower housing costs (compared to the western San Francisco Bay Area), and a growing and diversifying economy in those counties (Table 7.2-1). Although the counties are growing, a significant portion of the population resides in unincorporated areas. By 2020, population in San Joaquin, Contra Costa, and Alameda Counties is expected to increase by 45%, 16%, and 21%, respectively.

Table 7.2-1. Population Trends in San Joaquin, Contra Costa, and Alameda Counties

	San Joaquin	Contra Costa	Alameda
Population total (January 1, 2003)	613,500	994,900	1,496,200
% increase since 1995	17.5	14.0	12.1
% increase since 2002	2.8	1.4	0.8
Expected population in 2020	887,600	1,152,900	1,811,800
Expected % increase in 2020	44.7	15.9	21.1
% in unincorporated areas (2003)	22	15.8	9.3

Employment

The employment rate in the three-county area has been fairly robust, given the slowdown in the computer and technology industry in the Bay Area. It appears that smaller and more diversified technology firms are moving into the counties to take advantage of more affordable rents and filling market niches. The unemployment rate in San Joaquin County is slightly higher than in Alameda and Contra Costa. The higher unemployment rate reflects seasonal employment attributable to the agriculture sector (Table 7.2-2). Overall, all three counties are expecting growth in jobs through 2006.

Table 7.2-2. Employment Trends in San Joaquin, Contra Costa, and Alameda Counties

	San Joaquin	Contra Costa and Alameda*
2002 civilian labor force	274,900	1,290,900
2002 unemployment rate (%)	10	6.1
% non-farm employment	92	99.7
Expected growth of non-farm employment (% from 1999 through 2006)	18.7	17.5

* Both Alameda and Contra Costa Counties are in the Oakland Metropolitan Statistical Area (MSA).

San Joaquin County

San Joaquin County is located in central California, to the east of the San Francisco Bay Area. The county has extensive transportation facilities in Stockton, an inland port: five railroads, one airport, and north-south and east-west interstates that provide timely transportation of passengers and goods. The county's gateway location and transportation facilitates will facilitate future employment growth in the service and industry sectors. Currently, services, government, and retail trade are the three largest industries (California Employment Development Department 2002a). Agriculture remains an important sector in San Joaquin County; it ranks sixth in production ($1.4 billion) for the state and supports dependent industries such as food processing, wholesale trade, and transportation (U.S. Department of Agriculture 2001).

Contra Costa County

Industrial activity in Contra Costa County is located near the western and northern borders with San Francisco, Suisun, and San Pablo Bays. Residential, commercial, and light industrial land uses are located more inland. The county's transportation network includes the San Francisco Bay Area Rapid Transit District (BART), attracting commercial and residential development (California Employment Development Department 2002b). The services industry dominates the Contra Costa County job base. Growth is expected to be concentrated in business (including high technology), health services (including biotechnology), manufacturing (food and clothing), and retail trade.

Alameda County

Employment in Alameda County is based on manufacturing, services, wholesale and retail businesses, and trade. Trade is expected to be a major growth industry in the future. The Emeryville-Alameda-Oakland area is a haven for businesses and business services looking for affordable office space, housing, and shorter commutes than into the western Bay Area (California Employment Development Department 2002c).

Housing and Income

Available housing in the three-county area is scarce. Affordable rentals and homes for sale, compared to the western Bay Area, are causing residents to relocate to San Joaquin, Contra Costa, and Alameda Counties (Table 7.2-3). The most affordable housing in the three-county area is in San Joaquin County.

Income in the three counties spans a somewhat wide range. San Joaquin County has the lowest median household and per capita incomes of the three counties.

Table 7.2-3. Housing Supply and Costs in San Joaquin, Contra Costa, and Alameda Counties

	San Joaquin	Contra Costa	Alameda
Housing units as of January 1, 2003	201,398	366,397	551,137
Single-family (% increase)	152,286 (30.7)	272,320 (19.0)	335,469 (12.0)
Multifamily (% increase)	39,760 (1.5)	86,386 (11.9)	208,018 (8.5)
Mobile homes	9,352	7,591	7,650
Average persons per household	3.1	2.8	2.7
% vacancy rate	< 4	2.92	3.0
% units in unincorporated areas	21.3	16.1	9.1
New housing unit permits issued (2000)	5,323	5,639	4,208
Median rent (2000)	$617	$898	$852
Median house sale price	$142,400	$267,800	$303,100
Median household income (1999)	$41,282	$63,675	$55,946
Per capita income	$23,242	$41,110	$38,624

San Joaquin County

Stockton, the county's largest city, had 42.7% of the housing units in 2003; Tracy, the second largest city, had 10.7%; and Manteca, the fourth largest city, had 9.5%. Rent and housing sales prices are likely to increase over time. The lower cost of living in San Joaquin County is still significant enough to induce residents from the San Francisco Bay Area to relocate and to attract new development to the Central Valley. The income trend is expected to increase as more people move into the county and as the county's economic base becomes more diversified.

Contra Costa County

The three most populous cities in Contra Costa County are Concord, Richmond, and Antioch, and their share of the county's total housing units is 12.4%, 9.9%, and 9.0%, respectively. Housing values are still reasonable compared to the western Bay Area counties. As Contra Costa County's industries diversify and grow, it is expected that income will rise as well.

Alameda County

Oakland is the county's largest city (with 29% of the housing units), followed by Fremont (12.8%), Hayward (8.5%), and Berkeley (8.5%). The median rent is the second highest in the three-county study area. Alameda County's median home sales price is the highest at 13% above Contra Costa County's home sales price and 113% above San Joaquin County's home sales price.

Regional Setting

The regional setting of the project includes much of the area served by the SWP. The 29 long-term water supply contractors of the SWP are organized into six service areas: Feather River, North Bay, South Bay, Central Coast, San Joaquin Valley, and Southern California. The service areas discussed below are the South Bay, Central Coast, San Joaquin Valley, and Southern California. It is expected that the service areas north of the project (Feather River and North Bay) will not be affected by the project.

This section provides general socioeconomic information for the SWP service areas affected by the project. The information is provided at the county level, although the service areas do not necessarily follow county boundaries. The county-level data are indicative of overall demographic and economic trends within the service areas. This section also provides information on water supply and demand for the SWP service areas potentially affected by the project.

South Bay Service Area

The South Bay service area includes the eastern portion of Alameda County and all of Santa Clara County. Although no part of the project is located in Alameda County, the project is close to the northeast county boundary. The water contractors in this service area are the Alameda County Flood Control and Water Conservation District, Zone 7 (serving all of East Alameda County), the Alameda County Water District, and the Santa Clara Valley Water District.

Alameda County borders San Francisco Bay on the Bay's eastern boundary and is one of the three counties in the local project area. Alameda is currently the second-most-populous Bay Area county. The county has a diverse economic and job base, including a major seaport, manufacturing, services, and wholesale and retail businesses. Trade is expected to be a major growth industry through 2006. Recent employment growth has been in engineering and management and other services sectors resulting from the arrival of technology firms to the county (California Employment Development Department 2002c). Agriculture is a small industry in Alameda compared to other counties receiving SWP allocations and consists mostly of ornamental nursery products, wine grapes, and cattle (U.S. Department of Agriculture 2001). The cost of land for development, housing, and office and retail space remains lower than the western Bay Area, thus attracting new residents and businesses to the central and eastern portions of the county.

Santa Clara County borders San Francisco Bay and Alameda County to the south. It is the most populous county in the Bay Area and has the highest median household income (California Department of Finance 2002a). The county's economic base is predominantly services and manufacturing. The unemployment rate started to rise sharply in 2001 and 2002 concurrent with the downturn in the technology industry, but despite the downturn, new jobs are expected to be created in computer-related fields (California Employment Development

Department 2002d). For an urbanized Bay Area county, Santa Clara's agricultural sector is strong, ranking twenty-third in the state. The major commodities are nursery crops, mushrooms, and cut flowers. The county historically has experienced a housing imbalance where housing values were too high for many people to live near their work.

In 2000, the South Bay service area received 195,583 acre-feet of SWP water deliveries (California Department of Water Resources 2002b). M&I water supply in the South Bay service area is limited, as it is in many California urban areas, constraining growth and forcing conservation practices. The 4.9% increase in annual water use includes water savings from conservation practices. Agriculture in this service area is unlikely to grow and, in fact, agricultural acreage may decrease in response to urban development pressures.

Central Coast Service Area

The Central Coast service area includes all of San Luis Obispo and Santa Barbara Counties. The water contractors in this service area are the San Luis Obispo County Flood Control and Water Conservation District and the Santa Barbara County Flood Control and Water Conservation District. The Central Coast water contractors did not receive their SWP entitlements until July 1997 when the Coastal Branch of the SWP was opened.

San Luis Obispo County's economy is based largely on tourism and education, resulting in a job base centered around services, government (local), and retail trade. San Luis Obispo County ranked seventeenth in agricultural production in 2001. The leading commodities were wine grapes, cattle and calves, broccoli, head lettuce, foliage plants, and cut flowers (U.S. Department of Agriculture 2001).

Santa Barbara County's economy comprises mainly services, retail trade, and government (education, federal prison, and Vandenberg Air Force Base). Smaller technology manufacturing and service firms have filled business niches left by downsizing in the aerospace and military sectors, helping to keep the unemployment rate down. The county ranked thirteenth in 2001 in agricultural revenue in California. The top commodities were wine grapes, broccoli, strawberries, head lettuce, and cauliflower (U.S. Department of Agriculture 2001). The decrease in agricultural water demand is attributed to farmland being converted to accommodate the predicted urban growth in San Luis Obispo and Santa Barbara Counties.

San Joaquin Valley Service Area

The San Joaquin Valley service area consists of all of Kings County and the western half of Kern County. The water contractors in this service area include the County of Kings, Castaic Lake Water Agency, Dudley Ridge Water District, Empire West Side Irrigation District, Kern County Water Agency, and Tulare

Lake Basin Water Storage District. The service area also includes the Oak Flat Agricultural District, near Patterson in Stanislaus County.

Kings County is the seventh-fastest-growing county in California with Avenal, Hanford, and Lemoore leading the growth. Government, agriculture, services, and retail trade are the main industries in the county. Food processing and its sector of manufacturing are gaining in the county, diversifying the already-significant agricultural sector in the county. The unemployment rate appears high, but it is affected by seasonal fluctuations in agricultural employment. The county ranks twelfth in the state for agricultural production. Milk, cotton, cattle and calves, alfalfa, and turkeys are the leading commodities.

Kern County's fastest growing cities are Bakersfield, Delano, Ridgecrest, and Wasco. Historically, Kern County's economy has been supported by agriculture and petroleum production. It was California's fourth largest agriculture-producing county in 2001. The leading commodities were table grapes, citrus, milk, cotton and cottonseed, and almonds (U.S. Department of Agriculture 2001). Increasingly, Kern County's economy is diversifying into government (local and education), services, and value-added agriculture. Kern County has a transportation network that makes it appealing for companies looking for access to regional markets and distribution points. Similar to Kings County, seasonal unemployment in the agricultural sector raises the average unemployment rate.

The San Joaquin service area is one of the largest recipients of SWP water deliveries. In 2000, the service area received approximately 1.5 maf (California Department of Water Resources 2002b). A large portion of California's anticipated future growth is expected to occur in the Central Valley. The momentum of this predicted growth is based on demographic and migration trends; therefore, additional deliveries in SWP water will have only a minor, if any, impact on growth. Agriculture is expected to decline because of lack of water supply, urban development, and other environmental changes.

Southern California Service Area

The Southern California service area is the largest inland area and has the largest population. It encompasses almost all of Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties, and portions of Imperial and Ventura Counties[1]. There are 13 SWP contractors in the Southern California service area.

Southern California is the most populous region of the state; Los Angeles County is the most populated county, and Orange County is the second most populated. A total of 19,458,500 people lived in Los Angeles, Orange, San Diego, Riverside, and San Bernardino Counties in January 2003. This represents 55% of California's population. If the populations of Imperial and Ventura Counties are added, the population increases to 20,400,700, or 57% of the state population

[1] A small portion of Kern County is located in the Southern California service area; however, Kern County is discussed in the San Joaquin service area discussion.

(California Department of Finance 2003a). Growth is expected in the western portions of Riverside, San Bernardino, and Imperial Counties as people move away from the congested and relatively more expensive urban areas of Los Angeles, Orange, and San Diego Counties.

Environmental Consequences

Social and economic conditions may be affected in the project area during construction of the gates, dredging activities associated with project construction and operation, and the operation of the alternatives. These potential impacts are examined for the local project area (defined as San Joaquin, Contra Costa, and Alameda Counties) and for the South Bay, Central Coast, San Joaquin Valley, and Southern California SWP service areas.

Significance Criteria

Socioeconomic impacts were considered significant if construction and/or operation of the project alternatives would result in a substantial:

- increase in unemployment or decrease in personal income,
- change in the availability of housing, or
- disruption of local businesses.

Alternative 1 (No Action)

Under Alternative 1, the temporary barriers would continue to be installed, operated, and removed. The length of time the barriers are in place would not change, nor would employment and expenditures resulting from construction and operation of the barriers. Disruption of boating and associated effects on recreation-related businesses in the vicinity of the barriers would continue. In addition, the capacity of water conveyance facilities to transport water south of the Delta would not change.

No socioeconomic impacts are expected to occur in the local or export study areas because operation of the barriers and water conveyance facilities under the No Action Alternative would not change compared to existing conditions.

2020 Conditions

Under Future No Action conditions (2020 conditions), SDIP would not be implemented. It is expected that the temporary barriers program would continue to be implemented. It is also expected that no socioeconomic impacts would occur in the local or export study areas because operation of the barriers and water conveyance facilities under Future No Action conditions would not change compared to existing conditions.

Alternatives 2A, 2B, and 2C

Stage 1 (Physical/Structural Component)

Impact Soc-1: Temporary Increase in Employment and Income in the Local Area during Project Construction. The population of the local study area is estimated to increase by 192 people during construction. This increase includes construction workers and dependents that are expected to relocate to the area during the construction and dredging period. This would represent a very small increase in the study area population of approximately 3.1 million.

Construction of the gates and associated facilities would temporarily increase employment and personal income within the local study area. Employment during the construction period is estimated to increase by 210 jobs (Table 7.2-4). Total personal income associated with construction-related expenditures (salaries and purchases of equipment and supplies) is estimated to total $10.3 million (Table 7.2-5).

Table 7.2-4. Estimated Direct and Indirect/Induced Changes in Construction-Related Employment

	Employment		
Alternative	Direct	Indirect + Induced	Total
2A	140	70	210
2B	140	70	210
2C	140	70	210
3B	140	59	199
4B	120	48	168

The estimates of direct and indirect/induced changes in employment and income were evaluated based on the following estimated expenditures to construct the gates and dredge channels:

- construction would last up to 32 months,
- materials and supplies would constitute 50% of total construction costs,
- 6% of materials and supplies would be purchased locally, and
- 60% of construction workers would originate from the local study area.

Table 7.2-5. Estimated Direct and Indirect/Induced Changes in Personal Income Resulting from Construction-Related Expenditures

Alternative	Personal Income		
	Direct	Indirect + Induced	Total
2A	$6,950,727	$2,113,985	$9,064,712
2B	$6,950,727	$2,113,985	$9,064,712
2C	$6,950,727	$2,113,985	$9,064,712
3B	$5,438,743	$1,293,699	$6,732,422
4B	$3,801,600	$837,892	$4,639,492

The estimates of direct and indirect/induced changes in employment and income were evaluated based on the following estimated expenditures to construct the gates and dredge channels:

- construction would last up to 32 months,
- materials and supplies would constitute 50% of total construction costs,
- 6% of materials and supplies would be purchased locally, and
- 60% of construction workers would originate from the local study area.

Construction of the permanent gates and dredging activities would benefit the local economy by temporarily increasing employment and personal income. However, these changes would be very small relative to the total economic activity occurring within the local study area. Construction-related employment would represent a small fraction of total employment and personal income levels. The impact on employment is considered beneficial. No mitigation is required.

Impact Soc-2: Temporary Increase in Demand for Housing in the Local Area during Project Construction. The change in the demand for housing attributable to Alternatives 2A–2C is linked to the 192-person temporary increase in population. Assuming three persons per family, 64 housing units would be required to accommodate this expected temporary population increase. There are approximately 1,094,400 housing units, excluding motor homes, in the three-county area (California Department of Finance 2003b). Given the average county vacancy rate of 3.7%, there are about 40,500 vacant units in the area. The demand for the additional 64 units represents approximately 0.2% of the vacant units.

The change in vacancy rates attributable to the project would be very small, and the supply of available housing is not expected to change. This impact is less than significant. No mitigation is required.

Impact Soc-3: Disruption of Local Businesses as a Result of Construction of the Gates. No direct impacts on local business would occur because none are located at the sites of the permanent gates. Indirect effects on marinas located near the gates may occur during construction as a result of increasing travel times for boaters. DWR would continue to provide a system for transporting boats around the construction site similar to the system used when the temporary barriers are in place. Although the transportation system may take slightly longer to transport boats around the construction site compared to the time required to transport boats around the temporary barriers, the additional time is not expected to substantially reduce the number of boats passing through the construction site. Boating opportunities and travel time to and from businesses would not substantially change during the construction period; therefore, there is not expected to be a substantial change in business activity related to boating or other water-dependent recreation activities. This impact is less than significant. No mitigation is required.

Impact Soc-4: Permanent Increase in Employment and Income in the Local Area during Project Operation. Seven jobs would be created as a result of operating the gates (Table 7.2-6). Total annual personal income generated by operation-related expenditures (salaries and purchases of equipment and supplies) is estimated to be $385,000 (Table 7.2-7).

Table 7.2-6. Estimated Direct and Indirect/Induced Changes in Employment Resulting from Operation-Related Expenditures

	Employment		
Alternative	Direct	Indirect + Induced	Total
2A	5	2	7
2B	5	2	7
2C	5	2	7
3B	4	2	6
4B	2	1	3

The estimates of direct and indirect/induced changes in employment and income were evaluated based on the following estimated expenditures to construct and operate the proposed gates:

- construction would last up to 32 months,
- materials and supplies would constitute 50% of total construction costs,
- 6% of materials and supplies would be purchased locally, and
- 60% of construction workers would originate from the local study area.

Table 7.2-7. Estimated Direct and Indirect/Induced Changes in Personal Income Resulting from Operation-Related Expenditures

Alternative	Personal Income		
	Direct	Indirect + Induced	Total
2A	$300,000	$85,000	$385,000
2B	$300,000	$85,000	$385,000
2C	$300,000	$85,000	$385,000
3B	$240,000	$68,000	$308,000
4B	$120,000	$34,000	$154,000

The estimates of direct and indirect/induced changes in employment and income were evaluated based on the following estimated expenditures to construct and operate the proposed gates:

- construction would last up to 32 months,
- materials and supplies would constitute 50% of total construction costs,
- 6% of materials and supplies would be purchased locally, and
- 60% of construction workers would originate from the local study area.

Operation of the permanent gates would benefit the local economy by increasing employment and personal income. However, these changes would be very small relative to the total economic activity occurring in the local study area. Permanent employment would represent a small fraction of the total employment and personal income levels. This impact is beneficial. No mitigation is required.

Impact Soc-5: Increase in Demand for Housing in the Local Area. No impact on the availability of housing in the study area is expected as a result of operating the gates. No increase in the demand for housing is expected because gate operators would be hired from the local area. No mitigation is required.

Impact Soc-6: Disruption of Local Businesses as a Result of Operation of the Gates. Operation of the gates is not expected to substantially affect marinas located near the gates. When the gates are operating, travel time for boats passing through the boat locks may be slightly longer than the time required to pass around the temporary barriers. Travel time trough the gates during off-season periods would not be affected because the gates would remain open. Although the time required to pass through permanent gates may be longer, the additional time is not expected to substantially reduce the number of boats navigating the waterways crossed by the gates. Boating opportunities would not change and travel time to and from local businesses would not substantially increase as a result of operating the permanent gates. Because boating opportunities in the affected waterways will be maintained, little change in business activity generated by boating or other water-dependent recreation is expected. This impact is less than significant. No mitigation is required.

2020 Conditions

Construction-related impacts on the local area resulting from implementation of Alternatives 2A–2C under 2020 conditions would be similar to those described above because construction activities would be similar to those proposed under existing conditions. Therefore, impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Impact Soc-7: Change in Economic Benefits in the SWP and CVP Service Areas as a Result of Increased Diversions. An evaluation of the M&I and agricultural economic benefits of changing water deliveries to the SWP and CVP service areas was conducted (Appendix O). The analysis concluded that annual M&I and agricultural water supply economic benefits attributable to Alternative 2A would total approximately $8.7 million and $9.5 million, respectively. Under Alternative 2B, M&I water benefits would decrease by $8.4 million and agricultural benefits would total $1.6 million. Annual M&I and agricultural water supply economic benefits attributable to Alternative 2C would total approximately $5.4 million and $4.4 million, respectively.

2020 Conditions

Operation-related impacts on the local area resulting from the implementation of Alternatives 2A–2C under 2020 conditions would be similar to those described above because operation would be the same as proposed under existing conditions. Therefore, impacts would be the same as described above.

Interim Operations

Interim operations would result in impacts on socioeconomics similar to those described for permanent operations of the SDIP. All impacts are less than significant, and no mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Impact Soc-1: Temporary Increase in Employment and Income in the Local Area during Project Construction. The population of the local study area is estimated to increase by 192 people during construction of the three gates. This increase includes construction workers and dependents that are expected to relocate to the local study area during the construction period. This would represent a very small increase in the study area population of approximately 3.1 million.

Construction of the gates and associated facilities would temporarily increase employment and personal income within the local study area. As shown in Table 7.2-4, employment during the construction period is estimated to increase by 199 jobs. Total annual personal income associated with construction-related expenditures (salaries and purchases of equipment and supplies) is estimated to total approximately $6.7 million (Table 7.2-5).

Construction of the permanent gates and associated facilities would benefit the local economy by temporarily increasing employment and personal income. However, these changes would be very small relative to the total economic activity occurring within the local study area. Construction-related employment would represent a small fraction of total employment and personal income levels. The impact on employment and income is considered beneficial. No mitigation is required.

Impact Soc-2: Temporary Increase in Demand for Housing in the Local Area during Project Construction. The impacts on housing would be nearly the same as described for Alternatives 2A–2C. Temporary impacts on housing are considered less than significant, and no mitigation is required.

Impact Soc-3: Disruption of Local Businesses as a Result of Construction of the Gates. Impacts on local businesses during construction of the gates would be the same as described for Alternatives 2A–2C. Impacts on local business are considered less than significant, and no mitigation is required.

Impact Soc-4: Permanent Increase in Employment and Income in the Local Area during Project Operation. Six jobs would be created as a result of operating the gates (Table 7.2-6). Total annual personal income generated associated with operation-related expenditures (salaries and purchases of equipment and supplies) is estimated to total $308,000 (Table 7.2-7).

Operation of the permanent gates would benefit the local economy by increasing employment and personal income. However, these changes would be very small relative to the total economic activity occurring within the local study area. Permanent employment would represent a small fraction of the total employment and personal income levels. This increase in employment and income is considered a beneficial impact. No mitigation is required.

Impact Soc-5: Increase in Demand for Housing in the Local Area. The impact on housing would be the same as described for Alternatives 2A–2C. The impact on housing is considered less than significant because gate operators would be hired from the local area. No mitigation is required.

Impact Soc-6: Disruption of Local Businesses as a Result of Operation of the Gates. The impact on local businesses when the gates are operating would be the same as described for Alternatives 2A–2C. This impact is considered less than significant, and no mitigation is required.

2020 Conditions

Construction-related impacts on the local area resulting from implementation of Alternatives 3B under 2020 conditions would be similar to those described above because construction activities would be similar to those proposed under existing conditions. Therefore, impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Impact Soc-7: Change in Economic Benefits in the SWP and CVP Service Areas as a Result of Increased Diversions. An evaluation of the M&I and agricultural economic benefits of changing water deliveries to the SWP and CVP service areas was conducted (Appendix O). Under Alternative 3B, M&I water benefits would decrease by $8.4 million and agricultural benefits would total $1.6 million.

2020 Conditions

Operation-related impacts on the local area resulting from the implementation of Alternative 3B under 2020 Conditions would be similar to those described for existing conditions because operation would be the same. Therefore, impacts would be the same as described above.

Alternative 4B

Stage 1 (Physical/Structural Component)

Impact Soc-1: Temporary Increase in Employment and Income in the Local Area during Project Construction. The population of the local study area is estimated to increase by 72 people during construction of the gate. This increase includes construction workers and dependents that are expected to relocate to the local study area during the construction period. This would represent a very small increase in the study area population of approximately 3.1 million.

Construction of the gate and associated facilities would temporarily increase employment and personal income within the local study area. As shown in Table 7.2-4, employment during the construction period is estimated to increase by 168 jobs. Total annual personal income associated with construction-related expenditures (salaries and purchases of equipment and supplies) is estimated to total approximately $4.6 million (Table 7.2-5).

Construction of the permanent gate and associated facilities would benefit the local economy by temporarily increasing employment and personal income. However, these changes would be very small relative to the total economic activity occurring within the local study area. Construction-related employment would represent a small fraction of total employment and personal income levels. This impact is beneficial. No mitigation is required.

Impact Soc-2: Temporary Increase in Demand for Housing in the Local Area during Project Construction. The impacts on housing would be the same as described for Alternatives 2A–2C. Temporary impacts on housing are considered less than significant, and no mitigation is required.

Impact Soc-3: Disruption of Local Businesses as a Result of Construction of the Gates. Impacts on local businesses during construction of the gate would be similar to the impacts described for Alternatives 2A–2C, but slightly less as Alternative 4B would construct only the head of Old River fish control gate. Impacts on local business are considered less than significant, and no mitigation is required.

Impact Soc-4: Permanent Increase in Employment and Income in the Local Area during Project Operation. Three jobs would be created as a result of operating the gate (Table 7.2-6). Total annual personal income generated associated with operation-related expenditures (salaries and purchases of equipment and supplies) is estimated to total $154,000 (Table 7.2-7).

Operation of the permanent gate would benefit the local economy by increasing employment and personal income. However, these changes would be very small relative to the total economic activity occurring within the local study area. Permanent employment would represent a small fraction of the total employment and personal income levels. This impact is beneficial. No mitigation is required.

Impact Soc-5: Increase in Demand for Housing in the Local Area. The impact on housing would be slightly less than described for Alternatives 2A–2C. The impact on housing is considered less than significant because gate operators would be hired from the local area. No mitigation is required.

Impact Soc-6: Disruption of Local Businesses as a Result of Operation of the Gates. The impact on local businesses when the gate is operating would be similar to the impact as described for Alternatives 2A–2C. Only the head of Old River fish control gate would be constructed, and therefore fewer businesses have the potential to be disrupted. This impact is considered less than significant, and no mitigation is required.

2020 Conditions

Construction-related impacts on the local area resulting from implementation of Alternative 4B under 2020 Conditions would be similar to those described above because construction activities would be similar to those proposed under existing conditions. Therefore, impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Impact Soc-7: Change in Economic Benefits in the SWP and CVP Service Areas as a Result of Increased Diversions. An evaluation of the M&I and agricultural economic benefits of changing water deliveries to the SWP and CVP service areas was conducted (Appendix O). Under Alternative 4B, M&I water benefits would decrease by $8.4 million and agricultural benefits would total $1.6 million.

2020 Conditions

Operation-related impacts on the local area resulting from the implementation of Alternative 4B under 2020 Conditions would be similar to those described for existing conditions because operation would be the same. Therefore, there are no impacts.

Cumulative Evaluation of Impacts

Cumulative impacts on social and economic conditions are analyzed in Chapter 10, "Cumulative Impacts." This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

7.3 Utilities and Public Services

Introduction

This section describes the existing environmental conditions and the impacts of the SDIP alternatives on utilities and public services such as electricity, water supply, wastewater, and emergency services. The significance of impacts was determined based on guidance set forth in the State CEQA Guidelines.

Summary of Significant Impacts

There are no significant impacts on utilities and public services as a result of constructing or operating any of the alternatives. All impacts are discussed in detail under the Environmental Consequences section.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- Draft EIR/EIS for the ISDP, Volume I, July 1996;
- Contra Costa County General Plan 1995–2010, July 1996;
- San Joaquin County General Plan 2010, Volume I: Policies/Implementation, July 1996; and
- Site visit conducted on July 17, 2003.

Electricity

Electricity in the project vicinity is provided via high-voltage overhead transmission lines and associated substations and distribution lines to local customers. Several sets of high-voltage transmission lines traverse the area and are typically located within 100- to 120-foot-wide rights-of-way. Distribution lines are typically aligned parallel to the public roadways at an average height of 35 feet and provide electricity to individual users. Many of the distribution lines are visible from the local roadways in the project vicinity.

In the south Delta, most of the transmission lines are 230 kilovolts (kV), but others range from 60 to 500 kV. The Western Area Power Administration (WAPA) operates and maintains two sets of high-voltage transmission lines that cross West Canal. One line is aligned in a roughly southeast-northwest direction immediately south of the existing CCF intake and continues across the Byron

Tract. The second line is aligned in a northeast-southwest direction from the CVP Tracy facility (south of the forebay), across Union Island, then traverses the Middle River and continues across Middle Roberts Island in a northeast-southwest direction. Three 230-kV transmission lines connect into the nearby Tracy Substation.

The Pacific Gas and Electric Company (PG&E) operates and maintains one high-voltage transmission line in the project vicinity that is aligned in a southwest-northeast direction from the Naglee-Burke Tract; traverses the Tom Paine Slough, Paradise Cut, Old River, Middle River; continues across the Upper Roberts Island; and crosses the San Joaquin River. A second transmission line is aligned in a southwest-northeast direction from the Tom Paine Slough, across the southwest side of the Pescadero Tract, Paradise Cut, and across the southwest side of Stewart Tract.

Natural Gas

Chevron, Standard Oil, and Unocal operate and maintain several underground gas pipelines that transport natural gas and oil through the area southwest of CCF. These pipelines range from 6 to 20 inches in diameter. Most of these pipelines are aligned in a northwest-southeast direction near the Byron Highway. Natural gas pipelines also cross the eastern portion of the south Delta. Two major trunk lines cross San Joaquin County and are bisected by branch delivery lines. These natural gas delivery lines are not accessible to individual users. Many of the residential and agricultural customers in the project vicinity use on-site tanks for their gas supply.

Several gas fields in the Lathrop-Stockton area have conveyance pipelines that range from 4 to 12 inches in diameter. These gas fields are located at Roberts Island, Union Island, Lathrop, and Stockton. Natural gas pipeline markers are located along many of the local roadways in the project vicinity, and the Union Island Gas Field Central Production Facility is located along Howard Road.

Water Supply and Distribution

Water supply and distribution in the project vicinity are provided by a wide range of systems that serve statewide, regional, and individual needs. These range from large-scale elements of the SWP and CVP to the pumps and wells serving individual agricultural and residential uses.

As part of the SWP, the statewide systems in the project area include the California Aqueduct, CCF, DMC, and SWP Banks and CVP Tracy. The California Aqueduct and the DMC transport water from the south Delta to southern California. The SWP Banks facility diverts water through CCF into the California and South Bay aqueducts and on to contracting agencies in the San Francisco Bay Area, San Joaquin Valley, and southern California. The Delta

Field Division of the SWP maintains and manages these facilities and has offices adjacent to SWP Banks.

Regional water supply and distribution are administered by several agencies. In northeastern Alameda County, the Alameda County Flood Control and Water Conservation District for Zone 7 directs water resource management and watershed protection. Bethany Reservoir, located about 2 miles southwest of the Alameda/San Joaquin county line, serves as a major water storage site for this service provider. Contra Costa County's water supply is managed by special service districts and municipalities; few of these providers serve the project vicinity.

Most individuals rely primarily on individual wells and pumps, and several of the public and private suppliers tap groundwater supplies for the individual users. This includes residents of the nearby Bethel Island, Knightsen, Byron, and Discovery Bay areas. Southwestern San Joaquin County relies heavily on well water and exported fresh water from the Delta. San Joaquin County's Delta Planning Area is served by individual private water systems.

Water is supplied to individual users either by wells or directly from Delta waterways. Wells are used in Contra Costa County, but increasing concentrations of nitrates in the groundwater supply have limited their continued use or expansion. Approximately 75 miles of channels in the south Delta provide irrigation for adjacent farmlands through diversion pumps and siphons. A tidal pump control structure exists at the Tom Paine Slough. In San Joaquin County, agricultural water users include riparian rights users, agricultural users with private wells, water conservation districts, and irrigation districts.

Stormwater Drainage

Typically, stormwater drainage networks consist of both natural and human-made conveyance systems to collect, convey, and store runoff resulting from a storm event. Most stormwater drainage systems in urban areas and in some rural areas are managed by flood control districts. However, with the exception of the communities of Discovery Bay and Byron, most of the south Delta area is located in unmanaged stormwater drainage areas. As a result, most of the area in the vicinity of the project, including the proposed facility sites, is not served by highly developed stormwater drainage systems.

Impervious surfaces in the south Delta area are limited to roads, other small sections of pavement, and areas developed into rural residential or agricultural structures. The south Delta's agricultural area is drained primarily by overland flow into human-made ditches, natural drainage swales, and watercourses that discharge into Delta waterways.

Wastewater

Municipal and industrial wastewater is typically transported to a treatment facility, treated, and then the treated effluent is discharged into a receiving water body. Wastewater generated in the project vicinity is handled by sanitary sewer systems, treatment plants, and individual septic systems. Agricultural land in northeastern Alameda County is served mainly by on-site septic systems. In much of rural Contra Costa County, the use of septic tanks and leachfields is not feasible because of shallow water tables, high nitrate concentrations in groundwater, and soils with poor percolation.

The Contra Costa Water District operates a sanitary sewer and a 12.6 million gallons per day (mgd) treatment plant for the portion of the project area near Discovery Bay. Byron, Oakley, and Brentwood are served by municipal sanitation districts. In rural eastern Contra Costa County, treated wastewater effluent is used to irrigate agricultural lands or is discharged into a reclamation drain and ultimately into the Old River pursuant to a permit issued by the Central Valley Regional Water Quality Control Board (CVRWQCB). Rural San Joaquin County is served primarily by on-site septic systems. The incorporated City of Tracy operates a sanitary sewer system and community treatment plant.

Solid Waste Disposal

Solid waste from the south Delta is transported to several landfills, depending on the area and/or county in which the waste was generated. Solid waste generated in Alameda County is transported to the nearest landfill (the Altamont Sanitary Landfill). The Altamont Landfill is approximately 6 miles southwest of the project area. The Altamont Landfill has increased capacity and is expected to reach capacity by 2037 (Lewis pers. comm.). The Vasco Road Landfill, located in Livermore, is expected to reach capacity in year 2037 (Kaufman pers. comm.). Solid waste generated in Contra Costa County is transported to the Marsh Canyon Landfill, which is approximately 14 miles from the project area. A portion of the project area lies within San Joaquin County’s Central County and South County Refuse Areas. The waste from the Refuse Areas is disposed of at the Foothill Landfill near the Stanislaus County line. This landfill has substantial remaining capacity; it is expected to reach capacity by 2054 (Barrera pers. comm.).

Communications

SBC Communications, Inc. is the primary supplier of telephone service to the project area. Underground fiber trunk lines feed switching equipment, and overhead lines and poles supply individual service units. The communication lines are typically aligned parallel to the roadways and then traverse the roadways to supply the individual service units. Cable markers indicating underground cabling are located in some areas parallel to the roadways. A network of alternative telephone companies, cellular communication companies, and cable companies also serve the region. New service to specific sites is accomplished on a case-by-case basis. Satellite dishes are located near the Union Island Gas Field Central Production Facility on Howard Road.

Police, Fire, and Ambulance Services

Police protection services are provided to the south Delta by the San Joaquin County Sheriff's Department and the California Highway Patrol (CHP) from their main offices in the City of Stockton. The Stockton CHP office patrols south Delta highways and county roads. The CHP has 70 personnel to serve the south Delta, of which 40 are patrol officers (Lawton pers. comm.). No police protection facilities are located in the project area. In addition to patrolling the local roads, the Sheriff's Department also patrols the public waterways.

Most of the area in the vicinity of the project does not have fire protection services. The unprotected areas are south of the Stockton Deepwater Ship Channel and include Union Island, Roberts Island, and Drexler Tract. Areas that are protected include from east of Lathrop and southwest of the San Joaquin River and southwest to the Contra Costa and Alameda county lines. The fire stations closest to the project area that provide fire protection services in San Joaquin County are the City of Lathrop, Manteca Fire, and seven fire stations within the City of Tracy that collectively have 60 emergency response personnel (Ohmstead pers. comm.).

The portion of the project area in Contra Costa County is served by the East Contra Costa County Fire Department. The East Contra Costa Fire Department has three stations and one boat that serve the south Delta. They collectively have eight emergency response personnel (Hein pers. comm.). The stations are located in Discovery Bay, Point of Timber, and Byron, and the boat is stationed at Bethel Island.

Ambulance services for San Joaquin and Contra Costa counties are provided by American Medical Response. In Contra Costa County, it has two emergency response personnel (Hein pers. comm.). There is a non-transport paramedic unit in Byron and a transport paramedic unit in Brentwood. In San Joaquin County, there are 13 stations that collectively have 15 ambulances with a minimum of 30 emergency response personnel on duty (Ballard pers. comm.). There are nine ambulances in Stockton, three in Lodi, and three in Tracy.

Environmental Consequences

Assessment Methods

To evaluate potential impacts on public services and utilities, the following four-step process was followed:

- reviewed the 1996 Draft EIS/EIR for the ISDP to obtain information regarding known public services and utilities in the project vicinity,
- conducted a site visit to review in the field the utilities visible from local roadways, and
- placed telephone calls to various utility/service providers.

Significance Criteria

For the purposes of this analysis, impacts on public services and utilities are considered significant if implementation of the alternatives would:

- require the construction or expansion of electrical or natural gas transmission or distribution facilities;
- require the construction or expansion of a water conveyance or treatment facilities or require new or expanded water supply entitlements;
- require the construction of new or expanded stormwater drainage facilities;
- require the construction or expansion of wastewater treatment facilities;
- cause the capacity of a solid waste landfill to be reached sooner than it would without the project;
- require the construction or expansion of communications facilities (telephone, cell, cable, satellite dish);
- adversely affect public utility facilities that are located underground or aboveground along the local roadways from project construction activities; or
- create an increased need for new fire protection, police protection, or ambulance services or adversely affect existing emergency response times or facilities.

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project-specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program.

These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED Programmatic Mitigation Measures, please refer to Appendix E, “Mitigation Measures Adopted in the CALFED Record of Decision.”

Utilities and Public Services Mitigation Measures

1. Site project facilities and transmission infrastructure to avoid existing infrastructure.
3. Coordinate construction activities with utility providers.
4. Design and operate facilities to minimize the amount of energy required and to maximize the amount of energy created.
5. Design project facilities to avoid or minimize their effect on existing infrastructure.

Alternative 1 (No Action)

Implementation of the No Action Alternative (Alternative 1) would result in no construction activities related to the project occurring in the south Delta. The SWP would continue to operate under its current pumping capacity, and the temporary barriers would continue to be installed and removed annually.

With implementation of this alternative, there would be no change in the regional demand for electricity, natural gas, or communications facilities when compared to existing conditions. There would also be no change in local or regional water supply distribution systems, and no changes to south Delta agricultural diversions would occur. Stormwater, wastewater, and solid waste disposal services would remain unchanged in the project vicinity, and there would be no change in the need for police or fire protection or ambulance services in the south Delta region compared to existing conditions.

Urban development according to the San Joaquin County General Plan is expected to continue in the future, and additional public services and utilities are expected to be required to serve the increased populations that will accompany that development. Public services and utilities needed to support the growth planned for the county are addressed in the County's General Plan. Future service provision in the County would not be affected by implementing the No Action Alternative.

Because no project facilities would be constructed as part of this alternative, no conflict with the utility poles, pipelines, satellite dishes, or other facilities would occur. Planned urban development and its required infrastructure would continue to be installed in accordance with the County's General Plan. Future public utility installation in the County would not be affected under the No Action Alternative.

2020 Conditions

Under future no action conditions (2020 conditions) the SDIP would not be implemented. It is expected that utilities and public services would remain essentially the same as those described above. However, demands on utilities and need for public services in the south Delta would increase as the regional population increases. This increase is accounted for in the County's General Plan.

Alternatives 2A, 2B, and 2C

The demand for public services and utilities, potential for conflicts/effects on public utility facilities, and potential effects on emergency services from construction of the physical/structural component would be essentially the same under Alternatives 2A–2C; therefore, impacts for these are presented together.

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Construction of the proposed gates would have no impact on water conveyance or treatment facilities, stormwater drainage facilities, or communication facilities. Constructing the gates will not require the expansion of water supply and distribution facilities or stormwater drainage facilities. Communications services needed during project construction would likely be provided by cellular service and are not likely to adversely affect existing cellular service provided in the project vicinity.

Impact PUB-1: Disruption of Electric Service. The gate motors and boat lock hydraulic pumps would require electrical power to operate. A 120/208-volt, 3-phase, 4-watt service would be required at each gate site. The head of Old River and Middle River sites are located near existing power distribution lines and will not require construction of new power lines. The Old River at DMC gate site and Grant Line canal are more remote and will require power line extensions. Providing electrical service to the gates would result in a less than significant impact on existing services because construction of new transmission facilities would not disrupt existing uses. The impact of constructing the gates on existing electric service is considered less than significant. No mitigation is required.

Impact PUB-2: Reduction in Capacity of Local Solid Waste Landfills. Constructing and operating the gates is not expected to generate substantial amounts of solid waste because many of the gate components would be constructed offsite. Construction activities that are expected to generate the most waste would include dredging and excavating the gate foundation. Dredged material would be disposed on site. The small amount of waste generated during construction is not expected to substantially decrease the existing lifespan of landfills in the project vicinity.

Once constructed, the control facilities associated with each of the proposed gates would require solid waste disposal service. Because only one person would operate the gate, the amount of waste that would be generated at the sites is expected to be minimal and would not substantially affect the availability of landfill capacity. This impact is less than significant. No mitigation is required.

This impact is less than significant. No mitigation is required.

Impact PUB-3: Disruption of Public Utilities. Under Alternatives 2A–2C existing utility locations at gate construction sites would be identified prior to construction. Utility lines would be avoided or relocated in coordination with the utility company or service provider. Refer to Environmental Commitments in Chapter 2, "Project Description." This impact is less than significant. No mitigation is required.

Impact PUB-4: Increase in Emergency Service Response Times. Constructing gates would result in a temporary increase in the number of construction vehicles traveling on local roadways. These construction vehicles are not expected to change the level of service provided by local roadways or increase response times by emergency service providers. This impact is less than significant. No mitigation is required.

Impact PUB-5: Increased Use of Energy. Under Alternative 2A–2C the gate mechanisms and boat lock hydraulic pumps would be electrically operated. A 120/208-volt, 3-phase, 4-watt service will be required at each gate site. Operating permanent gates would result in an increase in local electricity consumption. The amount of electricity needed to operate the gates is considered minor relative to local electricity consumption and other SWP electricity use. This impact is less than significant. No mitigation is required.

Dredging

Impact PUB-6: Disruption of Public Utilities during Channel Dredging. Under Alternatives 2A–2C existing utilities crossing West Canal, Middle River, and Old River would be identified prior to dredging. Utility lines would be avoided or relocated in coordination with the utility company or service provider. Refer to Environmental Commitments in Chapter 2, "Project Description." This impact is less than significant. No mitigation is required.

2020 Conditions

Impacts resulting from implementation of Alternatives 2A–2C would be similar to those described above because it is not expected that the project would create a significant need for additional utilities and public services. All impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

The increased diversions into CCF would not require the construction of new facilities or involve the disruption of existing utilities. There would be no impact.

2020 Conditions

Similar to 2001 conditions, there would be no impacts resulting from implementation of Alternatives 2A–2C because there would be a similar demand on utilities and public services during operations. All impacts are less than significant, and no mitigation is required.

Interim Operations

Interim operations would not result in increased runoff, wastewater, solid or hazardous waste, or the need for additional fire, police, or other public services. Therefore, impacts would be less than significant, and no mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

The demand for public services and utilities, potential for conflicts/effects on public utility facilities, and potential effects on emergency services from the physical/structural component of Alternative 3B are expected to be similar to those discussed for Alternatives 2A–2C but may be slightly less because no Grant Line Canal permanent gate would be constructed as part of this alternative. Therefore, impacts PUB-1 through PUB-6 would occur under Alternative 3B, but to a lesser extent. These impacts are less than significant. No mitigation is required.

Dredging

Under Alternative 3B, impacts from dredging activities would be similar to those identified under Alternative 2A–2C. No utility or public service impacts from dredging would occur.

2020 Conditions

Impacts resulting from implementation of Alternative 3B would be similar to those described above because it is not expected that the project would create a significant need for additional utilities and public services. All impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

The increased diversions into CCF would not require the construction of new facilities or involve the disruption of existing utilities. There would be no impact.

2020 Conditions

Similar to 2001 conditions, there would be no impacts resulting from implementation of Alternative 3B because there would be a similar demand on utilities and public services during operations. All impacts are less than significant, and no mitigation is required.

Alternative 4B

Stage 1 (Physical/Structural Component)

The demand for public services and utilities, potential for conflicts/effects on public utility facilities, and potential effects on emergency services from construction of this alternative are expected to be less than those discussed for Alternatives 2A–2C because Alternative 4B does not include the construction and operation of the three flow control gates. Therefore, impacts PUB-1 through PUB-6 would occur under Alternative 4B, but to a lesser extent. As described above, these impacts are less than significant. No mitigation is required.

Dredging

Under Alternative 4B, impacts from dredging activities would be similar to those identified under Alternatives 2A–2C.

2020 Conditions

Impacts resulting from implementation of Alternatives 4B would be similar to those described above because it is not expected that the project would create a significant need for additional utilities and public services. All impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

The increased diversions into CCF would not require the construction of new facilities or involve the disruption of existing utilities. There would be no impact.

2020 Conditions

Similar to 2001 conditions, there would be no impacts resulting from implementation of Alternative 3B because there would be a similar demand on utilities and public services during operations. All impacts are less than significant, and no mitigation is required.

Cumulative Evaluation of Impacts

Cumulative impacts on public utilities and services are analyzed in Chapter 10, “Cumulative Impacts.” This chapter summarizes the other foreseeable future projects that may contribute to these impacts.

7.4 Recreation Resources

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on recreation opportunities and facilities.

Summary of Significant Impacts

There are no significant impacts on recreation as a result of constructing and operating any of the alternatives. All impacts are discussed in detail under the Environmental Consequences section.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- Draft EIR/EIS for the ISDP, Volume I and Appendix 7 of Volume II, July 1996;
- *CALFED Bay-Delta Program Final Programmatic Environmental Impact Statement/Environmental Impact Report*, July 2000; and
- Sacramento–San Joaquin Delta Recreation Survey (including Boating Survey and Fishing Survey), September 1997.

Delta Region Recreation Use and Activities

Most of the recreation associated with the Delta and SWP facilities is water-dependent (i.e., boating, fishing, rafting, and swimming) or water-enhanced (camping, picnicking, hiking, bicycling, hunting, and scenic/wildlife viewing).

Wildlife viewing, fishing, hunting, and water-based recreation such as swimming, motor boating, sailing, and windsurfing are popular throughout the state, and particularly in the Bay-Delta regions. Recreation is a multimillion-dollar industry in the state. The demand for recreation resources in California is expected to increase with future population growth. Increasing demand is expected to put additional pressure on limited recreation resources and potentially contribute to deterioration of the quality of recreation experiences.

Recreation use of the Delta has increased substantially since the mid-1950s. Recreation use in the late 1950s and early 1960s was estimated at 2.5 million visitor days[1]. By the late 1970s, recreation use in the Delta was estimated to range from 7 to 12 million visitor days. Hunting, sport fishing, boating, and other water-based activities have continued to be the most important recreation activities in the region. Estimates of recreation use of the Delta vary considerably. Current use levels could be as low as about 10 million visitor days, based on 1985 estimates expanded to account for population growth in the region. Based on recreation surveys conducted in 1996 for the DPC, the potential use level could be upwards of 40 million visitor days. Use is expected to increase concurrent with the growth that is occurring in the surrounding counties.

Table 7.4-1 lists the use levels that were determined from the DPR 1996 survey for fishing, non-fishing recreation, boating, and non-boating recreation throughout the Delta.

Table 7.4-1. Delta-Wide 1996 Fishing and Boating Recreation Use

Activity	Activity/Participation Days[a]	Activity	Activity Days[a]
Boating Recreation[b]		**Fishing Recreation[d]**	
Boating	8.1 million	Fishing from boat	11.8 million
Swimming from boat	–[c]	Fishing from shore	9.6 million
Fishing from boat	–	Fishing in tournament	0.2 million
Hunting from boat	–		
Non-Boating Recreation[b]		**Non-Fishing Recreation[d]**	
Sightseeing	3.2 million	Boating	7.1 million
Viewing wildlife	3.2 million	Swimming	6.2 million
Swimming from shore	2.9 million	Wildlife viewing	5.5 million
Walking for pleasure	2.6 million		

[a] The duration of an activity/participation day was not defined in DPR 1997.
[b] As reported in the boating survey portion of the DPR 1997 report.
[c] – = Data not provided.
[d] As reported in the fishing survey portion of the DPR 1997 report.
Source: California Department of Parks and Recreation 1997.

The Delta is conveniently located near several large population centers and serves the growing urban population in the Sacramento metropolitan area, the San Francisco Bay area, and the Stockton/Modesto/Tracy region. The DPR 1997 survey of boaters and anglers indicated that approximately 50% of the

[1] A visitor day represents one person spending a day or portion of a day in one or more types of activities.

recreationists in the Delta live within 50 miles of the Delta, and the average distance traveled one way was 70 to 75 miles.

In addition, the survey results indicated that a majority of visitors (50–60%) stay in the Delta 1 day or less. Approximately 35% stay 2 to 4 days, and approximately 11% stay 5 days or longer. The peak recreation period occurs from May through September. Use from March to September accounts for an estimated 75% of total annual use. According to the 1997 DPR survey report, most boating use occurred between 8:00 a.m. and 4:00 p.m., and most use was by boaters during June, July, and August.

Most of the navigable waterways in the Delta are public, and most of the land is private. This lack of public lands limits the use of the Delta for recreation, causing concentration of use in a few areas where marinas and other facilities provide recreational opportunities and access to the Delta waterways. There are few public parks in the Delta, and some of the recreation areas are accessible only by boat. This also limits access to the Delta for some recreationists.

Recreation use in the Delta is primarily water-oriented. Almost every type of recreation boating activity can be found in Delta waterways. Marinas account for most recreation facility types in the Delta. Activities include waterskiing, fishing, boating, sightseeing, camping, and picnicking. Fishing and boating are the most popular recreation activities in the Delta, together accounting for approximately 70% of total use. Boating accounts for approximately 17% of all visits, followed by fishing, relaxing, sightseeing, and camping.

Boating opportunities in the Delta have increased over the years and include houseboating, sailing, waterskiing, windsurfing, fishing, and other pleasure boating. Commercial boating excursions in the Delta are rare and are mainly limited to the Stockton Deepwater Ship Channel; however, individuals and groups often rent small fishing boats and houseboats.

Popular access points for boating, waterskiing, and personal watercrafting include Windmill Cove near SR 4; King Island, Paradise Points, Herman & Helen's near Eight Mile Road; Tower Park near SR 12; and River's End Marina & RV Park near the City of Tracy. Houseboating is concentrated along Eight Mile Road. Windsurfing typically occurs along SR 160 between Sherman Island and Rio Vista and at Windy Cove. The limited number of boating access points across the Delta and the lack of readily available rentals for ski boats and personal watercraft continue to be issues for recreational users.

Sport fishing in the Delta is a year-round activity, and includes bank fishing and the use of private vessels and commercial passenger vessels. Important sport fish in the Delta include striped bass, white sturgeon, Chinook salmon, and American shad.

Not all recreation activities in the Delta are associated with water. The more popular land-based recreation activities include hunting, camping, picnicking, walking for pleasure, bicycling, wildlife viewing, photographing wildlife, sightseeing (driving for pleasure), and attending special events.

Much of the open space in the Delta is used for public parks and wildlife refuges. Approximately 23 public recreation facilities are located in the Delta. Three state agencies maintain five recreation areas, and the remaining recreation areas are operated by county and city agencies.

Hunting continues on private lands, in public areas, on waterways, and on various small Delta islands. Popular areas include Sherman Island Wildlife Area, Twitchell Island, Franks Tract State Recreation Area, and CCF.

The majority of the DPR 1997 survey respondents (83%) indicated that Delta marinas were either adequate or more than adequate, and the majority of respondents indicated that launch ramps, and fuel docks were adequate or more than adequate. Respondents also thought that most types of other facilities[2] were either adequate or more than adequate. Approximately 60% of respondents indicated that restrooms were either somewhat inadequate or very inadequate. Most (67%) respondents indicated that swimming beaches were either inadequate or very inadequate, and fishing piers were indicated as either somewhat inadequate or very inadequate by 59% of the survey respondents.

In addition, sightseeing was identified by the 1997 DPR survey as the most common activity by the respondents, followed by boating and wildlife viewing, and windsurfing. Walking for pleasure ranked the highest in terms of average annual recreation days, followed by wildlife viewing, swimming, and attending special events. Tent camping and picnicking had the highest number of participants per group, followed by boating.

Project Area Recreation Use and Activities

The south Delta channels are used heavily for boating, fishing, and other water activities, providing an estimated 25% of Delta recreation. DWR conducted boat surveys on different days in each of several years (between 1991 and 1995 [excluding 1994]) at the proposed gate locations to determine the level of use and types of recreational boating at each site. In addition, boats were counted along the waterways on several different weekdays, weekends, and holidays from May to September. The surveys were conducted because of concerns regarding the impact of the temporary flow control structures on boating.

Table 7.4-2 summarizes the total number of boats[3] identified during the survey for each of the survey years. Activities identified during the survey included waterskiing, fishing, and cruising (driving a powerboat for pleasure along the waterways).

[2] These included tent campsites, RV campsites, picnic sites, public parking, places to buy food, scenic vista/overlooks, hiking trails, wildlife vistas, hunting areas, and windsurfing access.
[3] Includes aluminum boats (up to 14 feet long), ski boats, cruisers, and jet skis.

Table 7.4-2. Total Number of Boats Observed from 1991 to 1995[a] Survey by Year by Location

Location	Number of Boats[b] Identified by Year			
	1991	1992	1993	1995
Old River at San Joaquin River	52	29	33	40
San Joaquin River at Old River	113	95	96	98
Middle River	9	5	9	9
West Grant Line Canal	188	149	177	126
Old River near Tracy	33	–	–	21
East Grant Line Canal	–	–	–	88

[a] The survey was not conducted in 1994.
[b] Number of boats was calculated as average number of boats per day.
– = No data available.
Source: California Department of Water Resources and Bureau of Reclamation 1996a.

The DWR survey revealed that aluminum boats (up to 14 feet long), ski boats, cruisers, and jet skis made up the vast majority of the boats that use the south Delta. Most of the boats used in the south Delta, as indicated by the survey, were ski boats, and the greatest usage occurred on holidays and weekends. In general, on each day surveyed, the Grant Line Canal and the head of Old River had a large number of boats, and Middle River and Old River had limited usage because of shallow channels upstream of the sites. Grant Line Canal was the most popular for ski boats and jet skiing followed by head of Old River. Old River was more popular for fishing boats, and Middle River boating was fairly evenly distributed.

In addition to DWR's survey, the California DPR conducted a survey for the DPC and the California Department of Boating and Waterways (DBW) in 1996 of registered boat owners and licensed anglers who use the Delta for recreation. The purpose of the survey was to determine the number of boaters and anglers who use the Delta and other information, including the areas where they recreate, the activities in which they participate, and user satisfaction with facilities available in the Delta.

The DPR boating survey report designated zones within the Delta, with the project area designated as Zone F (Figure 7.4-1). Survey results indicated that very little boat launching and use occurred in the project area. The most common water-dependent recreation activity in this area was waterskiing, followed by cruising, fishing, and swimming from a boat. A comparison of the amount of recreation in this area with recreation use in the entire Delta indicates that most Delta-wide boating occurred outside Zone F. For example, even though waterskiing was the most common recreation activity in this area, only 16% of Delta-wide waterskiing occurred in this zone.

The most common non-boating recreational activities in Zone F identified in the boat survey were sightseeing, fishing from shore, wildlife viewing, picnicking, and swimming. When comparing the level of non-boating recreation participation in this area with use in the entire Delta, the survey results indicated that very little recreation use occurred in Zone F. The most popular recreation activity was bicycling.

DPR's 1997 fishing survey report also designated the project area as Zone F. The survey results indicated that, within Zone F, fishing from shore was the most common fishing activity, followed by fishing from a boat, then fishing in a tournament. When comparing fishing participation in Zone F with total fishing participation in all zones combined, it was determined that Zone F was not a popular location for any type of fishing (only about 14% of those who fished from a boat in the Delta did so in this zone).

The most common non-fishing recreational activities in Zone F identified by the fishing survey was swimming. A comparison of those participating in non-fishing activities in this area with the total non-fishing participation in all Delta zones combined revealed that this zone received a low level of use for most activities, with less than 20% of all recreation activities that occurred in the Delta occurring in this zone.

Project Area Recreation Facilities

Existing recreation facilities in the south Delta study area are listed in Table 7.4-3 and are shown on Figure 7.4-2. As shown, 33 water-dependent recreation facilities, including several large marinas, are located in the south Delta. In addition, two campgrounds and one trail are located in the area.

Table 7.4-3. Recreation Facilities and Facility Amenities within a 6-mile radius of Proposed South Delta Improvements

Facility Name	Rentals[a]	Services[b]	Camping	Guest Docks	Fuel	Supplies[c]	Food[d]
Buckley Cove Launching	–	–	–	–	–	–	–
Bullfrog Landing & Marina	FB	R			G	I, BT, M	RE, B
Cruiser Haven				LC, SC, O, RR, S		I, M	SN
River's End Marina & RV Park		X		X		X	X
Discovery Bay Yacht Harbor		BL, PO		LC, SC, O, RR, S	G, D	I, P, M	GS, SN
Dos Reis Park		BL	X				
Fore N' Aft	–	–	–	–	–	–	–
Haven Acres		BL, L		LC, SC, O, RR	G	I, BT	SN, RE, B
Heinbockle Harbor	–	–	–	–	–	–	–
Islander Mobile Park	–	–	–	–	–	–	–
Klamath Ferryboat	–	–	–	–	–	–	–
Ladd's Stockton Marina		R, DD				I, M	SN
Lazy M Marina		BL	X	SC, O, RR	G	I, P, BT, M	GS, SN, B
Mossdale Crossing Park	–	–	–	–	–	–	–
Mossdale Marina			X	SC, O	G	I, BT	SN, B
Mossdale Trailer Park		BL, L	X	SC, S, R		P	
Oakwood Lake	–	–	–	–	–	–	–
Orwood Resort		BL	X	SC, S, R	G	I, P, BT, M	GS, SN, RE, B
Riverpoint Landing		P, BL, R, DD		LC, SC, O, E	G, D	X	
Stephens 5 Star Marina		BL, R, DD					
Stockton Rod & Gun Club	–	–	–	–	–	–	–
Stockton Yacht Harbor	–	–	–	–	–	–	–
Tides Resort			X	SC, O			SN, B
Tiki Laguna Resort Marina		BL	X	LS, SC, E, O, RR, S	G	I, P	GS, SN
Tracy Oasis Marina Resort	FB	BL, R, L	X	LC, SC, E, O, RR, S	G	I, P, BT, M	GS, SN, RE, B
Turner Cut Resort	HB	BL, DD	X	LC, SC, E, O, RR, S	G	I, P, BT, M	RE, B
Turtle Beach Resort (private)	–	–	–	–	–	–	–
Union Point				LC, SC, O	G	X	SN, RE, B

Facility Name	Rentals[a]	Services[b]	Camping	Guest Docks	Fuel	Supplies[c]	Food[d]
Waterfront Yacht Harbor	X (?)	PO		LC, SC, E, O, RR, S	G, D	I, M	SN, B
Weston Ranch Marina (proposed)	–	–	–	–	–	–	–
Whiskey Slough Harbor		BL, PO	X	LC, SC, E, O, RR	G	I, BT, M	SN, B
Windmill Cove		BL		LC, SC, E, O, RR, S	G	I	SN, B

– Data not provided.
[a] Rentals include ski boats (SB), houseboats (HB), and fishing boats (FB).
[b] Services include boat launching (BL), boat/motor repair (R), dry dock (DD), and pump-out station (PO),' laundry (L), and showers (S).
[c] Guest Docks include large craft (LC), small craft (SC), electricity (E), overnight (O), restrooms (RR), showers (S).
[d] Fuel includes, gasoline (G) and diesel (D).
[e] Supplies include ice (I), propane (P), bait and tackle (BT), and marine supplies (M).
[f] Food includes snack bars (SN), restaurants (RE), grocery stores (GS),bars (B), and liquor store (LS).
Source: Hal Schell, no date; California Delta Chambers and Visitors Bureau 2004.

North-of-Delta Recreation Use and Activities

Shasta Reservoir

Lands and recreation facilities at Shasta Reservoir are managed as a unit of the Whiskeytown-Shasta-Trinity National Recreation Area (NRA) by the U.S. Forest Service (USFS). Approximately 80% of the recreational use in the Whiskeytown-Shasta-Trinity NRA occurs at Shasta Reservoir (U.S. Forest Service 2000). When full, the lake has a surface area of approximately 29,500 acres, 370 miles of shoreline, and surface elevation of 1,067 feet above msl. The lake has four main arms: the Sacramento River, McCloud River, Pit River, and Squaw Creek.

Water-dependent activities include power boating, houseboating, waterskiing, and warmwater and coldwater fishing. Water-enhanced activities include camping, hunting, and wildlife viewing. Recreational use at Shasta Reservoir averages about 2.4 million visitor days per year, with an estimated 75% of the recreational use occurring between May and September (Bureau of Reclamation 1997).

Facilities include several marinas, seven public boat ramps, three picnic areas, and 26 public campgrounds. Boat ramp facilities are located on all four arms of the reservoir. Several boat ramps have multiple lanes/ramps allowing boat launching to occur at low lake levels. The Hirz Bay and Packer's Bay boat ramps, located on the McCloud River arm, have three ramps and can remain in operation until the lake elevation is drawn down 155 feet. The Centimudi boat ramp near Shasta Dam and the Jones Valley boat ramp on the Pit River arm can both remain in operation until the lake elevation is drawn down 210 feet.

Trinity Reservoir

Trinity Reservoir is a unit of the Whiskeytown-Shasta-Trinity NRA with recreational facilities and activities administered by the USFS. The lake has 145 miles of shoreline 17,000 surface acres, and a surface elevation of 2,370 feet above msl when full.

Water-dependent activities include power boating, houseboating, waterskiing, swimming, and fishing. Water-enhanced activities include camping, hiking, hunting, and wildlife viewing. Recreational use at Trinity Reservoir was estimated at about 485,000 recreation visitor days in 1995 (U.S. Fish and Wildlife Service et al. 1999). Recreation facilities at Trinity Reservoir include 24 campgrounds, two swimming areas, and three day-use areas. Major boat ramps operated by the USFS include Minersville on the Stuart Fork arm, Trinity Center in the North Lake area, and Fairview near the Trinity Dam. There are four marinas located on the lake.

Oroville Reservoir

Recreation facilities and activities at Oroville Reservoir are managed by DPR as part of the Lake Oroville State Recreation Area (SRA). The reservoir has 167 miles of shoreline, 15,800 surface acres, and a surface elevation when full of 900 feet above msl.

Water-dependent activities include power boating, houseboating, waterskiing, swimming and fishing. Water-enhanced activities include camping. Bidwell Canyon and Loafer Creek on the southern shoreline and Lime Saddle on the West Fork are the major use areas. In addition to formal campgrounds, camping is allowed along the lake's shoreline and at boat-in campgrounds. Most water-dependent recreation occurs during the spring and summer months.

Feather River

The lower reach of the Feather River flows from Oroville Dam to the confluence of the Sacramento River. This stretch is approximately 40 miles, and there are several recreation areas within this reach. Yuba Recreation Area and Riverfront Park in Marysville are two of the major recreation areas along this stretch.

The recreation facilities along the Feather River include boat launching ramps, marinas, fishing areas, campgrounds, picnic areas, and athletic fields. Activities such as swimming, fishing, camping, bird watching, picnicking, and bicycling are popular in this area. Rafting on the North and Middle Forks of the Feather

River runs from January to April or May, depending on flow. Summer rafting and kayaking occurs on the North Fork depending on upstream PG&E reservoir operations, though lower flows in these reaches allow recreationists to use inner tubes to float down the river.

The section of the Feather River between the Thermalito Diversion Dam and Thermalito Afterbay outlet is commonly referred to as the Low Flow Channel of the Feather River. Fishermen, wildlife and birdwatchers, sightseers, hikers, and bicyclists enjoy recreation along the Low Flow Channel. The Brad P. Freeman Trail runs beside this section of river from the diversion dam to SR 162. This section is an important recreation resource for the residents of Oroville and nearby areas. Based on DFG regulations, the river is open for fishing north of the Table Mountain Bicycle Bridge. In the spring and fall, salmon are known to congregate at the Thermalito Afterbay outlet. In recent years, the Feather River has served as habitat to 40,000 Chinook salmon in spring and fall. Downstream from the Thermalito Afterbay outlet, the river continues throughout the Oroville Wildlife Area. The Oroville Wildlife Area provides opportunities for bird watching, in-season hunting, fishing, swimming, and camping.

Folsom Reservoir

Folsom Reservoir is part of the Folsom Lake SRA, an 18,000-acre area encompassing Folsom Lake and Lake Natoma managed by the DPR. The Folsom Lake SRA is one of the most heavily used recreation areas in the California State Park System because of its proximity to large urban areas, the diminishing open space of the area, and the high regional interest in recreation. When full, the reservoir has a surface area of approximately 11,900 acres and 75 miles of shoreline and a surface elevation of 466 feet above msl.

Folsom Reservoir accommodates a variety of water-dependent recreational activities, including power and sail boating, camping, fishing, swimming, waterskiing, jet skiing, and windsurfing. Major shoreline use areas are Beal’s Point, Granite Bay, and Rattlesnake Bar on the western shoreline; Folsom Point (formerly Dyke 8) and Folsom Lake Marina at Brown’s Ravine on the southern and eastern shorelines; and the Peninsula Campground between the north and south forks of the American River. Each of these areas contains a boat ramp and various other recreational facilities. Folsom Lake Marina at Brown’s Ravine, the only marina on Folsom Lake, is open year-round and has a main boat ramp, a low-water boat ramp, and 685 slips available for mooring. The recreation area has approximately 80 miles of trails available for hiking and horseback riding and approximately 30 miles of paved and unpaved bicycling trails.

Boating, sailing, and waterskiing take place throughout the main reservoir area. Anglers fish from boats throughout the lake and especially in the upper arms that are designated slow-boating zones. Fishing is mainly for coldwater species, such as rainbow trout and kokanee salmon, and warmwater species, such as bass, catfish, and sunfish. Swimming and sunbathing take place at many undesignated areas along the reservoir shoreline.

The water level at Folsom Lake dictates the type of recreation and length of the season. During years with normal precipitation, the main recreational season is May through Labor Day in September, when recreation is focused primarily on water-dependent activities. Approximately 625,000 people visited Folsom Lake SRA between July and September 2001, and approximately 695,000 people visited the SRA between April and June (California State Parks 2001). During the remaining months of the year, use consists mainly of fishing and land-based recreation. Visitation from October through December and January through March totaled approximately 175,000 and 165,000 people in 2001, respectively (California State Parks 2001). In general, the Granite Bay, Beal's Point, Folsom Point, and Brown's Ravine use areas account for approximately 50% of the use of Folsom Lake SRA.

Water-dependent activities account for nearly 85% of the recreation use at Folsom Lake. Boating is the most popular activity at the reservoir, followed by swimming and fishing. (Sacramento Area Flood Control Agency and Bureau of Reclamation 1994.)

Lake Natoma

Lake Natoma, just downstream of Folsom Reservoir, is also a unit of the Folsom Lake SRA. The lake has a surface area of approximately 500 acres at full capacity and has approximately 10 miles of shoreline. (EDAW and Surface Water Resources 1999.)

Water-dependent activities include fishing, rowing, kayaking, sailing, and windsurfing. Water-enhanced facilities consist primarily of picnic areas and bicycle, equestrian, and pedestrian trails, which are located on the north and south shores of the lake. Facilities include the California State University, Sacramento (CSUS), aquatic center. CSUS sponsors local, regional, and national rowing competitions on Lake Natoma, and its intercollegiate and club teams use the lake for rowing practice. An 8.4-mile-long segment of the Jedediah Smith Memorial Trail extends along the north shore of the lake. Developed recreation facilities are located at Mississippi Bar, Nimbus Flat, and Negro Bar. Boat-launching facilities are located at Nimbus Flat and Negro Bar, along with swimming-designated beaches.

Annual visitation at Lake Natoma is reported as part of the total visitation to the Folsom Lake SRA, discussed above in the Folsom Reservoir section.

Water-enhanced activities and water-dependent activities each account for approximately 50% of all recreation activities. Trail use (jogging, bicycling, hiking, and horseback riding), rafting, and boating are the most popular recreational uses of the lake area. The lake's water level dependably exceeds water-dependent recreation thresholds, making it a popular destination for boating, sailing, rowing, and windsurfing. (EDAW and Surface Water Resources 1999.)

Lower American River

The lower American River extends for 23 miles between Lake Natoma and the confluence with the Sacramento River. The river passes through the American River Parkway, a 6,000-acre open space corridor that includes a series of interconnected parks along the publicly owned lands of the river. The parkway has 14 county parks that provide user access to the river, and the 32-mile Jedediah Smith Memorial Trail provides bicycling, hiking, and horseback-riding opportunities from Discovery Park to the Folsom Lake SRA.

The lower American River is a major site for recreational boating (rafting, kayaking, and canoeing), fishing, swimming, and wading. Boating activity, particularly commercial rafting, depends primarily on air temperature, river flows, and season of the year. The most popular reach for rafting is from Sunrise Avenue to Goethe Park. There are 10 popular swimming areas along the river including Paradise Beach and Tiscornia Park, both with large sand beach areas. Both shoreline and boat fishing take place throughout the river. Anglers fish mainly for salmon, steelhead, and shad. Fishing is permitted year-round within the parkway, except during fall and early winter when the river is closed from Ancil Hoffman Park on the west to the Hazel Avenue Bridge on the east to protect spawning fish (EDAW and Surface Water Resources 1999).

Parkway visitation in 1997 was estimated at 6 million visitor-days. Visitation is expected to increase to 9.6 million visitor-days by 2020, assuming river flows are stable (County of Sacramento and Bureau of Reclamation 1997). Approximately 31% of all visits were associated with water-dependent activities. Boating, particularly rafting, is the most popular water-dependent activity on the river, followed by fishing and swimming (Sacramento Area Flood Control Agency and Bureau of Reclamation 1994). About 90% of annual rafting rental business occurs between Memorial and Labor Day (Jones & Stokes 2001).

Sacramento River

The Sacramento River extends for 300 miles between Keswick Reservoir and the Delta. Public access points to the river are administered by the State of California, Bureau of Land Management, and various counties and cities along the river. Popular water-dependent activities include boating, fishing and waterskiing. Water-enhanced activities include camping, hiking, picnicking, and sightseeing.

Numerous recreation areas are located on the reach of the river between Keswick Reservoir and the American River confluence. Fishing, rafting, canoeing, and kayaking activities are available along most of the upper Sacramento River and are popular activities on the river's northern reach. Boating, rafting, and swimming generally take place in summer months, and fishing is a year-round activity. Water-dependent activities (swimming, boating, fishing) account for approximately 52% of the recreation uses on the Sacramento River (County of Sacramento and Bureau of Reclamation 1997).

Downstream of the American River, the Sacramento River, is a popular boating and fishing area, with most boating occurring during the summer months. Public parks and trails, private marinas, and public boat launching facilities are located along this reach of the river.

Public parks, including Miller and Garcia Bend, have picnic sites, playgrounds, and multi-use fields. Garcia Bend Park, located in Sacramento's Pocket Area, is a 24-acre riverfront park that has a major boat-launching ramp for the entire Sacramento area, a playground, soccer fields, and a parking area. On- and off-street bike trails extend along this portion of the river. The Sacramento River Bike Trail begins with an off-street trail at the American River confluence and connects to various on-street and off-street trail segments. The southern segment is a 2-mile-long, on-levee, two-lane bike trail extending from Garcia Bend Park to a point approximately 6,000 feet north of the Freeport Bridge. The City of Sacramento is planning to extend the trail from its current end point (approximately 6,000 feet north of the Freeport Bridge) to the Freeport Shores Youth Sports Complex, with construction scheduled for 2003. Boating facilities between Sacramento and Courtland include the large Sacramento Marina, the Freeport Marina (145 berths), three medium-size marinas (50–200 berths), five small marinas (fewer than 50 berths), and five launch ramps (Delta Protection Commission 1997).

In 1980 (the last recreation-user survey completed for the entire river), total annual recreational use was estimated to total 2 million 6-hour visitor days (California Department of Water Resources 1982b). In May 1995, a survey was conducted of registered boat owners and licensed anglers who recreate in the Delta. The portion of the lower Sacramento River corridor from the City of Sacramento south to Courtland was included in the survey. Fishing from a boat, cruising, waterskiing, and swimming account for 90% of all recreation occurring on this segment of the river. Fifty-one percent of fishing took place from boats and 44% from shore. However, fishing in this segment of the river accounts for only 10% of all fishing in the Delta as a whole. In addition, recreation use of this segment of the river is low in all boat-use categories when compared to the Delta as a whole. (Delta Protection Commission 1997.)

Water-enhanced activities occurring on this segment of the Sacramento River include sightseeing, viewing wildlife, visiting cultural or historic sites, and bicycling. Other less popular activities include walking, picnicking, and swimming from shore.

South-of-Delta Recreation Use and Activities

San Luis Reservoir

San Luis Reservoir and O'Neill Forebay can be found in the foothills of Merced County on the west side of the San Joaquin Valley and lie approximately 12 miles west of the city of Los Banos. The reservoir and Forebay compose the

San Luis Reservoir SRA. The San Luis Reservoir serves both the SWP and CVP.

When full, San Luis Reservoir has approximately 12,700 surface acres, and both San Luis Reservoir and O'Neill Forebay offer activities such as boating, waterskiing, fishing, camping, and picnicking and trail use. San Luis Reservoir SRA is open year round. Boat access is available via one boat ramp at the Basalt area at the southeastern portion of the reservoir and at Dinosaur Point at the northwestern portion of the reservoir. The boat ramp at Basalt becomes difficult to use because of low reservoir levels at elevation 340 feet; the boat ramp at Dinosaur Point is difficult to access at elevation 360 feet (San Joaquin River Group 1999). There are no designated swimming areas or beaches at San Luis Reservoir, but O'Neill Forebay (with its stable surface elevation) has popular swimming, boating, fishing, and camping opportunities.

Castaic Lake

Castaic Lake is in the Castaic Mountains in southern California and has 29 miles of shoreline. Castaic Lake and Lagoon provide many opportunities for recreation. With two boat launch ramps, the upper lake offers visitors a wide range of water sports, such as sailing, waterskiing, power boating, and fishing. The east ramp is usable (above water) when the surface elevation is above elevation 1,325 feet msl. The west ramp becomes unusable earlier, at surface elevation 1,435 ft msl (Leahigh 2002 as cited in EWA 2003). Castaic Lake supports largemouth bass, bluegill, trout, crappie, and catfish. Castaic Lagoon, south of Castaic Lake, serves as a recreation area and a groundwater recharge basin. Overnight camping is available at the lagoon, which features sandy beaches, grassy picnic areas, and a two-lane boat launching ramp. Boating in Castaic Lagoon is limited to non-power boats only; sailing, canoeing, and fishing are popular activities in this area (Environmental Water Account 2003).

Lake Perris

Lake Perris can be found in northwestern Riverside County, southwest of the city of Moreno Valley. The lake is approximately 2,318 acres, and it includes three boat ramps; a marina; a water slide; two swimming beaches; hiking, biking, and equestrian trails; and picnic and camping areas. Recreation activities at Lake Perris include boating, waterskiing, fishing, swimming, camping, picnicking, horseback riding, bicycling, hiking, hunting, and rock climbing.

Pyramid Lake

Pyramid Lake is located immediately east of the Los Angeles–Ventura County line in northwestern Los Angeles County and is part of the Angeles National Forest. Recreation facilities at Pyramid Lake include a boat ramp, swimming beach, picnic area, six boat-in recreation areas, and campgrounds. Recreation activities here include boating, waterskiing, fishing, swimming, camping, picnicking, and hiking.

Silverwood Lake

Silverwood Lake is approximately 976 acres in size and is located in southwestern San Bernardino County. Recreation facilities here consist of a boat ramp, a cartop boat ramp, swimming beaches, picnic areas, and campgrounds. Boating, waterskiing, fishing, swimming, camping, picnicking, bicycling, and hiking are among the recreation activities at Silverwood Lake.

Environmental Consequences

Assessment Methods

The recreational assessment describes the impacts on recreation from construction and operation of SDIP gates and recreation impacts as a result of changes in reservoir storage and river flows. The assessment focuses on evaluating impacts on:

- recreation activities in the south Delta within approximately 6 miles of the flow control and fish control gates, and
- water-dependent (e.g., boating and swimming) and water-enhanced recreation opportunities at major north-of-Delta reservoirs and streams and major SWP south-of-Delta reservoirs.

Effects on recreation that could occur during construction of permanent gate facilities or channel dredging activities were evaluated qualitatively. Generally, construction activities could result in a short-term loss of recreation opportunities by disrupting use of recreation areas or facilities. A long-term effect could occur if a recreation opportunity is eliminated as a result of construction activities associated with SDIP project facilities.

Impacts on south Delta recreation could occur during operation of SDIP facilities because of changes in water flow and level conditions. Output from DSM2 was used to predict changes in water level under each SDIP operational scenario that could potentially affect south Delta water-dependent recreation activities and use.

Operating the SDIP alternatives could also result in changes in reservoir storage and river flows. The resulting change in reservoir storage could change the frequency and duration that lake levels are within acceptable ranges or above the minimum level necessary to conduct recreational activities. Similarly, river flows more frequently could fall outside the ranges necessary to conduct recreation. The evaluation of effects on water-dependent recreation was conducted by comparing the CALSIM II hydrological modeling results for each alternative with the reservoir storage and river flow recreation thresholds. Key opportunity thresholds used in this analysis are shown in Table 7.4-4.

Table 7.4-4. Recreation Opportunity Thresholds for Important North-of-Delta and South-of-Delta Recreation Resources

Water Resource	Elevation When Full	Recreation Opportunity Thresholds[a]
Folsom Reservoir	466 msl	360 msl—last boat ramp out of operation 400 msl—limited surface area (boating constrained) 405 msl—marina closes 430 msl—decline in shoreline activities
Shasta Reservoir	1,067 msl	>952msl—at least one boat ramp available on each arm 1,017 msl—limited surface area (boating constrained)
Trinity Reservoir	2,370 msl	2,170 msl—last boat ramp out of operation 2,320 msl—limited surface area (boating constrained)
Oroville Reservoir	900 msl	710 msl—last boat ramp out of operation 750 msl—limited surface area 819 msl—beaches close
Lower American River	–	State Water Board thresholds: 1,500–2,000 cfs—boating minimum range 3,000–6,000 cfs—boating optimal range 1,250–5,000 cfs—swimming
		CVPIA thresholds: 1,750–3,000 cfs—boating optimal range 1,750 cfs—minimum boating flows 1,500 cfs—optimal swimming flows
		Hodge Decision: 1,750 cfs—minimum summer recreation flows
Sacramento River	–	2,500–12,000 cfs—boating optimal range
Feather River	–	<2,5000 cfs—minimum rafting/boating elevation >5,000 cfs—optimal rafting/boating elevation
San Luis Reservoir	225 msl	340 msl—last boat ramp out of operation
Castaic Lake	1,515 msl	1,325 msl—last boat ramp out of operation 1,280 msl—minimum operating surface elevation
Lake Perris	1,590 msl	1,535 msl—last boat ramp out of operation 1,564 msl—marina closes 1,540 msl—minimum operating surface area
Pyramid Lake	2,579 msl	–
Silverwood Lake	3,355 msl	–

[a] Thresholds are measured in feet above msl for reservoirs and in cfs for rivers.

Sources: California State Water Resources Control Board 1988 (State Water Board opportunity thresholds for the Lower American River); U.S. Forest Service 2001 (boat ramp opportunity thresholds for Shasta Reservoir); U.S. Fish and Wildlife Service et al. 1999 (boat ramp opportunity thresholds for Trinity Lake); *Environmental Defense Fund v. EBMUD* 1990 (Hodge Decision; Bureau of Reclamation 1997 (all other opportunities).

A detailed discussion of CALSIM II and DSM2 modeling results is included in Chapter 5, "Physical Environment," under Section 5.1, Water Supply, and Section 5.2, Tidal Hydraulics.

Regulatory Setting

San Joaquin County General Plan

The San Joaquin County General Plan policies for recreation include emphasizing activities and facilities that are best provided on the regional level; addressing the needs of the county's residents; considering the recreational needs of the handicapped, youth, and people of low and moderate incomes; preserving natural features; providing opportunities to experience natural settings; protecting resource areas identified as being significant for recreation[4].

Contra Costa County General Plan

The Contra Costa County General Plan policies for recreation include reserving park lands to ensure that the present and future needs of the County's residents will be met; preserving areas of natural beauty or historical interest; designing parks appropriate to the need and access capabilities of all residents; public access to scenic areas on the waterfront and providing water-related recreation, such as fishing, boating, and picnicking; developing the Delta for recreation use in accordance with the state environmental goals and policies; protecting and enhancing the recreational value of the Delta; and distributing and managing recreational activity according to an area's carrying capacity (Contra Costa County 1996).

Delta Protection Act

The Delta Protection Act of 1992, includes the following sections:

- Section 29702, which indicates that the basic goals of the state for the Delta include the protection, maintenance, and, where possible, the enhancement and restoration of the overall quality of the Delta environment, including, but not limited to, agriculture, wildlife habitat, and recreational activities.
- Section 29705, which indicates that the Delta's wildlife and wildlife habitats are valuable, unique, and irreplaceable resources of critical statewide significance and should be preserved and protected for the enjoyment of current and future generations.

[4] The closest areas to the proposed barrier locations that are considered by the County as significant resource areas for recreation include an area along the Middle River located approximately 2 miles north of the proposed Middle River barrier and at Trapper Slough located approximately 0.5 mile north of the Middle River barrier.

- Section 29710, which declares that agricultural, recreational, and other uses of the Delta can best be protected by implementing projects that protect wildlife habitat before conflicts arise.
- Section 29712, which acknowledges that the Delta's waterways and marinas offer recreational opportunities of statewide and local significance and are a source of economic benefit to the region, and because of increased demand and usage, public safety requirements will increase (California Public Resources Code Section 21080.22, Division 19.5, Chapter 1, Section 29702).

Delta Protection Commission Land and Resource Management Plan

The DPC Land and Resource Management Plan (LRMP) for the Primary Zone of the Delta includes the following Recreation and Access Policies and Recommendations:

- P-1: Where public funds are limited, local governments shall promote maintenance and supervision of existing public recreation areas over construction of new public facilities.
- P-2: To minimize the impacts on agriculture and wildlife habitat, local governments shall encourage expansion of existing private water-oriented commercial recreational facilities over construction of new facilities. Local governments shall ensure any new recreational facilities will be adequately supervised and maintained.
- P-3: Local governments shall develop siting criteria for recreation projects that will ensure minimal adverse impacts on: agricultural land uses, levees, and public drinking water supply intakes, and identified sensitive wetland and habitat area.
- P-4: Local governments shall improve public safety on Delta waterways through enforcement of local, state, and federal laws.
- P-5: Local governments shall encourage provision of publicly-funded amenities in or adjacent to private facilities, particularly if the private facility will agree to supervise and manage the facility (fishing pier, overlook, picnic area), thus lowering the long-term cost to the public.
- P-6: Local governments shall support multiple uses of Delta agricultural lands, such as seasonal use for hunting or improved parking and access sites.
- P-7: Local governments shall support improved access for bank fishing along state highways and county roads where safe and adequate parking can be provided and with acquisition of proper rights-of-access from the landowners. Adequate policing, garbage cleanup, sanitation facilities, and fire suppression for such access shall be provided.
- P-8: New, renovated, or expanded marinas shall include adequate restrooms, pump-out facilities, trash containers, oily waste disposal facilities, and other facilities necessary to meet needs of marina tenants. Use fees may be

charged for the use of these facilities but such fees shall not exceed the cost of maintenance.

- P-9: Local governments shall encourage new recreation facilities that take advantage of the Delta's unique characteristics.
- R-6: State and federal projects in the Primary or Secondary Zones should include appropriate recreation and/or public access components to the extent consistent with project purposes and with available funding. State and federal agencies should consider private or user group improvements on publicly owned lands to provide facilities (Delta Protection Commission 1995).

Significance Criteria

The criteria used for determining the significance of an impact on recreational resources are based on the State CEQA Guidelines and professional standards and practices. Impacts on both water-dependent and water-enhanced recreation opportunities may be considered significant if implementation of an alternative would:

- cause a change in south Delta flows or water level, river flows, or reservoir surface water elevations that would result in substantial changes to existing recreational opportunities;
- locate project facilities that would result in a substantial long-term disruption of any institutionally recognized recreational facilities or activities;
- cause an increase in the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated; or
- result in substantial inconsistency with local recreation plans and policies, including the DPC LRMP.

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project-specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program.

These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED programmatic mitigation measures, please refer to Appendix E, "Mitigation Measures Adopted in the CALFED Record of Decision."

Recreation Mitigation Measures

1. Incorporate project-level recreation improvements and enhancements.
2. Work with recreational interests to protect and enhance recreation resources.
3. Conduct an analysis of boating circulation to ensure that appropriate alternative routes are identified and clearly marked if boating circulation in the Delta is modified due to temporary, seasonal, or permanent channel closures or to speed restrictions.
4. Identify and mark alternate boating routes.
6. Maintain boating access to prime areas.
8. Construct boat locks.
9. Provide public information regarding alternate access.
10. Avoid construction during peak-use seasons and times.
11. Post warning signs and buoys in channels.
12. Maintain reservoir levels as high as feasible during recreation season, given regulatory and other operational constraints.
13. Minimize water level fluctuation and establish minimum pool levels.
14. Coordinate operation of all reservoir facilities to minimize adverse reservoir fluctuations in any particular facility consistent with regulatory and other operational constraints.
20. Relocate, or construct new, recreation facilities and infrastructure.

Delta Protection Commission Mitigation

DWR and Reclamation are committed to adding project-level recreation improvements and enhancements and are working with the recreation subcommittee of the DPC to identify appropriate projects in and around the SDIP project area. Project-level improvements will be evaluated in separate documents when those actions are identified.

Alternative 1 (No Action)

The No Action Alternative would not result in any construction-related or operations-related recreation impacts associated with SDIP facilities.

Under the No Action Alternative temporary fish and flow control gates on Old River, Middle River and Grant Line Canal would continue to have the same effect on recreation uses as under existing conditions. Generally, boating and fishing use in the south Delta is minor compared to Delta-wide use levels (California Department of Parks and Recreation 1997). However, interviews with south Delta commercial recreation business owners and managers (July 2003) indicate the opinion that their businesses have been adversely affected by lack of patronage since the installation of the temporary barriers (refer to the Social and Economic Conditions section for information on interviews conducted for DWR). These interviews indicate that access to south Delta channels may be affected by continued use of temporary barriers because boaters are not aware that access across temporary barriers is provided by a portage service or because boaters choose not to use the portage service. This No Action effect is the same as under existing conditions; therefore no impact would result.

Under the No Action Alternative, recreation facilities, including restrooms, drinking fountains, and picnic areas, would not be constructed at the gate sites. Therefore, this benefit to recreation would not occur if the SDIP project is not constructed as proposed. Continued operation of temporary barriers under Alternative 1 would not conflict with applicable County General Plan or DPC plans or policies.

2020 Conditions

Under Future No Action conditions (2020 conditions) SDIP would not be implemented. It is expected that the temporary barriers program would continue. It is also expected that the type of recreational uses in the south Delta and in reservoirs north and south of the Delta would remain the same as existing conditions. However, the number of users would increase as population increases throughout the state.

Alternatives 2A, 2B, and 2C

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact REC-1: Temporary Disruption to Recreational Opportunities during Construction of Gates. Construction of the fish control and flow control gates on Old River, Middle River and Grant Line Canal would disrupt boating access in these areas for a total of approximately 36 months. Each gate would require approximately 15–36 months to construct, and gates would be constructed concurrently. Temporary loss of recreation opportunities would result from the presence of construction vehicles, equipment, and personnel in and adjacent to south Delta channels; construction of cofferdams or sheetpiles at the gate locations; and temporary construction effects on channel water quality during construction (i.e., increased turbidity from suspended materials) near gate sites. The greatest potential for disruption of boating would occur on Old River and Grant Line Canal. Boating use on Middle River is generally low because of shallow, narrow channels. This impact is less than significant because:

- disruption of boating access near these sites would be temporary;
- overall, the effect of gate construction on boating access in the south Delta would be minor considering the current opportunities for this activity;

- gates would be constructed in a manner that would allow boating access through half of the channel cross section at all times,
- construction work would not occur during major summer holiday periods;
- warning signs and buoys upstream will be posted at, and downstream of, all construction equipment, sites, and activities; and
- adequate warning would be provided regarding activities and equipment in construction sites.

No mitigation is required.

Impact REC-2: Disruption of Recreation Opportunities from Permanent Gates. The location of permanent fish control and flow control gates on Old River, Middle River, and Grant Line Canal could potentially affect the amount of boating that occurs in the vicinity of gates because of perceived difficulty of navigating past these new structures. Because the permanent control gates have more operational flexibility than temporary barriers, the difficulty in navigation may be reduced. The Old River and Grant Line Canal gates would be designed to allow boat ingress/egress. The Middle River gate would be operated to allow boat passage during certain times of the day. This potential effect on boating would be most notable during summer months when recreation use is highest. The greatest potential for lost recreation opportunities would occur on Old River and Grant Line Canal. Boating on Middle River occurs less often because of shallow, narrow channels that most boats cannot access. In addition, boats cannot pass when the Middle River temporary barrier is in place. Gates on Old River and Grant Line Canal would include a boat lock to allow boat passage. In addition, DWR would implement Environmental Commitments to educate boaters about navigating in the vicinity of proposed gates (See Chapter 2). This impact is less than significant. No mitigation is required.

Impact REC-3: Reduced Accessibility to Commercial Recreation Facilities because of Gates. The location of permanent fish control and flow control gates could potentially affect the ability of boaters to access commercial recreation businesses (Figure 7.4-2) on Old River and Grant Line Canal. Interviews with marina operators and commercial recreation providers in July 2003 indicate that access to recreation sites has been an issue for recreationists since the implementation of the temporary barriers in the south Delta. Commercial recreation business owners and managers indicated that their businesses have experienced declining use and economic impacts since the temporary barriers have been in place, suggesting that temporary barriers have adversely affected public access to the south Delta channels. There are approximately 32 marinas within a 6-mile radius of the project area; therefore, reduced access to one would not result in a significant loss in recreation access or services. There are approximately 15 boat launches within the 6-mile radius and Alternative 2A–2C would reduce access to only one boat launch. The proposed permanent gates would also improve boating access from the current conditions. Boat locks on Old River and Grant Line flow control gates would allow access to marinas and other businesses. It is possible that during peak use periods (afternoons), boaters could experience a short delay at boat locks, but overall, boating access would not be reduced. This impact is less than significant. No mitigation is required. Please refer also to Section 7.2, Social Issues and Economics.

Impact REC-4: Conflict with Applicable Policies and Regulations. Implementation of Alternatives 2A–2C would not conflict with the identified applicable policies and regulations because, compared to the temporary barriers, permanent gates would result in improved access to the south Delta channels and to the commercial recreation businesses, and no recreation facilities would be displaced by project implementation. Implementing Alternatives 2A–2C would also not conflict or be inconsistent with local or state land use and recreation goals and policies. There would be no impact. No mitigation is required.

Impact REC-5: Alteration of Present Patterns of Recreational Navigation in Waterways. The placement of a permanent fish control gate at the head of Old River and permanent flow control gates on Old River, Middle River, and Grant Line Canal, would slightly modify the present recreational navigation access in these areas when the gates are operated. The proposed gates at Head of Old River, Old River and Grant Line Canal would provide permanent boat locks to allow boat passage during this time. An operator would be employed at each boat lock during the time that the gate is operated.

Use of current boat portage services takes approximately 10 minutes per boat (Doty pers. comm.). Under Alternatives 2A–2C, Middle River would continue to have a boat portage service to allow boats to cross. However, the gate and the boat portage service will be in place year-round instead of seasonally. This impact is less than significant. No mitigation is required.

Implementation of Alternatives 2A–2C would create permanent gates with boat locks at the head of Old River, Old River and Grant Line Canal. Boats entering/exiting Old River via San Joaquin River or Grant Line Canal would be required to stop year-round and wait for access through the gate via boat lock. The time to pass through the gate using the boat lock is anticipated to average 15 minutes (Doty pers. comm.). Although the time to pass through the boat lock on average is expected to be 5 minutes longer than with the boat portage service, this increase in wait time is minimal. This impact is less than significant. No mitigation is required.

Impact REC-6: Change in Water-Dependent and Water-Enhanced Recreation Opportunities in the South Delta. Operation of Alternatives 2A–2C would result in very small changes in south Delta water surface elevations. DSM2 modeling for Alternatives 2A–2C operations predicts that water surface elevations downstream of the proposed gates would decrease by less than 2 inches compared to existing conditions and the No Action Alternative. This predicted change in water surface elevation in the Old River, between the CVP Tracy facility and SR 4 bridge, would not be noticeable to recreationists engaged in water-dependent or -enhanced activities along those waterways. This impact is less than significant. No mitigation is required.

Dredging

Impact REC-7: Temporary Disruption to Recreational Opportunities during Dredging Operations. Under Alternatives 2A–2C proposed dredging of Old River, West Canal, and Middle River (Figure 7.4-2) and maintenance dredging would occur between August 1 and November 30 and could temporarily disrupt boating access during operation of hydraulic or clam shell dredging equipment from a barge. Boating and other recreation access would be restricted in the dredged area while equipment is being operated. This project activity could result in delays in boating on the affected channels or temporary loss of the recreation opportunity. Boating use in the south Delta would not be substantially degraded by temporary operation of dredging equipment, dredging would not occur on major summer holidays or weekends, and an Environmental Commitment would be implemented to educate and inform boaters about SDIP activities (See Chapter 2). This impact is less than significant. No mitigation is required.

2020 Conditions

Recreation use within the Delta is expected to increase by 2020 in response to regional population growth. The impact on recreation resulting from constructing and operating Alternatives 2A–2C would be similar to those described above. Therefore, all impacts would be less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Impact REC-8: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at North-of-Delta Reservoirs and Rivers. Operation of Alternatives 2A–2C would result in very small changes in the frequency with which the surface elevation of Shasta, Oroville, Trinity, and Folsom Reservoirs would fall below levels identified as important water-dependent recreation thresholds. During the peak season, from May to September, the change in surface elevation of these reservoirs would range between 4 additional months above the recreation thresholds to 11 additional months below the recreation thresholds over the 73-year modeling period (Table 7.4-5). Operation of the alternatives would also result in a very small change in the frequency with which flows in the Sacramento, American, and Feather Rivers are within a range suitable for water-dependent recreation during the peak recreation season (May to September). Flows in the rivers would range between 1 additional month inside the recreation thresholds to 6 additional months outside the recreation thresholds over the 73-year modeling period (Table 7.4-5). The small changes in reservoir surface elevations and river flows would not adversely affect water-dependent or water-enhanced recreation at these reservoirs or rivers. In addition, these small changes are not expected to affect the abundance of sport fish in reservoirs or rivers. (Section 6.1, Fish, provides a detailed evaluation of impacts on fish.) This impact is less than significant. No mitigation is required.

Table 7.4-5. Comparisons of Reservoir Level and River Flow Exceedance Frequencies for Recreation Opportunities at Important Recreation Resources[a]

	Project Change			
	2001 Baseline	Scenario A	Scenario B	Scenario C
Recreation Threshold	Months[b]/ Percent[c]	Months[d]/ Percent[c]	Months[d]/ Percent[c]	Months[d]/ Percent[c]
Folsom Reservoir[e] (Peak Season)				
360 msl—last boat ramp out of operation	10/2.7	+1/0.3	+1/0.3	+2/0.6
400 msl—limited surface area	50/13.7	+3/0.8	+1/0.3	No change
405 msl—marina closes	64/17.5	+6/1.6	+2/0.6	+4/1.1
430 msl—decline in shoreline activities	163/44.7	+5/1.4	+3/0.8	+3/0.8
Shasta Reservoir[e] (Peak Season)				
952 msl—last boat ramp out of operation	43/11.8	+2/0.6	No change	No change
1,107 msl—limited surface area	172/47.1	+5/1.4	+3/0.8	+3/0.8
Trinity Reservoir[e] (Peak Season)				
2,170 msl—last boat ramp out of operation	12/3.3	No change	+1/0.3	+1/0.3
2,320 msl—limited surface area	195/53.4	+3/0.8	-4/1.1	-4/1.1
Oroville Reservoir[e] (Peak Season)				
710 msl—last boat ramp out of operation	21/5.8	+3/0.8	+6/1.6	+5/1.4
750 msl—limited surface area	55/15.1	+2/0.6	No change	+4/1.1
819 msl—beaches close	156/42.7	+4/1.1	+11/3.0	+6/1.6
San Luis Reservoir[e]				
340 msl–last boat ramp out of operation	5/1.4	-4/1.1	-4/1.1	-5/1.4
Lower American River[e]				
<1,500 cfs—minimum rafting/boating elevation	39/10.7	+3/0.8	+1/0.3	-1/0.3
>3,000 cfs—optimal rafting/boating elevation	177/48.5	+3/0.8	+5/1.4	+4/1.1
Feather River[e]				
<2,500 cfs—minimum rafting/boating elevation	134/36.7	No change	+1/0.3	+3/0.8
>5,000 cfs—optimal rafting/boating elevation	144/39.5	+3/0.8	+5/1.4	+4/1.1
Sacramento River[e]				
<2,500 cfs—optimal rafting/boating minimum elev	0/0	No change	No change	No change
>12,000 cfs—optimal rafting/boating elevation	92/25.2	+6/1.6	+1/0.3	-1/0.3

[a] Project changes under Scenarios A–C are for Alternative 2 and are based on a comparison with the 2001 Baseline (conditions under the 73-year hydrologic period).

[b] Number of months the reservoir level is below indicated threshold or river flows are above or below indicated threshold.

[c] Percent of time reservoir level is below indicated threshold or river flows are above or below indicated threshold or inside.

[d] Change in number of months above or below threshold or inside indicated range compared to Baseline: + additional months below threshold or inside of indicated range, - fewer months below threshold or inside indicated range.

[e] The peak season extends from May to September (365 months over the 73-year hydrologic period).

Impact REC-9: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at SWP South-of-Delta Reservoirs. Operation of Alternatives 2A–2C would result in very small changes in the storage at San Luis Reservoir and other SWP reservoirs south of the Delta. During the peak season, from May to September, the surface elevation of San Luis Reservoir would remain above the recreation thresholds for 5 additional months over the 73-year modeling period (Table 7.4-5). Changes in storage and surface elevation at other SWP south-of-Delta reservoirs are also expected to be small. These small changes are not expected to affect the abundance of sport fish in south-of-Delta reservoirs. This impact is less than significant. No mitigation is required.

2020 Conditions

As described in Sections 5.1 and 5.2, water levels within the north- and south-of-Delta storage facilities and waterways would be similar to the present levels. Therefore, impacts resulting from implementation of Alternatives 2A–2C would be similar to those described above. All impacts are less than significant, and no mitigation is required.

Interim Operations

Interim operations in south Delta would have similar effects on recreation as discussed under the No Action Alternative. No new facilities would be constructed and the temporary barriers would continue to be installed and removed annually. The slight change in diversions to CCF would not result in a substantial change in the surface elevation of Delta waterways. The impacts on recreation opportunities and use are considered less than significant, and no mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact REC-1: Temporary Disruption to Recreational Opportunities during Construction of Gates. Construction of the fish control and flow control gates on Old River and Middle River would disrupt boating access in these areas for a total of approximately 36 months. Each gate would require approximately 15–36 months to construct, and gates would be constructed concurrently. Temporary loss of recreation opportunities would result during the construction period in a manner similar to that described for Alternatives 2A–2C. The greatest potential for disruption of boating would occur on Old River. Boating use on Middle River is generally low because of shallow water depths. This impact is less than significant because:

- disruption of boating access near these sites would be temporary;

- overall, the effect of gate construction on boating access in the south Delta would be minor considering the current opportunities for this activity;
- gates would be constructed in a manner that would allow boating access through half of the channel cross section at all times;
- construction work would not occur during major summer holiday periods;
- warning signs and buoys upstream will be posted at, and downstream of, all construction equipment, sites, and activities; and
- adequate warning would be provided regarding activities and equipment in construction sites.

No mitigation is required.

Impact REC-2: Disruption of Recreation Opportunities from Permanent Gates. The location of permanent fish control and flow control gates on Old River and Middle River could potentially affect the amount of boating that occurs in the vicinity of gates because of perceived difficulty of navigating past these new structures. Because the permanent control gates have more operational flexibility than temporary barriers, the difficulty in navigation may be reduced. All permanent gates would be designed to allow boat ingress/egress past permanent gates. This potential effect on boating would be most notable during summer months when recreation use is highest. The greatest potential for lost recreation opportunities would occur on Old River because boating on Middle River occurs less often because of shallow water depths. The Old River gates would operate a boat lock to allow boat passage. DWR would also implement Environmental Commitments to educate boaters about navigating in the vicinity of proposed gates (See Chapter 2). This impact is less than significant. No mitigation is required.

Impact REC-3: Reduced Accessibility to Commercial Recreation Facilities because of Gates. The location of permanent fish control and flow control gates under Alternative 3B could potentially affect the ability of boaters to access commercial recreation businesses (Figure 7.4-2) on Old River in a manner similar to that described for Alternatives 2A–2C. The proposed permanent gates under Alternative 3B would improve boating accessibility compared to existing conditions and No Action Alternative conditions. This impact is less than significant. No mitigation is required. Please refer also to Section 7.2, Social Issues and Economics.

Impact REC-4: Conflict with Applicable Policies and Regulations. Implementation of Alternative 3B would not conflict with the identified applicable policies and regulations because compared to the temporary barriers, permanent gates would result in improved access to the south Delta channels and to the commercial recreation businesses, and no recreation facilities would be displaced by project implementation. Implementing Alternative 3B would also not conflict or be inconsistent with local or state land use and recreation goals and policies. This impact is less than significant. No mitigation is required.

Impact REC-5: Alteration of Present Patterns of Recreational Navigation in Waterways. The impacts on recreational navigation in south Delta waterways would be similar to those under Alternatives 2A–2C. This impact would be slightly less under Alternative 3B because no gate will be constructed at Grant Line Canal. Under this alternative there will be one less barrier that would alter patterns of recreational navigation. This impact would be less than significant. No mitigation is required.

Impact REC-6: Change in Water-Dependent and Water-Enhanced Recreation Opportunities in the South Delta. Operation of Alternative 3B would result in very small changes in south Delta water surface elevations. DSM2 modeling for Alternative 3B operations predicts that water surface elevations in Old River would decrease by less than 2 inches compared to existing conditions and the No Action Alternative. This predicted change in water surface elevation in the Old River, between the CVP Tracy facility and SR 4 bridge, would not be noticeable to recreationists engaged in water-dependent or -enhanced activities along those waterways. This impact is less than significant. No mitigation is required.

Dredging

Impact REC-7: Temporary Disruption to Recreational Opportunities during Dredging Operations. Under Alternative 3B, proposed dredging of Old River, West Canal, and Middle River (Figure 7.4-2) and maintenance dredging would occur between August 1 and November 30 and could temporarily disrupt boating access during operation of hydraulic or clam shell dredging equipment. This potential disruption would be similar to the disruption described under Alternatives 2A–2C. Boating and other recreation access would be restricted in the dredged area while equipment is being operated. This impact is less than significant for the same reason identified under Alternatives 2A–2C. No mitigation is required.

2020 Conditions

Recreation users are expected to increase in the future. However, the impacts resulting from implementation of Alternative 3B under 2020 conditions would be similar to those described above. Therefore, all impacts would be less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Impact REC-8: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at North-of-Delta Reservoirs and Rivers. Operation of Alternative 3B would result in very small changes in the frequency with which the surface elevation of Shasta, Oroville, Trinity, and Folsom Reservoirs and Sacramento, American, and Feather Rivers would fall below levels identified as important water-dependent recreation thresholds. During the peak season, from May to September, the surface elevation of these reservoirs would range between 4 additional months above the recreation thresholds to 11 additional months below the levels at which boating becomes constrained over the 73-year modeling period (Table 7.4-5). Operation of this alternative would also result in a very small change in the frequency with which flows in the Sacramento, American, and Feather Rivers are within a range suitable for water-dependent recreation during the peak recreation season (May–September). Flows in the rivers would fall outside the suitable range between 0 and 5 additional months over the 73-year modeling period (Table 7.4-5). The small changes in reservoir surface elevations and river flows would not adversely affect water-dependent or water-enhanced recreation at these reservoirs or rivers. In addition, these small changes are not expected to affect the abundance of sport fish in reservoirs or rivers. (Section 6.1, Fish, provides a detailed evaluation of impacts on fish.) This impact is less than significant. No mitigation is required.

Impact REC-9: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at SWP South-of-Delta Reservoirs.
Operation of Alternatives 2A–2C would result in very small changes in the storage at San Luis Reservoir and other SWP reservoirs south of the Delta. During the peak season, from May to September, the surface elevation of San Luis Reservoir would remain above the recreation thresholds for 4 additional months over the 73-year modeling period (Table 7.4-5). Changes in storage and surface elevation at other SWP south-of-Delta reservoirs are also expected to be small. These small changes are not expected to affect the abundance of sport fish in south-of-Delta reservoirs. This impact is less than significant. No mitigation is required.

2020 Conditions

As described in Sections 5.1 and 5.2, water levels within the north- and south-of-Delta storage facilities and within south Delta waterways would be similar to present levels. Therefore, impacts resulting from implementation of Alternative 3B would be similar to those described above. All impacts are less than significant, and no mitigation is required.

Alternative 4B

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact REC-1: Temporary Disruption to Recreational Opportunities during Construction of Gates. Construction of the fish control and flow control gates on Old River would disrupt boating access in these areas for a total of approximately 36 months. Each gate would require approximately 15–36 months to construct, and gates would be constructed concurrently. Temporary loss of recreation opportunities would result during the construction period in a manner similar to that described under Alternatives 2A–2C and 3B. This impact is less than significant for the same reasons identified for Alternatives 2A–2C. No mitigation is required.

Impact REC-2: Disruption of Recreation Opportunities from Permanent Gates. The location of a permanent fish control gate on Old River could potentially affect the amount of boating that occurs in the vicinity of the gate because of perceived difficulty of navigating past the new structure. Because the permanent gate would have more operational flexibility than a temporary barrier, the difficulty in navigation may be reduced. The permanent gate would be designed to allow boat ingress/egress past permanent gates. This potential effect on boating would be most notable during summer months when recreation use is highest. This impact is less than significant. No mitigation is required.

Impact REC-3: Reduced Accessibility to Commercial Recreation Facilities because of Gates. The location of permanent fish control and flow control gates under Alternative 4B could potentially affect the ability of boaters to access commercial recreation businesses (Figure 7.4-2) on Old River in a manner similar to that described for Alternatives 2A–2C and 3B. The proposed permanent gates under Alternative 4B would improve boating accessibility compared to existing conditions and No Action Alternative conditions. This impact is less than significant. No mitigation is required. Please refer also to Section 7.2, Social Issues and Economics.

Impact REC-4: Conflict with Applicable Policies and Regulations. Implementation of Alternative 4B would not conflict with the identified applicable policies and regulations because compared to temporary barriers, the permanent gate would result in improved access to the south Delta channels and to the commercial recreation businesses, and no recreation facilities would be displaced by project implementation. Implementing Alternative 4B would also not conflict or be inconsistent with local or state land use and recreation goals and policies. This impact is less than significant. No mitigation is required.

Impact REC-5: Alteration of Present Patterns of Recreational Navigation in Waterways. The impacts on recreational navigation in south Delta waterways would be similar to those under Alternatives 2A–2C. The head of Old River fish control gate is the only gate that will be constructed under Alternative 4B; therefore the impacts under this alternative would be slightly less than under Alternatives 2A–2C. Under this alternative there will only be one gate that would alter patterns of recreational navigation and this gate would have a boat lock. This impact is less than significant. No mitigation is required.

Impact REC-6: Change in Water-Dependent and Water-Enhanced Recreation Opportunities in the South Delta. Operation of Alternative 4B would result in very small changes in south Delta water surface elevations. DSM2 modeling for Alternative 4B operations predicts that water surface elevations downstream of the proposed Old River fish control gate would decrease by less than 2 inches compared to existing conditions and the No Action Alternative. This predicted change in water surface elevation in the Old River, between the CVP Tracy facility and SR 4 bridge, will not be noticeable to recreationists engaged in water-dependent or -enhanced activities along those waterways. This impact is less than significant. No mitigation is required.

Dredging

Impact REC-7: Temporary Disruption to Recreational Opportunities during Dredging Operations. Under Alternative 4B, proposed dredging (Figure 7.4-2) and maintenance dredging would occur between August 1 and November 30 and could temporarily disrupt boating access during operation of hydraulic or clam shell dredging equipment similar to that described for Alternatives 2A–2C. Boating and other recreation access would be restricted in the dredged area while equipment is being operated, most likely during the months of August and September. This impact is less than significant for the same reason identified for Alternatives 2A–2C. No mitigation is required.

2020 Conditions

Recreation users are expected to increase in the future. However, the impacts resulting from implementation of Alternative 4B under 2020 conditions would be similar to those described above. Therefore, all impacts would be less than significant, and no mitigation is required.

Stage 2 (Operational Component)

Impact REC-8: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at North-of-Delta Reservoirs and Rivers. Operation of Alternative 4B would not result in changes in the frequency with which the surface elevation of Shasta, Oroville, Trinity, and Folsom Reservoirs and Sacramento, American, and Feather Rivers would fall below levels identified as important water-dependent recreation thresholds. During the peak season, from May to September, the surface elevation of these reservoirs would range between 4 additional months above the recreation thresholds to 11 additional months below the levels at which boating becomes constrained over the 73-year modeling period (Table 7.4-5). Operation of this alternative would also result in a very small change in the frequency with which flows in the Sacramento, American, and Feather Rivers are within a range suitable for water-dependent recreation during the peak recreation season (May–September). Flows in the rivers would fall outside the suitable range between 0 to 5 additional months over the 73-year modeling period (Table 7.4-5). The small changes in reservoir surface elevations and river flows would not adversely affect water-dependent or water-enhanced recreation at these reservoirs or rivers. In addition, these small changes are not expected to affect the abundance of sport fish in reservoirs or rivers. (Section 6.1, Fish, provides a detailed evaluation of impacts on fish.) This impact is less than significant. No mitigation is required.

Impact REC-9: Change in Water-Dependent and Water-Enhanced Recreation Opportunities at SWP South-of-Delta Reservoirs. Operation of Alternative 4B would result in very small changes in the storage at San Luis Reservoir and other SWP reservoirs south of the Delta. During the peak season, from May to September, the surface elevation of San Luis Reservoir would remain above the recreation thresholds for 4 additional months over the 73-year modeling period (Table 7.4-5). Changes in storage and surface elevation at other SWP south-of-Delta reservoirs are also expected to be small. These small changes are not expected to affect the abundance of sport fish in south-of-Delta reservoirs. This impact is less than significant. No mitigation is required.

2020 Conditions

As described in Sections 5.1 and 5.2, water levels within the north- and south-of-Delta storage facilities and within south Delta waterways would be similar to present levels. Therefore, impacts resulting from implementation of Alternative 3B would be similar to those described above. All impacts are less than significant, and no mitigation is required.

Cumulative Evaluation of Impacts

Cumulative impacts on Recreation are analyzed in Chapter 10, “Cumulative Impacts.” This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

7.5 Power Production and Energy

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on power production and energy. Specifically, it evaluates and discusses the consequences associated with construction and operation of the project. Significance of impacts is determined by applying significance criteria set forth in the State CEQA Guidelines.

Summary of Significant Impacts

There are no significant impacts on power production and energy as a result of implementation of any of the alternatives. All impacts are discussed in detail under the Environmental Consequences section.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- Draft EIR/EIS for the ISDP, Volume I, July 1996;
- California Department of Water Resources Bulletin 132-01: *Management of the California State Water Project*, December 2002;
- California Department of Water Resources Bulletin 132-00: *Management of the California State Water Project*, December 2001;
- California Department of Water Resources Bulletin 132-99: *Management of the California State Water Project*, March 2001;
- California Department of Water Resources Bulletin 132-98: *Management of the California State Water Project*, November 1999; and
- California Department of Water Resources Bulletin 132-97: *Management of the California State Water Project*, December 1998.

State Water Project Electrical Generation and Consumption

The primary purpose of the SWP electrical generation facilities is to meet the energy requirements of the SWP pumping plants. Because DWR has the flexibility to regulate SWP pumping on an hourly basis, maximum SWP pumping is generally scheduled when power costs are low (e.g., during the middle of the night when there is less demand on the regional power system). By scheduling as much off-peak pumping as possible, DWR is able to take advantage of inexpensive surplus electrical generation capability. Conversely, DWR maximizes its electrical generation when electricity is the most expensive (e.g., during the afternoon and early evening in the summer). In this manner, DWR is able to manage a comprehensive power resources program that helps minimize the cost of water deliveries to SWP water supply contractors (California Department of Water Resources 2002c).

The SWP is one of the largest water and power systems in the world (California Department of Water Resources 2002c). Operation of the SWP (e.g., pumping plants that pump SWP water to farms and cities) requires more electricity than is generated by SWP facilities (e.g., hydroelectric plants at SWP reservoirs). The balance of electricity needed to operate the SWP is provided by long-term contracts with electricity providers and short-term purchases. Because of the flexibility in SWP operations (described above), DWR sells electricity to utility companies when the SWP generates electricity that is surplus to its requirements; this reduces DWR's net cost of pumping (California Department of Water Resources 2002c). Table 7.5-1 is a summary showing the amount of electricity consumed and generated throughout the SWP for 1996 through 2000, including long- and short-term purchases and electricity sales.

Table 7.5-1. Electricity Purchased and Generated by the SWP (1996–2000)[a]

	Year				
Category	2000	1999	1998	1997	1996
Electricity Required by SWP Facilities	9,190.38	5,757.53	3,445.29	5,669.61	5,308.24
Electricity Generated by SWP Facilities	6,371.67	5,673.63	5,915.17	4,566.82	5,189.82
Electricity Provided through Long-term Agreements	3,429.91	3,084.52	3,621.38	4,639.58	4,292.01
Electricity Provided through Short-term Purchases	2,310.83	1,230.77	808.50	370.13	159.29
Electricity Sales	2,921.88	4,231.40	6,899.76	3,906.91	4,332.88

Note:
[a] Units are shown in millions of kilowatt-hours.
Sources: California Department of Water Resources 1998c, 1999d, 2001d, 2001c, and 2002c.

The SWP generates a large portion of the electricity it consumes at the power plants that are owned either entirely or partially by DWR. The locations of these power plants are shown on Figure 7.5-1. In addition, DWR has several short- and long-term contracts for electricity purchases, exchanges, transfers, and sales with other electric utilities in California and the western states (California Department of Water Resources 2002c).

DWR has contracts with Southern California Edison and PG&E for most of the intrastate transmission service it needs to operate the SWP (California Department of Water Resources 2002c). DWR owns 32 circuit miles of 230-kV transmission lines connecting the Hyatt-Thermalito Powerplant to PG&E's Table Mountain Substation (California Department of Water Resources and Bureau of Reclamation 1996a).

CVP Electrical Generation and Consumption

Similar to the SWP, the federal CVP is a major generator and consumer of electricity in California. Electricity produced at Reclamation facilities is used at CVP facilities to meet authorized project purposes or sold as surplus power. Unlike the SWP, the CVP is a net producer of power—it generates more electricity than it requires to operate. Generation by CVP power plants in 2002 was approximately 4,295 million kilowatt-hours (Bureau of Reclamation 2003c). Surplus power contracts are marketed in the CVP area by the Western Area Power Administration. Preference for surplus power contracts is given to municipalities, public corporations, public and State agencies, and cooperatives or other nonprofit organizations. In the south Delta, the CVP Tracy facility is located near the SWP Banks facility and diverts water into the DMC for export.

Environmental Consequences

Assessment Methods

Changes in SWP electricity generation and consumption were assessed using the CALSIM II model (see http://modeling.water.ca.gov for a discussion of CALSIM II). For this project, DWR developed a power module based on CALSIM II. This new power module uses CALSIM II output (e.g., river and aqueduct flow, reservoir capacity) and standard electricity equations to determine how much power would be generated by SWP facilities and how much electricity would be consumed by other SWP facilities. To understand the order of magnitude changes in CVP net electricity use, CALSIM II output was also analyzed using Long-term Generation, a spreadsheet developed by the Western Area Power Administration.

The effects of operating the flow control and fish control gates are not considered in the quantitative assessment of changes in SWP electricity generation and consumption. At this time, the CALSIM II power module does not include the proposed facilities. A separate assessment was conducted, using standard engineering calculations, to determine the increase in electricity consumption by the permanent operable gates.

Significance Criteria

For electricity generation and consumption, the environmental consequences of the project are measured in terms of how the operation of the project would affect the net energy requirements of the SWP. This is consistent with the significance criteria used in the CALFED Bay-Delta Program Final Programmatic EIS/ EIR (July 2000(b)).

Effects on the SWP net energy requirements would be considered significant if net electricity consumption increased substantially. For this analysis, a substantial increase is defined as an increase in net electricity consumption of more than 10%.

Alternative 1 (No Action)

Impact POW-1: Potential Changes in SWP Electricity Generation and Consumption as a Result of Operating the Temporary Barriers. Table 7.5-2 summarizes average electricity generation and consumption for the No Action Alternative and the future no action conditions as modeled by CALSIM II. The table shows that there would not be a substantial increase in either electricity generation or consumption between the current condition and the future condition with implementation of the No Action Alternative, and no mitigation is required.

Table 7.5-2. Alternative 1 SWP Electricity Generation and Consumption, Average of All Water Years (in gigawatt-hours)

Delivery Type	2001 Demand	2020 Demand
Electricity Generation	4,663	4,820
Electricity Consumption	9,102	9,721

Source: CALSIM II model output (California Department of Water Resources 2003 unpublished information).

Impact POW-2: Increased Electricity Consumption as a Result of Operating the Temporary Barriers. No electricity would be consumed under the No Action Alternative because there would be no active operation of the temporary rock barriers.

2020 Conditions

As described above, there would be no significant changes in energy production or consumption under the future no action conditions (2020 conditions). Therefore, impacts would be less than significant, and no mitigation is required.

Alternatives 2A, 2B, 2C

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

There are no impacts to power production and energy as a result of the construction of the fish control and flow control gates.

Impact POW-3: Increased Electricity Consumption as a Result of Operating the Fish Control and Flow Control Gates. Minor changes to local electricity consumption could occur under Alternatives 2A–2C relative to the No Action Alternative. Average energy usage for the permanent gates is expected to total approximately 4,000 kilowatt-hours per month (Enas pers. comm.). Electric power will be required to operate the fish control and flow control gates. Under Alternatives 2A–2C, electricity at the head of Old River fish control gate would be used to raise and lower the bottom hinge gates, and for operating miter gates for the boat locks (the boat locks would not otherwise require power for operations). Lighting for accessory buildings and navigation/safety purposes would require additional electricity consumption. Similar electricity consumption would be required for each of the flow control gates, except that there would be no boat locks at the Middle River gate. The electricity consumed by the gates relative to overall SWP electricity consumption is very small. This impact is less than significant. No mitigation is required.

Dredging

There are no impacts to power production and energy as a result of the dredging proposed as part of Alternatives 2A–2C.

2020 Conditions

Implementation of Alternatives 2A–2C under 2020 conditions would result in physical/structural component impacts on power production or consumption as described above.

Stage 2 (Operational Component)

Impact POW-4: Potential Changes in SWP Electricity Generation and Consumption. Increasing diversions from 6,800 cfs to 8,500 cfs would allow greater flexibility in DWR's operations and potentially change the amount of electricity generated and consumed by SWP facilities. These changes depend on how the SWP Banks facility is operated. Potential changes are discussed below, with additional information presented in Table 7.5-3.

Table 7.5-3. Alternative 2 SWP Electricity Generation and Consumption, Average of All Water Years (in gigawatt-hours)

Delivery Type and Year of Demand		Alt 1	Alt. 2A (% change)	Alt. 2B (% change)	Alt. 2C (% change)
Generation	2001	4,663	**41** (0.9%)	**-6** (-0.1%)	**24** (0.5%)
	2020	4,820	**55** (1.1%)	**8** (0.2%)	**52** (1.1%)
Consumption	2001	9,102	**168** (1.8%)	**-17** (-0.2%)	**136** (1.5%)
	2020	9,721	**235** (2.4%)	**30** (0.3%)	**229** (2.4%)

Source: CALSIM II model output (California Department of Water Resources 2003h unpublished information).

Annual average SWP electricity generation would increase under operational scenarios that result in increased SWP water deliveries (e.g., Alternatives 2A and 2C), primarily as a result of increased flows through generating facilities along the California Aqueduct (e.g., Devil Canyon). Alternative 2B would result in decreased generation under 2001 demands. SWP electricity consumption would continue to outpace generation under all operational scenarios. For alternatives that result in increased water deliveries (Alternatives 2A and 2C), annual average SWP electricity consumption would increase, primarily as a result of increased pumping at pumping plants along the California Aqueduct (e.g., Edmonston) and to a lesser degree at the SWP Banks facility. For these alternatives, the increase in SWP electricity consumption would outpace the increase in generation described in the above paragraph, resulting in a net increase in consumption. Alternative 2B would result in decreased consumption under 2001 demands. Overall, net consumption changes little under Alternative 2B.

Relative to the No Action Alternative, Alternatives 2A and 2C would result in an increase in net SWP electricity consumption. On an annual average basis, the level of net SWP electricity consumption could increase up to 177 gigawatt-hours under Alternative 2C. In addition, it is possible that the increased flexibility of SWP operations would allow additional pumping to occur during off-peak times and, therefore, DWR could take advantage of more favorable off-peak rates. This potential economic benefit of increased pumping flexibility could help offset the adverse effect of increased SWP energy consumption. Because of the small increase and expected increase in flexibility, this impact would be less than significant.

Relative to the No Action Alternative, Alternative 2B would result in approximately the same level of SWP electricity generation and consumption. This impact is less than significant. No mitigation is required.

Impact POW-5: Potential Changes in CVP Electricity Generation and Consumption. Increased capacity of the SWP Banks facility combined with flexible operation by DWR could allow some diversion requirements to be transferred to the federal CVP Tracy facility. This is expected to be especially true under Alternative 2A, which increases the integrated operation of the state and federal pumping facilities in the south Delta. Because of this increased integrated operation, the potential effects of Alternative 2A on CVP electricity generation and use were analyzed using the Western Area Power Administration's Long-term Generation spreadsheet. All other operational scenarios were assumed to cause a smaller increase in net consumption than under Alternative 2A. This impact is less-than-significant. No mitigation is required.

2020 Conditions

Implementation of Alternatives 2A–2C would result in increased power generation and consumption under 2020 demands. However, overall, the consumption is greater than the generation in all alternatives. Electricity consumption under Alternative 2A is expected to increase by about 47 million kilowatt-hours per year, or about 3.8% relative to the No Action Alternative. In that same timeframe, no change is expected in electricity generation, and therefore net generation is expected to decline by an annual average of 3.8% relative to the No Action Alternative. This is comparable to the project-related changes in net SWP electricity consumption (Impact POW-3) discussed above. These impacts are less than significant, and no mitigation is required.

Interim Operations

Interim operations would result in an increase in diversions into CCF. As described above, this would result in a general net increase in consumption; however, both consumption and generation would be decreased. No permanent gates would be operated, and therefore, there would be no consumption of energy related to gate operation. These impacts are less than significant, and no mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

There are no impacts to power production and energy as a result of the construction of the fish control and flow control gates.

Impact POW-3: Increased Electricity Consumption as a Result of Operating the Fish Control and Flow Control Gates. Minor changes to local electricity consumption could occur relative to the No Action Alternative. Average energy usage for the permanent gates is expected to total approximately

4,000 kilowatt-hours per month (Enas pers. comm.). Electric power will be required to operate the fish control and flow control gates. Under Alternative 3B, electricity at the head of Old River fish control gate would be used for operating inflatable bladders to raise and lower the bottom-hinged gates, and for operating miter gates for the boat locks (the boat locks would not otherwise require power for operations). Lighting for accessory buildings and navigation/safety purposes would require additional electricity consumption. Similar electricity consumption would be required for each of the agricultural gates, except that there would be no boat locks at the Middle River gate. The electricity consumed by the gates relative to overall SWP electricity consumption is very small. This impact is less than significant. No mitigation is required.

Dredging

There are no impacts to power production and energy as a result of the dredging associated with Alternative 3B.

2020 Conditions

Implementation of Alternative 3B under 2020 conditions would not result in construction-related impacts on power production or consumption as described above.

Stage 2 (Operational Component)

Impact POW-4: Potential Changes in SWP Electricity Generation and Consumption. Increasing diversions from 6,800 cfs to 8,500 cfs would allow greater flexibility in DWR's operations and potentially change the amount of electricity generated and consumed by SWP facilities. These changes would depend on how the SWP Banks facility is operated. Alternative 3B would result in decreased generation under 2001 demands. SWP electricity consumption would continue to outpace generation under Alternative 3B. Implementation of this alternative would result in decreased consumption under 2001 demands. Overall, net consumption changes little under Alternative 3B.

In addition, it is possible that the increased flexibility of SWP operations would allow additional pumping to occur during off-peak times and, therefore, DWR could take advantage of more favorable off-peak rates. This potential economic benefit of increased pumping flexibility could help offset the adverse effect of increased SWP energy consumption. Relative to the No Action Alternative, Alternative 3B would result in approximately the same level of SWP electricity generation and consumption. This impact is less than significant. No mitigation is required.

Impact POW-5: Potential Changes in CVP Electricity Generation and Consumption. Increased diversions combined with flexible operation by DWR could allow some diversion requirements to be transferred to the federal CVP Tracy facility. This is comparable to the project-related changes in net SWP electricity consumption (Impact POW-3). This impact is less-than-significant. No mitigation is required.

2020 Conditions

Implementation of Alternative 3B under 2020 conditions would result in increased generation and consumption of energy. Overall, there is a net increase in consumption. Under 2020 conditions, electricity consumption under Alternative 2A is expected to increase by about 47 million kilowatt-hours per year, or about 3.8% relative to the No Action Alternative, and Alternative 3B is assumed to cause a smaller increase in net consumption than under Alternative 2A. In that same timeframe, no change is expected in electricity generation and, therefore, net generation is expected to decline by an annual average of 3.8% relative to the No Action Alternative. These impacts are less than significant, and no mitigation is required.

Alternative 4B

Stage 1 (Physical/Structural Component)

Fish Control Gate

There are no impacts to power production and energy as a result of the construction of the fish control gate.

Impact POW-3: Increased Electricity Consumption as a Result of Operating the Fish Control and Flow Control Gates. Minor changes to local electricity consumption could occur relative to the No Action Alternative. Average energy usage for the permanent gate is expected to total approximately 4,000 kilowatt-hours per month (Enas pers. comm.). Electric power will be required to operate the fish control gate. Under Alternative 4, electricity at the head of Old River fish control gate would be used to raise and lower the bottom hinge gates, and for operating miter gates for the boat locks (the boat locks would not otherwise require power for operations). Lighting for accessory buildings and navigation/safety purposes would require additional electricity consumption. This impact is less than significant. No mitigation is required.

Dredging

There are no impacts to power production and energy as a result of the dredging associated with Alternative 4B.

2020 Conditions

Implementation of Alternative 4B under 2020 conditions would not result in construction-related impacts on power production or consumption as described above.

Stage 2 (Operational Component)

Impact POW-4: Potential Changes in SWP Electricity Generation and Consumption. Increasing diversions from 6,800 cfs to 8,500 cfs would allow greater flexibility in DWR's operations and potentially change the amount of electricity generated and consumed by SWP facilities. Such changes depend on how SWP Banks is operated. Alternative 4B would result in decreased generation under 2001 demands.

SWP electricity consumption would continue to outpace generation under Alternative 4B. This alternative would result in decreased consumption under 2001 demands. Overall, net consumption changes little under Alternative 4B.

In addition, it is possible that the increased flexibility of SWP operations would allow additional pumping to occur during off-peak times, and therefore DWR could take advantage of more favorable off-peak rates. This potential economic benefit of increased pumping flexibility could help offset the adverse effect of increased SWP energy consumption. Relative to the No Action Alternative, Alternative 4B would result in approximately the same level of SWP electricity generation and consumption. This impact is less than significant. No mitigation is required.

Impact POW-5: Potential Changes in CVP Electricity Generation and Consumption. Increasing the flexibility of DWR operations could allow some diversion requirements to be transferred to the federal CVP Tracy facility. This is comparable to the project-related changes in net SWP electricity consumption (Impact POW-4). This impact is less-than-significant. No mitigation is required.

2020 Conditions

Implementation of Alternative 4B under 2020 conditions would result in increased generation and consumption of energy. Overall, there is a net increase in consumption. Under 2020 conditions, electricity consumption under Alternative 2A is expected to increase by about 47 million kilowatt-hours per year, or about 3.8% relative to the No Action Alternative, and Alternative 4B is assumed to cause a smaller increase in net consumption than under Alternative 2A. In that same timeframe, no change is expected in electricity generation and, therefore, net generation is expected to decline by an annual average of 3.8% relative to the No Action Alternative.

Cumulative Evaluation of Impacts

Cumulative impacts on power production and energy are analyzed in Chapter 10, “Cumulative Impacts.” This chapter summarizes the other foreseeable future projects that may contribute to these impacts.

7.6 Visual/Aesthetic Resources

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on visual resources or aesthetics in the project vicinity. Specifically, this section evaluates and discusses the consequences of the construction and operation of the project in terms of changes to visual character and quality, visibility of proposed changes, and viewer response to and significance of those changes. Significance of impacts is determined by using significance criteria set forth in the State CEQA Guidelines.

The primary concern related to visual/aesthetic resources in the south Delta is permanent changes in views and nighttime light and glare following construction of the gates. These impacts are considered significant because recreationists and nearby landowners with high sensitivity would be affected by the SDIP. Mitigation measures are provided that would reduce these impacts to less-than-significant levels.

Summary of Significant Impacts

Table 7.6-S summarizes the significant construction and operation related impacts on visual resources. Significant impacts would occur as a result of light and glare and changes in views associated with the river gates.

Table 7.6-S. Summary of Significant Impacts on Visual Resources

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
Impact VR-3: Changes in Views at the Head of Old River Fish Control Gate Site	2A–2C, 3B, 4B	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion.	Less than Significant
Impact VR-4: Changes in Light and Glare at Head of Old River	2A–2C, 3B, 4B	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion. VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards	Less than Significant
Impact VR-9: Changes in Light and Glare at the Middle River Gate Site	2A–2C, 3B	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion. VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards	Less than Significant

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
Impact VR-12: Changes in Local Scenic Character at the Grant Line Canal Gate Site	2A–2C	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion.	Less than Significant
Impact VR-14: Changes in Light and Glare at the Grant Line Canal Gate Site	2A–2C	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion. VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards	Less than Significant
Impact VR-15: Inconsistency with Local Visual Policies at the Grant Line Canal Gate Site	2A–2C	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion.	Less than Significant
Impact VR-17: Changes in Local Scenic Character at the Old River at DMC Flow Control Gate Site	2A–2C, 3B	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion.	Less than Significant
Impact VR-18: Changes in Views at the Old River at DMC Flow Control Gate Site	2A–2C, 3B	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion.	Less than Significant
Impact VR-19: Changes in Light and Glare at the Old River at DMC Flow Control Gate Site	2A–2C, 3B	Significant	VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards	Less than Significant
Impact VR-20: Inconsistency with Local Visual Policies at the Old River at DMC Flow Control Gate Site	2A–2C, 3B	Significant	VR-MM-1: Implement Measures to Reduce Visual Intrusion.	Less than Significant

Concepts and Terminology for Visual Assessment and Visual Quality

In Webster's *New World Dictionary*, aesthetics is defined as "the study or theory of beauty and the psychological responses to it." Aesthetics (or visual resource) analysis is, therefore, a process to logically assess visible change and viewer response to that change.

Identification of existing conditions with regard to visual resources entails three steps:

1. Objective identification of the visual features (visual resources) of the landscape.

2. Assessment of the character and quality of those resources relative to overall regional visual character.
3. Identification of the importance to people, or sensitivity, of views of visual resources in the landscape.

Visual quality is evaluated using the well-established approach to visual analysis adopted by the FHWA, employing the concepts of vividness, intactness, and unity (Federal Highway Administration 1983). These terms are defined below:

- **Vividness**—The visual power or memorability of landscape components as they combine in striking or distinctive visual patterns.
- **Intactness**—The visual integrity of the natural and artificial landscape and its freedom from encroaching elements. Intactness can be present in well-kept urban and rural landscapes, as well as in natural settings.
- **Unity**—The visual coherence and compositional harmony of the landscape considered as a whole; it frequently attests to the careful design of individual components in the artificial landscape.

The appearance of the landscape is described below using these criteria and descriptions of the dominance of elements of form, line, color, and texture. These elements are the basic components used to describe visual character and quality for most visual assessments (U.S. Forest Service 1974, Federal Highway Administration 1983). In addition to their use as descriptors, vividness, unity, and intactness are used more objectively as part of a rating system to assess a landscape's visual quality. This rating system includes seven categories, ranging from very low to moderate to very high. Viewer sensitivity or concern is based on the visibility of resources in the landscape, the proximity of viewers to the visual resource, the relative elevation of viewers to the visual resource, the frequency and duration of views, the number of viewers, and the types and expectations of individuals and viewer groups.

The criteria for identifying importance of views are related in part to the position of the viewer relative to the resource. An area of the landscape that is visible from a particular location (e.g., an overlook) or series of points (e.g., a road or trail) is defined as a viewshed. To identify the importance of views of a resource, a viewshed may be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater is its importance to the viewer. Although distance zones in viewsheds may vary between different geographic regions or types of terrain, a commonly used set of criteria identifies the foreground zone as 0.4–0.8 kilometer (0.25–0.5 mile) from the viewer, the middleground zone as extending from the foreground zone to 4.8–8 kilometers (3–5 miles) from the viewer, and the background zone as extending from the middleground zone to infinity (U.S. Forest Service 1974).

Visual sensitivity also depends on the number and type of viewers and the frequency and duration of views. Generally, visual sensitivity increases with an increase in total numbers of viewers, the frequency of viewing (e.g., daily or seasonally), and the duration of views (i.e., how long a scene is viewed). Also, visual sensitivity is higher for views seen by people who are driving for pleasure; people engaging in recreational activities such as hiking, biking, or camping; and homeowners. Sensitivity tends to be lower for views seen by people driving to and from work or as part of their work (U.S. Forest Service 1974; U.S. Soil Conservation Service 1978; Federal Highway Administration 1983). Views from recreation trails and areas, scenic highways, and scenic overlooks are generally assessed as having high visual sensitivity.

Affected Environment

Sources of Information

The description of existing visual/aesthetic conditions in the SDIP project area is based primarily on the following resources:

- Draft EIR/EIS for the ISDP, Volumes I and II, 1996;
- direct field observations;
- photographic documentation; and
- CALFED Bay-Delta Final Programmatic EIS/EIR, 2000.

Regional Visual Character

The Delta is a relatively flat and expansive area that occupies 1,100 square miles at the confluence of the Sacramento and San Joaquin Rivers. The Delta covers five counties and is roughly bounded (for the purposes of this project) by I-5 on the east, the Suisun Marsh on the west, the City of Sacramento to the north, and Old River on the south. SRs 4 and 160 are designated scenic highways running through the region. It is not possible to view the Delta waterways from many sections of SR 4, but features such as Mount Diablo are visible (CALFED Bay-Delta Program 2000b). The major population centers of the San Francisco Bay Area and the cities of Sacramento and Stockton are located in the surroundings of the Delta (San Joaquin County General Plan 1992).

As an agricultural region, the Delta is one of extensively managed landforms and water bodies, largely altered from their natural state. By the end of World War I, the Delta had been transformed from a large tidal marsh into the series of channels and leveed islands visible today. Because much of the Delta’s land is below sea level, miles of levees are relied on for its protection against flooding. This supports agriculture, recreation, and other human-influenced land uses, further taking the Delta out of a natural visual context (California Department of Water Resources 1995a). With 700 miles of interconnected waterways, the Delta is a unique resource providing recreational opportunities such as boating, swimming, fishing, waterskiing, and bird watching (San Joaquin County General Plan 1992). Many of the human-made channels have noticeable visible differences from natural water bodies. Features such as diversion structures; regular, evenly sloped and riprapped banks; and uniform, often straight, courses distinguish many of the dredged waterways. In some instances, slight differences in line and scale, instead of unnatural structures, are what set natural and altered channels apart, making the distinction less noticeable. The vegetation growth along the banks of watercourses created during reclamation helps them to blend visually with natural channels. From a near viewpoint, rural residential and agricultural uses separate the Delta into orderly, cultivated rows and grids. Although the imprint of humans upon the landscape is obvious, the lack of permanent structures allows the area to remain a more natural setting, especially as it is viewed from a distance.

The Delta region can be described as two separate geographic and visual areas. The lowlands range in elevation from below sea level to about 10 feet above msl and have a generally flat topography. The uplands rise from around 10 to 100 feet msl in a gently sloping alluvial plain, forming a transition between the Delta lowlands and the inland hills of the Mount Hamilton, Altamont, and Diablo ranges.

Because of the minimal topographic variation within the Delta, views in the lowlands are fairly homogenous in form, texture, and color. Foreground views are typically composed of large areas of flat agricultural land interspersed with levees, waterways, tree clusters, and occasional residential or commercial tracts. Most of the residents in the area are rural and associated with farm operations, with the exception of the Discovery Bay community and the communities lying outside of Stockton. Although these views offer little in the way of middle-ground features, on clear days the Sierra Nevada and Coast ranges are noticeable in the eastern and western backgrounds respectively.

The upland plain and the lowland are distinguishable from one another through differences in vegetation, landform, waterforms, and development patterns. Natural vegetation in the upland plain has largely been altered by agricultural, residential, and commercial land uses. Other vegetation in this area consists of grasslands, small oak clusters, and riparian areas. The vegetation of the upland plain is diversified by the presence of orchards and row crops. The background views consist of ridgelines leading up to the hills and ridges of eastern Alameda and Contra Costa Counties. Water forms in the upland plain are less frequent than in the lowlands and include rivers and streams, agricultural ponds, and drainage/irrigation canals. Residential developments are more frequent in the uplands than in the lowlands.

Viewers, Viewer Sensitivity, Aesthetic Character, and Visibility of the Project Element Locations

Viewer sensitivity varies with regard to visual change. Those viewers considered most sensitive to visual change include local residents, recreational users, employees at business, and travelers on scenic roadways. For each project site, sensitive viewers are described.

The south Delta's aesthetic character is similar to that of the entire Delta: meandering waterways with densely vegetated instream islands intersecting large flat agricultural lands. Because of the lack of topographical variation in the south Delta, views from the levees are vast and comprise mainly sunken agricultural islands. Foreground views from the levees are mainly of roadside vegetation and cultivated fields with high voltage transmission lines crossing the landscape in some areas. In the western background, the Altamont Hills merge with the Mount Hamilton Range to the south and the Mount Diablo Range to the north. Landmarks such as Mount Diablo and the Altamont Pass windfarms complement the view.

Boaters' views are mostly short in range because of the height of the surrounding levees. Foreground views from the waterways include riprapped levees and densely vegetated instream islands, an abundance of agricultural pumps, and occasional riverside docks and residences. To the west, the Altamont Hills can sometimes be seen in the distance.

Proposed Head of Old River Fish Control Gate Site

Located at the confluence of the head of Old River and the San Joaquin River is the Old River fish control gate site. Travelers on San Joaquin Road and recreationists on Old River and the San Joaquin River are sensitive viewers in the vicinity of this site.

The Old River fish control gate site has visual quality similar to the south Delta but is scarce in vegetational cover and topographic variety. Old River and the San Joaquin River are lined with levees except for a portion on the eastern side of the confluence. Levees close to the site are tall and create a wall blocking views from the waterway (Photograph 7.6-1). The banks slope more gently toward the water on the eastern side and support larger vegetation (Photograph 7.6-2). Foreground views are almost exclusively of agricultural uses. None of the nearby farmsteads and other residences are visible from the waterway, but some can be seen from the surrounding levees. San Joaquin Road runs along the levee on the southern side of Old River (Photograph 7.6-3). This road offers good views to the site, but along with other elements, detracts visually from the vividness, intactness, and unity of the site. The vividness, intactness, and unity of the site are generally considered low to moderate.

Proposed Middle River Gate Site

The Middle River gate site is located in Middle River, San Joaquin County, near its confluence with Victoria Canal, North Canal, and Trapper Slough, approximately 13 miles southwest of Stockton. Nearby residents, travelers using

SR 4, and recreationists using adjacent waterways are considered sensitive viewers of the Middle River gate site.

The visual character of this site is typical of the south Delta. Views from the Middle River gate site are moderate to low in vividness, intactness, and unity. The Middle River gate site is surrounded by riprapped levees on both banks with moderate vegetation. A chain-link fence gates off the south bank of the gate site. Views up and down river from the site include small, densely vegetated islands (Photograph 7.6-4). Immediately southeast of the project area lies a farmstead with an agricultural pump that extends into the river (Photograph 7.6-5). A temporary rock barrier is installed at the site seasonally during the months of April, May, October, and November (Photograph 7.6-6). A county-designated scenic highway, SR 4, runs to the north of this site.

Proposed Grant Line Canal Gate Site

The Grant Line Canal gate site is located east of the confluence of Grant Line Canal and Old River. Sensitive viewers in the vicinity of the Grant Line Canal gate site consist of nearby residents and recreationists on Grant Line Canal, Fabian and Bell Canal, and Old River.

This area is characteristic of the south Delta with some unique visual qualities. Typically, the views from the gate site are moderate to high in vividness, intactness, and unity. Grant Line Canal is visually recognizable as a straight waterway (Photograph 7.6-7). A large vegetated berm separates Grant Line Canal from Fabian and Bell Canal and supports some residences. Other residences and farmsteads are located north of the project site on Union Island and west near CCF. Two vacant houses are located on the smaller islands west of the project site. The northern bank of Grant Line Canal is lightly vegetated with grasses and shrubs; much denser vegetation is located along the levees of Fabian and Bell Canal. Vertical structures include high-voltage power lines that cross the canal to the west of the gate site with a steel lattice transmission tower located on the north bank (Photograph 7.6-8). Levees protect the south side of Fabian Canal and the north side of Grant Line Canal.

Proposed Old River at Delta-Mendota Canal Gate Site

The Old River at DMC gate site is situated east of the DMC approximately 4,000 feet southeast of the intersection of the Alameda, Contra Costa, and San Joaquin County lines. Nearby residents and recreationists along Grant Line Canal and Old River are considered sensitive viewers of the Old River gate site.

Although typical of the visual character of the south Delta, the Old River gate site has some visual elements unique to the site. Typical views to the south from the Old River at DMC gate site (Photograph 7.6-9) are characterized as having moderate to high vividness, intactness, and unity. Views to the north (Photograph 7.6-10) are less picturesque because of the presence of more developmental features and a lack of vegetation. The quality of these northern views is generally moderate to low in vividness, intactness, and unity. A number of agricultural pumps extend into the river to the east and west of the project site (Photograph 7.6-11). A seasonal rock barrier is partly submerged and supports a boat ramp that extends to the northern levee. A residence is located directly west of the project site, with a number of residences also occupying the southern edge of Old River and several small islands nearby.

Old River Dredging Site

The Old River dredging site consists of the portion of Old River at the east end of Fabian Tract to the west end of Stewart Tract. Sensitive viewers in the vicinity of the Old River dredging site include nearby residents, recreationists at Old River Golf Course and along Old River and adjacent waterways, and travelers along surrounding roads. Old River Golf Course is a public golf course located in the northwest corner of Pescadero Tract. Golfers would be sensitive to dredging operations as the aesthetics of the outdoor setting are typically associated with the golfers' experience.

Although the visual qualities of the Old River dredging site are similar to those of the south Delta, there are unique visual qualities associated with this site as well. Views from the Old River dredging site are generally moderate in vividness, intactness, and unity. The varied land uses surrounding this site include large agricultural parcels, Old River Golf Course, and numerous farmsteads and residences. Old River is lined by riprapped levees on either side and large tracts of tules can be found along the waterway edges.

If dredging is performed hydraulically, the location for the disposal of dredged material from Old River would be Stewart Tract at Paradise Cut. A settling area consisting of three basins (a primary, secondary, and return basin) would be constructed and would occupy an area approximately 600 feet long by 80 feet wide. Water would be pumped back into Old River once it reaches the return basin. It is estimated that the dredged material would occupy an area of 1 acre. The disposal area is generally moderate in vividness, intactness, and unity. Land uses surrounding the site include agriculture, residences and farmsteads, and Old River Golf Course. As at the Old River dredging location, residents, recreationists, and travelers using the levee roads around Old River would have visual sensitivity at the proposed disposal site.

Middle River Dredging Site

The Middle River dredging site extends from the head of Middle River (at Old River), MR 49 to MR 12 (Figure 2-3). Residents, recreationists, and travelers using the levee roads surrounding Middle River would be sensitive to any visual change occurring at this site.

The visual quality of the Middle River dredging site is similar to that of the south Delta (Photographs 7.6-12 and 7.6-13). Views from the Middle River dredging site are generally moderate to low in vividness, intactness, and unity. Land use surrounding this site varies. Numerous residences and farmsteads dot the landscape. Two residences on Stark Road are located directly to the east of the project site where Howard Road crosses Middle River.

Dredged material would be transferred through a pipeline to one or more settling areas on Union or Roberts Island. Views from these locations are generally moderate in vividness, intactness, and unity. Union and Roberts Islands are primarily agricultural use with some residences and farmsteads. Sensitive viewers would include residents, recreationists, and travelers on nearby roads. Approximately 925 acres would be necessary to dispose of the dredged spoils, assuming that the basins can be reused during each dredging phase. The settling area would consist of three basins (a primary, secondary, and return basin), each approximately 3,600 feet long and 1,600 feet wide. The spoils ponds would be placed according to preferable conditions (i.e., avoidance of residences and sensitive species and habitats). Once water reaches the return basin, it would be pumped back into Middle River. The dried dredged material would be used to reinforce the existing levee or for other beneficial agricultural use in the Delta vicinity.

West Canal Dredging Site

The West Canal dredging site extends from the CCF intake point north to West Canal's confluence with Victoria Canal. The visual quality of the West Canal dredging site is similar to that of the south Delta (Photograph 7.6-14). Views are generally moderate to low in vividness, intactness, and unity. CCF, a large waterbody, is located on the west side of the canal. On the east side of the canal are agricultural lands. Sensitive viewers at this site include residents, recreationists, and travelers on surrounding levee roads.

If hydraulic dredging is used, the locations for dredge spoils extend north-south, adjacent to the canal, on both sides of the canal. Widdows Island lies directly to the west of the canal, and Coney Island is to the east. Existing ponds located between CCF and West Canal would also be considered as disposal sites. Assuming that the ponds could be reused after each dredging phase, it is estimated that all of the dredged material would occupy an area approximately 264 acres in size. Pipelines would carry the dredged material from West Canal into no more than two settling ponds, each 3,600 feet long by 1,600 feet wide. Each settling area would consist of three settling basins, a primary, secondary, and return basin. Once water reaches the return basin, it would be pumped back into West Canal. Dried material would be reshaped to reinforce the existing levee or used in other beneficial ways in the vicinity.

Clifton Court Forebay Intake Site

Residents of Kings Island, boaters on West Canal and Old River, and recreationists using West Canal, Old River, and the levees surrounding CCF are sensitive to any visual change occurring at the CCF intake site.

The CCF intake site is located at the northwest corner of CCF. Visual elements unique to the intake site include riprapped levees on both sides of the West Canal, which supports recreational uses, a small, vegetated island east of the site, and a residential island known as Kings Island. Views to Kings Island are partially blocked by mature vegetation. To the northeast of the project location, levees run along the south of Victoria Island, and tules edging Old River screen the views. The project site supports little vegetation and can be seen from surrounding levees (Photograph 7.6-14). High-voltage power lines cross the site to the south. This site offers good views of coastal mountains to the west. In general, visual quality of the CCF intake site is moderate to high.

Existing Sources of Light and Glare in the Project Vicinity

Because of the general lack of buildings and extensive nature of most farms in the region, few artificial sources of light and glare exist. Existing sources of light and glare in the project vicinity include water surfaces, reflections from paved surfaces, vehicles, and reflective building materials. The residences, commercial establishments, and other structures in the project vicinity are also sources of light and glare.

Environmental Consequences

Assessment Methods

Analysis of the visual effects of the project are based on:

- direct field observation from key vantage points such as public roadways;
- photographic documentation of key views of and from the project site, as well as regional visual context;
- review of project construction drawings; and
- review of the project in regard to compliance with state and local ordinances and regulations and professional standards pertaining to visual quality.

With an establishment of the existing (baseline) conditions, alternatives or other change to the landscape can be systematically evaluated for its degree of impact. The degree of impact depends both on the magnitude of change in the visual resource (i.e., visual character and quality) and on viewers' responses to and concern for those changes. This general process is similar for all established federal procedures of visual assessment (Smardon et al. 1986) and represents a suitable methodology of visual assessment for other projects and areas.

The approach for this visual assessment is adapted from FHWA's visual impact assessment system (Federal Highway Administration 1983) in combination with other established visual assessment systems. The visual impact assessment process involves identification of:

- relevant policies and concerns for protection of visual resources;
- visual resources (i.e., visual character and quality) of the region, the immediate project area, and the project site;
- important viewing locations (e.g., roads) and the general visibility of the project area and site using descriptions and photographs;
- viewer groups and their sensitivity; and
- potential impacts.

Regulatory Setting

Federal

The preparation of environmental impact statements is guided by the NEPA CEQ regulations at the federal level. These regulations state that the following should be taken into account when determining an impacts significance: direct effects of the alternatives; indirect effects of the alternatives; and possible conflicts between the alternatives and the objectives of federal, regional, state, and local land use plans, policies and controls for the area concerned.

State

Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992

At a state and local level, the Johnston-Baker-Andal-Boatwright Delta Protection Act of 1992, incorporated into Section 21080.22 and Division 19.5 of the California Public Resources Code, facilitates the recognition, preservation, and protection of Delta resources for the use and enjoyment of current and future generations. The act includes a series of findings and declarations related to the quality of the Delta environment. Protecting the unique resources of the Delta is emphasized as national, state, and local importance. It is emphasized that the protection of these resources will best be achieved through implementation of land use planning and management practices by local governments, in compliance with a comprehensive, long-term resource management plan under the act.

California Department of Transportation
State Scenic Highway Program

California's Scenic Highway Program was created by the California State Legislature in 1963. Its purpose is to preserve and protect scenic highway corridors from change that would diminish the aesthetic value of lands adjacent to highways. A highway may be designated scenic depending upon how much of the natural landscape can be seen by travelers, the scenic quality of the landscape, and the extent to which development intrudes on the traveler's enjoyment of the view. The State Scenic Highway System includes a list of highways that are either eligible for designation as scenic highways or have been so designated. The status of a state scenic highway changes from eligible to officially designated when the local jurisdiction adopts a scenic corridor protection program, applies to the Caltrans for scenic highway approval, and receives notification from Caltrans that the highway has been designated as a Scenic Highway. For the purpose of visual resource protection, this analysis shall treat eligible roadways with the same status as officially designated roadways (California Department of Transportation 1996).

Two designated scenic highways may be affected by the proposed project alternatives. One is SR 160 (River Road), and the other is SR 4. The portion of SR 160 designated as a scenic highway extends from SR 4 near Antioch to the southern city limit of Sacramento. Designated in 1969, the route meanders through Delta agricultural areas and small towns along the Sacramento River.

Examples of visual intrusions that would degrade scenic corridors as stipulated by Caltrans include dense and continuous development, highly reflective surfaces, parking lots not screened or landscaped, billboards, noise barriers, dominance of power lines and poles, dominance of exotic vegetation, extensive cut and fill, scarred hillsides and landscape, and exposed and unvegetated earth (California Department of Transportation 1996).

Local

County of Sacramento General Plan

The Sacramento County General Plan includes the following objectives, goals, and policies that may be applicable to the visual resources analysis of the project alternatives:

Objective
Low glare external building surfaces and light fixtures that minimize reflected light and focalize illumination.

Policies
LU-22: Exterior building materials on nonresidential structures shall be composed of a minimum of 50 percent low-reflectance, non-polished finishes.

LU-23: Bare metallic surfaces such as pipes, flashing, vents and light standards on new construction shall be painted so as to minimize reflectance.

LU-24: Require overhead light fixtures to be shaded and directed away from adjacent residential areas.

LU-25: Require exterior lighting to be low-intensity and only used where necessary for safety and security purposes.

Scenic Highways Element

The Scenic Highways Element of the Sacramento County General Plan attempts to strike a balance between the goal of scenic preservation and that of minimizing vehicle miles traveled.

Goal 1: To preserve and enhance the aesthetic quality of scenic roads without encouraging unnecessary driving by personal automobile.

Objective 1: To retain designation of the River Road (State Highways 160 and 84) as an Official State Scenic Highway and to preserve and enhance its scenic qualities.

Objective 4: To strengthen the provisions of scenic corridor regulations so as to further protect the aesthetic values of the County's freeways and scenic roads. (County of Sacramento General Plan 1997)

San Joaquin County General Plan 2010

The San Joaquin County General Plan includes the following objectives, goals, and policies that may be applicable to the visual resources analysis of the project alternatives:

Open Space

Goal: Views of waterways, hilltops, and oak groves from public land and public roadways shall be protected.

Goal: Outstanding scenic vistas shall be preserved and public access provided to them whenever possible.

Goal: Development proposals along scenic routes shall not detract from the visual and recreational experience.

Goal: Waterway development and development on Delta islands shall protect the natural beauty, the fisheries, wildlife, riparian vegetation, and the navigability of the waterway. (San Joaquin County General Plan 1992.)

Significance Criteria

In addition to the specific federal, state, and local laws, ordinances, regulations, and standards for visual resources described above, the SDIP is subject to federal and state guidelines and professional standards below.

Federal Criteria

The EPA's 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material is another federal regulation considered when determining aesthetics impacts. These guidelines relate the aesthetic quality of aquatic ecosystems with the quality of life enjoyed by the general public and property owners. The 404(b)(1) Guidelines find that a dredged or fill material discharge into aquatic environments may have a potentially significant impact on aesthetic resources if they:

- mar the beauty of natural aquatic ecosystems by degrading water quality, creating distracting disposal sites, inducing inappropriate development, encouraging unplanned and incompatible human access, or by destroying vital elements that contribute to the compositional harmony or unity, visual distinctiveness, or diversity of an area;
- adversely affect the particular features, traits, or characteristics of an aquatic area that make it valuable to property owners; or
- degrade water quality, disrupt natural substrate and vegetation characteristics, deny access to or visibility of the resource, or result in changes in odor, air quality, or noise levels, thereby potentially reducing the value of an aquatic area to private property owners.

State Criteria

According to the State CEQA Guidelines, as amended in 1998, visual resource impacts are considered significant if a project has a "substantial, demonstrable negative aesthetic effect." Based on professional standards and practices, a project would normally be considered to have a significant impact it if would:

- conflict with adopted visual resource policies;
- substantially reduce the vividness, intactness, or unity of high-quality views; or
- introduce a substantial source of light and glare into the viewshed.

Professional Standards

According to professional standards, a project may be considered to have significant impact if it would significantly:

- conflict with local guidelines or goals related to visual quality;
- alter the existing natural viewsheds, including changes in natural terrain;
- alter the existing visual quality of the region or eliminate visual resources;
- increase light and glare in the project vicinity;
- result in backscatter light into the nighttime sky;

- result in a reduction of sunlight or introduction of shadows in community areas;
- obstruct or permanently reduce visually important features that are in Variety Classes A (high in vividness, intactness, unity) and B (moderate in vividness, intactness, unity), and can be viewed from visually sensitive areas (CALFED Bay-Delta Program 2000b); or
- result in long-term (that is, persisting for 2 years or more) adverse visual changes or contrasts to the existing landscape as viewed from areas with high visual sensitivity within 3 miles (also considering how many viewing sites would be affected). (CALFED Bay-Delta Program 2000b.)

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program.

The discussion of significant impacts and mitigation measures within this section will include a citation of one or more of the following programmatic mitigation measures used to build project-specific mitigation measures to offset significant impacts identified from implementation of the SDIP. These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED programmatic mitigation measures, please refer to Appendix E, "Mitigation Measures Adopted in the CALFED Record of Decision."

Visual Resources Programmatic Mitigation Measures

2. Minimize construction activities during the peak-use recreation season.
4. Water areas where dust is generated, particularly along unpaved haul routes and during earth-moving activities, to reduce visual impacts caused by dust.
5. Locate and direct exterior lighting for construction activities so that it is concealed to the extent practicable when viewed from local roads, nearby communities, and any recreation areas.
7. Construct facilities with earth-tone building materials or other visually aesthetic design materials.
8. Revegetate disturbed areas as soon as possible after construction.
9. Locate visually obtrusive features, such as borrow pits and dredged material disposal sites, outside visually sensitive areas and observation sites.

10. Select vegetation type, placement, and density to be compatible with patterns of existing vegetation where revegetation occurs in natural areas. Vegetation such as emergent marsh grasses that can tolerate period flooding and drying may be useful.
11. Install landscape screening, such as grouped plantings of trees and tall shrubs, to screen proposed facilities from nearby sensitive viewers.
12. Use native trees, bushes, shrubs and ground cover for landscaping, when appropriate, at facilities such as dams and pumping-generating plants, and along new and expanded canals and conveyance channels, in a manner that does not compromise facility safety and access.

Alternative 1 (No Action)

Under this No Action Alternative, no additional facilities related to the SDIP would be constructed, and maintenance of existing conditions in the south Delta would be continued. Therefore, there would be no changes to existing visual resources. This alternative is considered to have no impact.

2020 Conditions

Under the future no action conditions (2020 conditions) SDIP would not be implemented. It is expected that the temporary barriers program would continue and that no significant impacts on visual resources would result. Conditions would be similar to those described under existing conditions, and there would be no impact.

Alternatives 2A, 2B, and 2C

Alternatives 2A–2C would include the construction, operation, and maintenance of the following facilities associated with the SDIP: head of Old River fish control gate, Old River at DMC flow control gate, Grant Line Canal flow control gate, Middle River flow control gate; increased diversions and pumping at CCF and SWP Banks; dredging of selected portions of south Delta channels and maintenance associated with gates and dredging.

Stage 1 (Physical/Structural Component)

Head of Old River Fish Control Gate

Construction activities would introduce considerable heavy equipment and associated vehicles, including cranes for installation of steel structures and channel excavation, trucks or barges for disposal of excavated materials, and pile-driving equipment, into the viewshed of the project location. These activities generally would require additional area to accommodate the proposed construction, including a gravel access road connecting to Undine Road and a construction staging area approximately 100 by 50 feet that would be located on the south side of Old River outside of the levee roads. These activities would be completed in one half of the channel cross section at a time using a sheetpile-braced cofferdam, or an in-the-wet construction method, that would be removed upon the completion of each construction phase. Construction is expected to occur over a period up to 30 months.

The head of Old River fish control gate would result in the addition of a concrete gate within the channel. Features of this structure include five bottom-hinged gates totaling approximately 125 feet in length, a boat lock with miter gates on either side, a fenced-and-gated permanent storage area to the north side of the channel adjacent to the gate, a control building, microwave tower, and propane tank. The gate typically would be operated from April through June and September through November annually. Other features would include floating and pile-supported warning signs, water level recorders, and navigation and security lights.

Impact VR-1: Temporary Visual Changes as a Result of Construction Activities. Construction of Alternatives 2A–2C would create temporary changes in views of and from the project area. These activities would be visible to recreationists within adjacent waterways, travelers along San Joaquin Road, and to people at nearby farmsteads and residences. The project area is located in a setting in which the presence of construction activities and equipment is somewhat common because of the placement, maintenance, and removal of the temporary barrier, although to a lesser degree than the proposed construction activities.

This adverse visual impact is considered less than significant for the following reasons: (1) low to moderate vividness, intactness, and unity of the project site views; (2) limited number of sensitive receptors; (3) the presence of construction activities at this site is familiar to viewers; and (4) construction impacts would be temporary. No mitigation is required.

Impact VR-2: Changes in Local Scenic Character and Quality at the Head of Old River Fish Control Gate Site. The construction of the head of Old River fish control gate would result in the addition of a variety of structures at the site (gate, storage area, control building, etc.). This impact is considered to be adverse because it would further detract from the visual quality of the site. However, this adverse impact is considered less than significant because the existing aesthetic character is already visually degraded through the presence of tall, riprapped levee embankments that lack vegetation and the proximity of San Joaquin Road to the project location. No mitigation is required.

Impact VR-3: Changes in Views at the Head of Old River Fish Control Gate Site. Many views from Old River, San Joaquin River, and nearby roads would be affected by the head of Old River fish control gate and associated structures. Characteristics of these that could potentially change the viewsheds in this project area include: (1) when raised, the bottom-hinged gates may block viewing distances from adjacent waterways, levees, and lands including San Joaquin Road; and (2) other proposed structures such as the levee-top control building, and the microwave tower would further impede the existing views in the area. Because recreationists and nearby landowners with high sensitivity would be affected by these actions, this is considered a significant impact on visual resources. Implementation of Mitigation Measure VR-MM-1 would reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-1: Implement Measures to Reduce Visual Intrusion.

- Implement the mitigation measures identified as part of the CALFED Programmatic document regarding visual resources.
- Store visually obtrusive features, such as cut and fill materials, outside visually sensitive areas.
- Construct facilities of low-sheen and non-reflective building materials to minimize glare and obtrusiveness.
- Provide a vegetative buffer to visually screen the site. The vegetative buffer would be integrated around the periphery of the site to provide substantial screening from adjacent residential or agricultural uses. The buffer plan would be consistent with local policies and guidelines for native landscaping. Vegetation should be chosen and planted to be compatible with patterns of existing vegetation. Vegetation should be planted within the first year following project completion.

Impact VR-4: Changes in Light and Glare at Head of Old River.

Nighttime Light. New nighttime light would include amber-colored security lighting and a small white navigational light. These lights would be visible for a small distance from the nearby waterways and levees and may create backscatter and ambient light visible beyond the levees to neighboring land. Lights are to be located and directed at facilities and during construction activities so that it is concealed to the extent possible when viewed from local roads, nearby communities, and any recreation areas. However, because existing light levels are extremely low in the project area and because of the rural character, the threshold for new light sources is extremely low and this change would be considered a significant adverse impact. The following mitigation is recommended to reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards.

- Luminaires shall be cut-off type fixtures that cast low-angle illumination to minimize incidental spillover of light onto adjacent properties and open space. Fixtures that project upward and horizontally should not be used. Luminaires should be focused only where needed (such as on building entrances) and should not provide a general “wash” of light on building surfaces.
- Luminaires shall be directed away from residential areas and the river adjacent to the project site.

- Luminaire lamps shall provide good color rendering and natural light qualities. Luminaire intensity should be the minimum feasible for security and maintenance and access safety.
- Luminaire mountings shall be downcast and the height of placement minimized to reduce potential for backscatter into the nighttime sky and incidental spillover into adjacent properties and open space. Luminaire mountings should have nonglare finishes.
- Where an intermittent light will be used (such as for navigation or marking purposes), slow pulses shall be considered in lieu of rapid flashes or blinking lights.

Daytime and Nighttime Glare. The project would not create a new source of substantial glare that would adversely affect day or nighttime views. This is considered a less-than-significant impact. Mitigation Measure VR-MM-1 includes an element that addresses glare through the use of low-sheen and non-reflective materials; therefore, no further specific mitigation is required.

Impact VR-5: Inconsistency with Local Visual Policies. Although the proposed head of Old River fish control gate would not contribute to the goals and policies of San Joaquin County for protection and enhancement of scenic resources, it would not substantially conflict with them either. The scale of the gate structure is small enough, and the number of sensitive receptors is small enough, that any conflicts with these goals and policies are considered a less-than-significant adverse impact. No mitigation is required.

Flow Control Gates—Middle River/Grant Line Canal/Old River

Middle River Flow Control Gate

Construction activities would introduce considerable heavy equipment and associated vehicles, including cranes, pile drivers, scrapers, excavators, backhoes, and graders, into the viewshed of the project location. These activities would generally require additional area to accommodate the proposed construction, including a gravel access road and a construction staging area on the north side of the river measuring approximately 100 feet by 100 feet. The proposed activities may be completed using an in-the-wet construction method, or a braced cofferdam, which would be cut at the required invert depth upon the completion of each construction phase. Construction is expected to occur over a period up to 18 months.

The Middle River gate would result in the addition of a concrete control structure with 12 16-foot-wide-by-10-foot-high bottom-hinged gates; a reinforced concrete foundation; steel sheetpile wall; and a permanent storage area located on the landward side of the north levee bounded by a 6-foot-high chain-link fence.

The operation of the Middle River gate would include the opening and closing of 12 bottom-hinged gates. It is expected that the gate would need to be closed 2 hours before low tide and for approximately 2 hours after the low tide event has passed. Navigational lights and security lighting would be in operation as well.

Impact VR-6: Temporary Visual Changes as a Result of Construction Activities. Construction of Alternatives 2A–2C would create temporary changes in views of and from the project area. Few viewers would be affected by the visual changes associated with the construction of the Middle River flow control gate, and these viewers are accustomed to the existing program of seasonally constructing the temporary barrier. Therefore, this is considered a less-than-significant impact. No mitigation is required because of the temporary nature of this impact.

Impact VR-7: Changes in Local Scenic Character and Quality at the Middle River Gate Site. The Middle River flow control gate would result in the addition of a variety of permanent visual elements within the project gate site area. The surrounding visual character is typically agricultural with some developed structures related to nearby farmsteads present. A temporary rock barrier is installed at the project site seasonally. The project site is visible from nearby farmsteads but few boaters use the waterways because of the low water level. As discussed for construction-related impacts, the number of viewers and sensitive receptors is considered very low. The addition of a gate at this location would likely blend into the existing mix of human-made and natural visual components of the site (California Department of Water Resources and Bureau of Reclamation 1996a). Because the effects would be limited to few viewers and the change does not introduce substantial new visual intrusions or obstructions relative to the existing condition, this is considered a less-than-significant impact. No mitigation is required.

Impact VR-8: Changes in Views of the Middle River Gate Site. Few sensitive visual receptors exist at the Middle River flow control gate site, because of visual inaccessibility. Middle River is not frequented by boaters because of shallow waters, and surrounding levees, distance, and dense vegetation impede views to the site from local residences and travelers on SR 4. This combination of factors makes it unlikely that the gate and associated structures would be visible to boaters, residents to the north, or travelers on SR 4. Views north from the farmstead along the southern levee of the project area would be limited by existing vegetation and the levee itself (California Department of Water Resources and Bureau of Reclamation 1996a). Because the effects would be limited to few viewers, this is considered a less-than-significant impact. No mitigation is required; however, implementation of Mitigation Measure VR-MM-1 discussed above for the head of Old River fish control gate is recommended to ensure that any impact is reduced to the lowest possible magnitude.

Impact VR-9: Changes in Light and Glare at the Middle River Gate Site. *Nighttime Light.* The Middle River gate and associated facilities would include new nighttime light with amber-colored security lighting and a small white navigational light. These lights would be visible for a small distance from the nearby waterways and levees, and may create backscatter and ambient light visible beyond the levees to neighboring lands. Because existing light levels are extremely low in the project area and because of the rural character, the threshold for new light sources is extremely low and this change would be considered a significant adverse impact. The following mitigation is recommended to reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards. Refer to the discussion of this mitigation measure under the head of Old River fish control gate site.

Daytime and Nighttime Glare. It is not likely that the Middle River gate and associated facilities would create a new source of substantial glare that would adversely affect daytime or nighttime views. Also, because there is a lack of visual receptors in this location, this is considered a less-than-significant impact. No mitigation is required; however, the recommendation to use low-sheen, non-reflective materials (discussed under Mitigation Measure VR-MM-1) is also recommended here to further ensure that any impact is reduced to the lowest possible magnitude.

Impact VR-10: Inconsistency with Local Visual Policies. The small scale of the proposed facility would not be visually intrusive on the local visual quality or obstruct high quality views. Although the project would not further the county's visual resource goals and policies to protect and enhance scenic resources, the SDIP is unlikely to be substantially negative (California Department of Water Resources and Bureau of Reclamation 1996a). Therefore, inconsistency with local visual policies is considered a less-than-significant impact, and no mitigation is required.

Grant Line Canal Flow Control Gate

Construction activities would introduce considerable heavy equipment and associated vehicles, including cranes, pile drivers, scrapers, excavators, backhoes, and graders, into the viewshed of the project location. These activities would generally require additional area to accommodate the proposed construction, including a gravel access road and two construction staging areas, one to the north measuring approximately 100 feet by 100 feet, and one to the south measuring approximately 100 feet by 50 feet. The proposed activities would be completed using an in-the-wet construction method, or a sheetpile-braced cofferdam, which would be cut at the required invert depth upon the completion of each construction phase. Construction is expected to occur over a 36-month period.

The Grant Line Canal gate would result in the addition of a concrete control structure that would house four bottom-hinged gates, each 20 feet wide by 16 feet high; buried utility lines supplying electricity and communications to the area; a 50-foot-wide by 105-foot-long boat lock; and a 50-foot-wide flashboard opening. Additional structures include a control building to be built on top of the levee adjacent to the boat lock, a building to house the standby power source, and a microwave tower.

The operation of the Grant Line Canal gate would include the opening and closing of four bottom-hinged gates. It is expected that gates would need to be closed approximately 2 hours before low tide and for approximately 2 hours after the low tide event. Navigational lights and security lighting would be in operation as well.

Impact VR-11: Temporary Visual Changes as a Result of Construction Activities at Grant Line Canal. Construction of the Grant Line Canal gate would create temporary changes in views of and from the project area. Grant Line Canal is a popular recreation area and has several residences close by (California Department of Water Resources and Bureau of Reclamation 1996a). These viewers would have high visual sensitivity.

Constructing the Grant Line Canal gate is not expected to result in a substantial change in visual character of the area because: (1) construction would be temporary with most in-water worked occurring in August, September, and October; and (2) no permanent sensitive receptors (residences) would be directly affected during construction. Therefore, this impact is considered less than significant. No mitigation is required.

Impact VR-12: Changes in Local Scenic Character at the Grant Line Canal Gate Site. The scale of the proposed Grant Line Canal gate would adversely affect the local scenic integrity. The Grant Line Canal gate would result in the addition of a variety of new visual elements within the project area. The gate would be visible by recreationists who use the canal; these groups have high viewer sensitivity. The addition of a gate at this location would likely blend into the existing mix of human-made and natural visual components of the site (California Department of Water Resources and Bureau of Reclamation 1996a); however, because of high viewer sensitivity, this is considered a significant impact. Implementation of Mitigation Measure VR-MM-1 would reduce this impact to a less than significant level.

Mitigation Measure VR-MM-1. Implement Measures to Reduce Visual Intrusion. Refer to the discussion for the head of Old River fish control gate for a complete description of this measure.

Impact VR-13: Changes in Views at the Grant Line Canal Gate Site. The proposed gate structure would occasionally obstruct some existing views of the project area from water level and land-based viewpoints. Long-distance water-level views of the canal from boats would occasionally be obstructed when gates are raised above the surface. No permanent residences would have views blocked by the gate. Gate structures such as the levee-top control building and the microwave tower are not expected to substantially impede existing views of the area. The impact of the gate operations on views is considered less than significant because views of the canal from boats would only be blocked during gate operations and would only be blocked at the western end of the canal near the gate. No mitigation is required.

Impact VR-14: Changes in Light and Glare at the Grant Line Canal Gate Site. *Nighttime Light.* New nighttime light would include amber-colored security lighting and a small white navigational light. These lights would be visible for a small distance from the nearby waterways and levees and may create backscatter and ambient light visible beyond the levees to neighboring lands. Lights are to be located and directed at facilities and during construction activities so that they are concealed to the extent possible when viewed from local roads, nearby communities, and any recreation areas. However, because existing light levels are extremely low in the project area and because of the rural character, the threshold for new light sources is extremely low, and this change would be considered a significant adverse impact. The following mitigation is recommended to reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards. Refer to the discussion of this mitigation measure under the head of Old River fish control gate site.

Daytime and Nighttime Glare. Existing vegetation would buffer nearby residents from any addition of glare into the project area. However, it is not likely that the project would create a new source of substantial glare that would adversely affect daytime or nighttime views. This is considered a less-than-significant adverse impact. No mitigation is required; however, the recommendation to use low-sheen, non-reflective materials (discussed under Mitigation Measure VR-MM-1) is also recommended here to further ensure that any impact is reduced to the lowest possible magnitude.

Impact VR-15: Inconsistency with Local Visual Policies at the Grant Line Canal Gate Site. The proposed structures' scale is large enough that a substantial conflict could arise in complying with the County of San Joaquin's goal of protecting scenic corridors from unsightly development (California Department of Water Resources and Bureau of Reclamation 1996a). This is considered a significant adverse impact. Implementation of Mitigation Measure VR-MM-1 would reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-1. Implement Measures to Reduce Visual Intrusion. Refer to the discussion for the head of Old River fish control gate for a complete description of this measure.

Old River at Delta-Mendota Canal Flow Control Gate

A considerable amount of heavy equipment and associated vehicles would be introduced into the project area through proposed construction activities. Some of this equipment would include a crane, pile driver, scrapers, excavators, and a grader. These activities generally would require additional area to accommodate the proposed construction, including a gravel access haul road and a construction staging area approximately 100 by 100 feet that would be located on the north side of the river. A permanent access road would be connected to the southern existing country road. A new levee would be constructed north of the levee, which would eventually be breached after the new levee's construction. Portions of the existing levee would be left as a channel island. Construction is expected to occur over a period up to 30 months.

The SDIP would result in the addition of a concrete gate within the existing channel. Features of this structure include 11 16-foot-wide-by-10-foot-high bottom-hinged gates; steel sheetpile wall; buried utility lines supplying electricity and communications to the area; and a 50-foot-wide-by-105-foot-long boat lock. Other components include a control building adjacent to the boat lock, a building to house the standby fuel source, and a microwave tower. Other features would include floating and pile-supported warning signs, water level recorders, and navigation lights.

The operation of the Old River at DMC gate would include the opening and closing of 11 bottom-hinged gates. It is expected that gates would need to be closed approximately 2 hours before low tide and for approximately 2 hours after the low tide event. Navigational lights and security lighting would be in operation as well.

Impact VR-16: Temporary Visual Changes as a Result of Construction Activities at the Old River at DMC Flow Control Gate Site. Construction of the SDIP would create temporary changes in views of and from the project area. These activities would be visible to recreationists within Old River and nearby residences. These viewers would have high visual sensitivity.

This adverse visual impact is considered less than significant for the following reasons: (1) moderate vividness, intactness, and unity of the project site views; (2) viewers are familiar with the placement and removal of the existing temporary structure; and (3) construction impacts would be temporary. No mitigation is required because of the temporary nature of this impact.

Impact VR-17: Changes in Local Scenic Character at the Old River at DMC Flow Control Gate Site. The addition of the proposed concrete control structure with its 11 bottom-hinged gates and a 50-by-105-foot boat lock would dominate the viewshed from Old River. When raised, the gates would be large enough to also affect the views from nearby residences and the proposed nearby development. The levee-top control building, microwave tower, storage areas, utility lines, and addition of 49,000 square feet of riprap would remove the site visually from its existing character (California Department of Water Resources and Bureau of Reclamation 1996a). Because of the numerous sensitive receptors that would be affected at this location, this is considered a significant adverse impact. Implementation of Mitigation Measure VR-MM-1 would reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-1: Implement Measures to Reduce Visual Intrusion. Refer to the discussion for the head of Old River fish control gate for a complete description of this measure.

Impact VR-18: Changes in Views at the Old River at DMC Flow Control Gate Site. Views from Grant Line Canal, Old River, and nearby homes would be partially restricted by the implementation of the proposed facility, affecting many sensitive receptors, and potentially causing substantial conflict with the goals and policies of the County of San Joaquin. Characteristics of the SDIP that could potentially change the viewsheds in this project area include: (1) when raised, the gates would block viewing distances from adjacent waterways and lands; and (2) other proposed structures for this site, such as the levee-top control building, and the microwave tower, would further shorten and obstruct the existing views in the area. Because many sensitive receptors would be affected by these visual changes, this is considered a significant adverse impact. Implementation of Mitigation Measure VR-MM-1 would reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-1. Implement Measures to Reduce Visual Intrusion. Refer to the discussion for the head of Old River fish control gate for a complete description of this measure.

Impact VR-19: Changes in Light and Glare at the Old River at DMC Flow Control Gate Site. *Nighttime Light.* New nighttime light would include amber-colored security lighting and a small white navigational light. These lights would be visible for a small distance from the nearby waterways and levees and may create backscatter and ambient light visible beyond the levees to neighboring lands. Lights are to be located and directed at facilities and during construction activities so that it is concealed to the extent possible when viewed from local roads, nearby communities, and any recreation areas. However, because existing light levels are extremely low in the project area and because of the rural character, the threshold for new light sources is extremely low, and this change would be considered a significant adverse impact. The following mitigation is recommended to reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-2: Incorporate Lighting Design Specifications for Minimum Maintenance and Access Safety Standards. Refer to the discussion of this mitigation measure under the head of Old River fish control gate site.

Daytime and Nighttime Glare. Existing vegetation would buffer nearby residents from any addition of glare into the project area. However, it is not likely that the project would create a new source of substantial glare that would adversely affect daytime or nighttime views. This is considered a less-than-significant adverse impact. No mitigation is required; however, the recommendation to use low-sheen, non-reflective materials (discussed under Mitigation Measure VR-MM-1) is also recommended here to further ensure that any impact is reduced to the lowest possible magnitude.

Impact VR-20: Inconsistency with Local Visual Policies at the Old River at DMC Flow Control Gate Site. The proposed structures' scale is large enough that a substantial conflict could arise in complying with the County of San Joaquin's goal to protect scenic corridors from unsightly development (California Department of Water Resources and Bureau of Reclamation 1996a). This is considered a significant impact. Implementation of Mitigation Measure VR-MM-1 would reduce this impact to a less-than-significant level.

Mitigation Measure VR-MM-1. Implement Measures to Reduce Visual Intrusion. Refer to the discussion for the head of Old River fish control gate for a complete description of this measure.

Dredging

Portions of West Canal, Middle River, and Old River would be dredged to improve conveyance and the operation of private agricultural siphons and pumps. In total, approximately 250,000 cubic yards of material would be dredged and spoiled. Placement of these spoils would be in an area of low visual quality and minimal visibility to people. Three dredging methods are being considered—hydraulic (suction) dredging, clamshell (mechanical) dredging, and dragline dredging. A decision on which method to use would be made before work is begun.

Construction- and operation-related impacts of dredging are included in a single discussion because this project component is more related to a temporary activity rather than the introduction of permanent facilities.

Impact VR-21: Changes in Views as a Result of Channel Dredging. Construction activities would introduce considerable heavy equipment and associated vehicles, including dredgers, barges, and disposal trucks, into the viewshed of the project locations. In areas of hydraulic dredging, semi-permanent piping, ranging from 8 to 18 inches in diameter, would extend from the channel, over the levee, and into settling ponds adjacent to the channel. The pipe would cross the levee and require that a gravel ramp be placed on either side for vehicle and agricultural equipment access. The exact locations for these pipes are unknown at this time and are contingent upon the use of the hydraulic dredging method. The dredging process itself is unlikely to cause permanent visual intrusions on the West Canal, Middle River, or Old River. Equipment would temporarily shorten existing views in the dredging areas. This is considered a less-than-significant impact. No mitigation is required because of the temporary nature of this impact. It is likely that some viewers may be attracted to views of the dredging operation because of the unusual nature of the activity.

It is unlikely that the temporary dredging process would have substantial long-term effects on the local scenic character of the project locations. Some changes to side slopes of the channels may occur as a result of dredging. The spoils disposal locations would be in areas of minimal visibility and therefore would not cause visual impact. Part of the baseline condition of the visual environment of the SDIP project area includes earthwork and machinery as part of agricultural operations. The process of spreading and grading the spoils is not likely to be substantially different visually from this baseline. This is considered a less-than-significant impact, and no mitigation is required.

Impact VR-22: Changes in Light and Glare as a Result of Dredging Activities. *Daytime and Nighttime Glare and Nighttime Light.* The dredging of West Canal, Middle River, and Old River would not introduce any permanent sources of light or glare into the project area. This is considered a less-than-significant impact, and no mitigation is required.

Impact VR-23: Inconsistency with Local Visual Policies. The proposed dredging of the identified waterways would not conflict with applicable goals and policies. This impact is less-than-significant. No mitigation is required.

2020 Conditions

Impacts on visual resources associated with implementation of Alternatives 2A–2C under 2020 conditions would be similar to impacts that would occur under 2001 conditions as described above. In addition, the same mitigation would apply.

Stage 2 (Operational Component)

Impact VR-24: Impacts on Local Scenic Character of the State Water Project. The duration of water level fluctuations within SWP reservoirs would likely be affected by the implementation of the SDIP. Water levels are not expected to rise above maximum capacity or fall below minimum pool. However, water could remain at high or low levels for longer periods of time than they do in existing conditions. Fluctuations in water levels are typical features of a reservoir and would not cause substantial visual change (California Department of Water Resources and Bureau of Reclamation 1996a). This is considered a less-than-significant impact. No mitigation is required.

2020 Conditions

Operation-related impacts resulting from the implementation of Alternatives 2A–2C under 2020 conditions would result in an impact similar to that described above. This impact is less than significant and requires no mitigation.

Interim Operations

Interim operations would result in impacts similar to those described above for operation of the permanent gates. There would be minimal visual changes resulting from the implementation of the interim operations and the impact would be less than significant because no permanent gates would be constructed.

Alternative 3B

Alternative 3B would include the construction, operation, and maintenance of the following components associated with the proposed SDIP: head of Old River fish control gate, Old River at DMC flow control gate, and Middle River flow control gate, and increased diversions at CCF. Dredging of selected portions of south Delta channels, maintenance associated with dredging, and extension of agricultural diversions are also included in this alternative.

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Alternative 3B contains the same components as Alternatives 2A–2C, with the exception of the Grant Line Canal gate. Therefore, impacts and associated mitigation measures would be similar to those identified for the head of Old River fish control gate, Old River at DMC flow control gate, and Middle River flow control gate in the Alternatives 2A–2C discussion above.

Dredging

Impacts and associated mitigation measures would be similar to those identified for dredging within the Alternatives 2A–2C discussion above.

2020 Conditions

Impacts on visual resources associated with implementation of Alternative 3B under 2020 conditions would be similar to impacts that would occur under 2001 conditions as described above. In addition, the same mitigation would apply.

Stage 2 (Operational Component)

Impacts and associated mitigation measures would be similar to, but may be somewhat less than those identified for under Operational Component for Alternatives 2A–2C above because no Grant Line Canal permanent gate would be constructed as part of this alternative.

2020 Conditions

Operation-related impacts resulting from the implementation of Alternative 3B under 2020 conditions would result in an impact similar to that described above. This impact is less than significant and requires no mitigation.

Alternative 4B

Alternative 4B would include the construction, operation, and maintenance of the following components associated with the proposed SDIP: head of Old River fish control gate, increased diversions at CCF, dredging of selected portions of south Delta channels, and the extension of agricultural diversions.

Stage 1 (Physical/Structural Component)

Fish Control Gate

Alternative 4B includes the same components as Alternatives 2A–2C, except the Old River at DMC, Middle River, and Grant Line Canal flow control gates would not be constructed. As a result, impacts and mitigation measures for Alternative 4B would be the same as those discussed for the head of Old River fish control gate under Alternatives 2A–2C above.

Dredging

Proposed dredging activities under Alternative 4B are the same as those proposed under Alternatives 2A–2C; therefore, impacts and associated mitigation measures would be the same as those identified for dredging in the Alternatives 2A–2C discussion above.

2020 Conditions

Impacts on visual resources associated with implementation of Alternative 4B under 2020 conditions would be similar to impacts that would occur under 2001 conditions as described above. The same mitigation would apply.

Stage 2 (Operational Component)

Impacts and associated mitigation measures under Alternative 4B would be similar to, but somewhat less than those identified under the Operational Component above for Alternatives 2A–2C because no Grant Line Canal, Middle River, or Old River at DMC permanent flow control gates would be constructed as part of this alternative.

2020 Conditions

Operation-related impacts resulting from the implementation of Alternative 4B under 2020 conditions would result in an impact similar to that described above. This impact is less than significant and requires no mitigation.

Cumulative Evaluation of Impacts

Cumulative visual/aesthetic resources are analyzed in Chapter 10, "Cumulative Impacts." This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

7.7 Cultural Resources

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on cultural resources in the south Delta and includes summaries of regional prehistory, ethnography, and history. The primary concern related to cultural resources is potential damage or destruction to archaeological sites and buried human remains. These potential impacts are reduced to a less-than-significant level by implementing mitigation measures that are based on mitigation measures in the CALFED Programmatic ROD. The mitigation measures may include measures such as stopping work if archaeological materials or human remains are discovered during construction or dredging.

Summary of Significant Impacts

Table 7.7-S summarizes the significant impacts on cultural resources as a result of implementation of the project alternatives.

Table 7.7-S. Summary of Significant Impacts on Cultural Resources

Impact	Applicable Alternative	Level of Significance before Mitigation	Mitigation Measure	Level of Significance after Mitigation
Impact CR-2: Inadvertent Damage to or Destruction of Buried Archaeological Sites and Human Remains.	2A–2C, 3B, 4B	Significant	CR-MM-1: Stop Work If Archaeological Materials Are Discovered during Construction or Dredging. CR-MM-2: Stop Work If Human Remains Are Discovered during Construction or Dredging.	Less than significant

Affected Environment

The SDIP is located in the Sacramento–San Joaquin Delta, which is one of the areas of California that archaeologists have studied most intensively. Prior to the 1960s, archaeologists working in the Delta focused on documenting large habitation sites, which are recognizable by mounds and midden soil (Cook and Elsasser 1956). The inception of cultural resources management in 1966 resulted in archaeological studies that documented a broader range of site types, including historic archaeological sites. Study of historic cultural resources has received somewhat less attention prior to the late 1980s, although at least one comprehensive overview of historic cultural resources and numerous project-specific historical studies have been conducted since that time (Owens 1991).

Sources of Information

The affected environment and impact assessments presented in this section are based on:

- review of existing information,
- consultation with interested parties,
- field surveys of the SDIP area of potential effects (APE),
- archival research, and
- evaluation of identified cultural resources (Jones & Stokes 2004).

Records Search

The review of existing information included records search materials provided by DWR. The records searches were conducted at the Central California Information Center (CCIC) and the Northwest Information Center (NWIC) of the California Historical Resources Information System (CHRIS). Each regional information center of CHRIS maintains the state's database of previous cultural resource studies and known cultural resources for the counties in its jurisdiction; the CCIC maintains the database for a seven-county area that includes San Joaquin County, whereas the NWIC maintains the database for a 16-county area that includes Contra Costa County. The records maintained by the CHRIS, including cultural resource locations and cultural resource studies containing locations of cultural resources, are not accessible to the general public but to cultural resource professionals.

In addition to the state's database of previous cultural resource studies and known cultural resources, the record searches included reviews of historic topographic maps, local historical surveys and overviews, primary and secondary historical writings, and the Caltrans' Historical Bridges Inventory.

The records search indicates that portions of the SDIP have been surveyed for archaeological resources using methods that are considered professionally sound today (Archeo-Tec 1989, 1990; Baker and Shoup 1991; Peak & Associates 1997; Shapiro 1997; Shapiro and Syda 1997a, 1997b, 1997c; True et al. 1981; U.S. Army Engineer District 1986; West 1991, 1994; West and Scott 1990; Windmiller and Osanna 2000). The proposed dredge spoil areas, however, have not been previously surveyed for the presence of cultural resources. The SDIP APE consists primarily of those areas that will be subject to ground disturbance during construction and operation activities. A survey of historic architecture and other elements of the built environment (including water conveyance features) was conducted by a qualified architectural historian.

Consultation with Interested Parties

Interested parties were consulted to obtain information about known cultural resources and the sensitivity for cultural resources in the study area. Individuals and entities known to have an interest in the prehistory, archaeology, and history of the region were contacted, including Native Americans, museums, and historical societies. The San Joaquin County Historical Society and San Joaquin County Museum were contacted by letter on May 3, 2004. No response has been received.

Jones & Stokes requested a search of the sacred lands file and a list of potentially interested Native American contacts from the Native American Heritage Commission (NAHC) on June 28, 2003. The sacred lands file search did not identify Native American cultural resources, including sacred or culturally significant sites, in the APE. On October 5, 2004, Jones & Stokes sent consultation letters to the parties listed by the NAHC. No response has been received. In addition, the ethnographic literature cited in the Ethnographic Setting below does not indicate the presence of sacred sites in the APE.

Field Surveys

A Jones & Stokes architectural historian visited the project area on July 15, 2003. The survey area included the proposed gate locations on the Middle River, Old River, and Grant Line Canal as well as proposed dredging sites on the Middle River and Old River. Because of restricted access, the proposed dredging site on the West Canal/CCF was not surveyed. Therefore, assumptions regarding cultural resources in this area were made based on surrounding areas. As part of the field process, irrigation features, buildings, and structures in the APE were inspected and photographed, and notes were gathered.

Jones & Stokes archaeologists surveyed proposed Middle River spoils ponds (ponds 1–7) on November 23 and 24, 2004 and April 14, 2005. These areas were surveyed because they were not included in previous iterations of the SDIP or in previous cultural resource inventories. All proposed spoils ponds were surveyed by walking parallel transects spaced 15–30 meters apart. Jones & Stokes surveyed approximately 185 acres for the presence of cultural resources.

Historical Research

In an effort to identify important historic people, events, and architectural trends that may have been associated with the project area, Jones & Stokes conducted archival research at the California State Library, Sacramento, the California Geological Survey Library, Sacramento, and the Jones & Stokes cultural resources library.

Prehistoric Setting

Little is known of human occupation in the lower Sacramento Valley prior to 4500 B.P. (years before present, or 1950). Because of rapid alluvial and colluvial deposition in the valley over the past 10,000 years, ancient cultural deposits are deeply buried in many areas. The earliest evidence of widespread occupation of the lower Sacramento Valley/Delta region comes from several sites assigned to the Windmiller Pattern (previously, Early Horizon), dated ca 4500–2500 B.P. (Ragir 1972).

Known Windmiller Pattern sites are concentrated on low rises or knolls within the floodplains of major creeks or rivers. Such locations provided protection from seasonal flooding and proximity to riverine, marsh, and valley grassland biotic communities. Most Windmiller Pattern sites contain cemeteries, in which skeletons are typically extended ventrally, oriented toward the west, and accompanied by abundant grave goods. Subsistence apparently focused on hunting and fishing, as evidenced by large projectile (spear or dart) points, clay net sinkers, bone fishhooks and spears, and abundant faunal remains. Collection and processing of floral resources, such as seeds and nuts, is inferred from mortar and milling slab fragments recovered from a few of the sites. Other characteristic artifacts include charm stones, quartz crystals, bone awls and needles, and abalone and olive snail shell beads and ornaments (Beardsley 1948; Gerow 1974; Heizer 1949; Heizer and Fenenga 1939; Lillard et al. 1939; Ragir 1972; Schulz 1970).

The succeeding Berkeley Pattern (formerly the Middle Horizon) dates from ca. 2500 to 1500 B.P. in the Central Valley. Berkeley Pattern sites are greater in number and more widely distributed than Windmiller sites and are characterized by deep midden deposits, suggesting intensified occupation and a broadened subsistence base. The abundance of milling slabs, mortars, and pestles indicates a dietary emphasis on vegetal resources; however, distinct projectile points and faunal remains attest to the continued importance of hunting. Fishing technology improved and diversified, suggesting greater reliance on aquatic resources. Common artifacts include mortars and milling slabs, quartz crystals, charm stones, projectile point styles, shell beads and ornaments, and bone tools. New elements include steatite beads, tubes and ear ornaments, slate pendants, and burial of the dead in flexed positions or cremations accompanied by fewer grave goods (Beardsley 1948; Fredrickson 1973; Heizer and Fenenga 1939; Lillard et al. 1939; Moratto 1984).

The late prehistoric period (ca 1500 to 100 B.P., formerly the Late Horizon) is characterized by the Augustine Pattern (Fredrickson 1973). The Augustine Pattern represents the peak cultural development of the prehistoric period in the lower Sacramento Valley and Delta regions and is characterized by intensified hunting, fishing, and gathering subsistence strategies; large, dense populations; highly developed trade networks; elaborate ceremonial and mortuary practices; and social stratification. In addition to cultural elements from the preceding patterns, new elements include shaped mortars and pestles, bone awls for basketry, bone whistles and stone pipes, clay effigies, and the introduction of the bow and arrow as evidenced by small notched and serrated projectile points. Pottery is also found at a few of the sites assigned to this period. Burials were flexed and generally lacked grave goods (Beardsley 1948; Fredrickson 1973; Moratto 1984; Ragir 1972).

Ethnographic Setting

The aboriginal inhabitants of the area in which the APE is located are known as the Northern Valley Yokuts. *Yokuts* is a term applied to a large and diverse number of peoples inhabiting the San Joaquin Valley and Sierra Nevada foothills of central California. The Yokuts cultures include three primary divisions, corresponding to gross environmental zones: the Southern Valley Yokuts, the Foothill Yokuts, and the Northern Valley Yokuts (Kroeber 1976; Silverstein 1978).

The Northern Valley Yokuts lived in the northern San Joaquin Valley from around Bear Creek north of Stockton to the bend in the San Joaquin River near Mendota (Wallace 1978). The APE was inhabited by a division of the Northern Valley Yokuts known as the Cholbones (also Chulamni), which includes groups of Yokuts designated Nototemes, Jusmites, and Fugites or Tugites (Schenck 1926: Figure 1, 137–138; Wallace 1978: Figure 1, 469). Similar to most Indian groups in California, the largest political entity among the Yokuts was that of the tribelet. A tribelet consisted of a large village and a few smaller surrounding villages. Larger villages and tribelets had a chief or headman, an advisory position that was passed from father to son (Wallace 1978).

The Yokuts were seasonally mobile hunter-gathers with semi permanent villages. Seasonal movements to temporary camps would occur to exploit food resources in other environmental zones. The Northern Valley Yokuts relied heavily on acorns (which were processed into a thick soup) as a food staple, along with salmon and other fish, grass seeds and tule roots (which were processed into meal), and probably waterfowl, tule elk, and pronghorn.

Principal settlements were located on the tops of low mounds, on or near the banks of the larger watercourses. Settlements were composed of single-family dwellings, sweathouses, and ceremonial assembly chambers. Dwellings were small and lightly constructed, semi-subterranean and oval. The public structures were large and earth covered. Sedentism was fostered by the abundance of riverine resources in the area (Wallace 1978).

The Yokuts first came into contact with Europeans when Spanish explorers visited the area in the late 1700s, followed by expeditions to recover Indians who had escaped from the missions. The North Valley Yokuts were far more affected by missions than were the other groups. The loss of individuals to the missions, the influence of runaway neophytes, various epidemics in the 1800s, and the arrival of settlers and miners inflicted major depredations on the Yokuts peoples and their culture (Wallace 1978).

Historical Setting

In general, European settlers in Alta California ignored the Central Valley until the mid-19th century. The Spanish confined their settlement of the region to a thin strip along the coastline. In 1806, Gabriel Moraga explored much of the San Joaquin Valley by following the Kern and Kings Rivers into the foothills of the Sierra Nevada. After Mexico's independence from Spain in 1821, the settlement of California progressed with the issuance of rancho lands by the Mexican governors. The most notable of these governors were Juan Bautista Alvarado, Manuel Micheltorena, and Pio Pico. With the exception of a few grants in the Sacramento Valley, the ranchos were located in the same general areas as the coastal missions. Only six ranchos were located either wholly or in part in San Joaquin County, including the El Pescadero grant, which was situated in a portion of the project area (immediately south of the Grant Line/Fabian and Bell Canal). Micheltorena granted Antonio Pico the 8-square-league (approximately 35,546-acre) rancho in 1843 and following the confirmation by the U.S. Supreme Court in 1856 (and subsequent survey); Pico and Henry M. Naglee received a formal patent in 1865. Additional lands located in the project area (and outside the rancho) remained essentially unsettled before the well-publicized discovery of gold in 1848 (Bean and Rawls 1993:52; Hoffman 1862:37; Thompson 1957:144).

Following the Gold Rush, settlement in the Delta region increased dramatically, largely as a result of the passage of the Swamp and Overflow Act in 1850. The law transferred swamplands from the U.S. Government into the control of the state of California. As a result of this act, approximately 500,000 acres of newly acquired California swampland located in the Sacramento–San Joaquin Delta (and including the project area) were sold to private citizens (CALFED Bay-Delta Program 1996:10; Thompson 1957:186).

Early settlers in the project area included the Willis, Baird, Meyers, Tait, and Swain families, who located to the region currently occupied by the CCF. By 1890, Kidd Ranch and the Levi Tract were established in the vicinity of the Middle River. Within 5 years, the Bixler and Williams families settled on large land holdings on Union Island, and a Mr. Burke bought out Pico's share of the former Rancho El Pescadero. Naglee maintained ownership of his portion of the property. Lots during this period were typically 100–500 acres in size, although land to the east of the Middle River was subdivided into smaller parcels (Anonymous 1890; McMahon and Minto 1885; San Joaquin Board of Supervisors 1912).

Land speculators and individual farmers were attracted to the Delta region because of its fertile agricultural soil and because the area featured miles of navigable channels. Efforts to reclaim the land were begun immediately (largely through the efforts of Chinese laborers), although the process was time consuming and costly. Because of the expenses involved, large corporations were commonly formed to supply the capital needed to reclaim vast areas of swampland. In the Delta area, financier Lee Philips (who created California Delta Farms Incorporated) played a key role in reclaiming the region located primarily north of the project area. Phillips purchased thousands of acres of Delta land and teamed with Japanese immigrant farmer George Shima to reclaim and plant the area with profitable crops. Other companies involved in reclamation included the Tide Land Reclamation Company and the Old River Land Reclamation Company. Overall, dredging efforts during this period were not very successful until the advent of improved dredging machinery in the late 19th century (CALFED Bay-Delta Program 1996:11; Paterson et al 1978:21a–23; Thompson 1957:220).

Based on historic maps, the project area was reclaimed between 1870 and 1890, with most of the present canal system in place by 1890. In the late 1870s, the Tide Land Reclamation Company undertook efforts to reclaim a portion of Union Island and areas to the north of the island through the construction of dams, canals, and levees. Additional levees were also constructed near the Middle River. Reclaimed land in the project area was used to grow sugar beets, corn, beans, and alfalfa and also was used as grazing pastures for livestock (CALFED Bay-Delta Program 1996:11; Owens 1991:19–20; Thompson 1957).

By the turn of the 20th century, transportation improved in the area when officials constructed roads on the tops of levees. Before this construction, roadways were virtually non-existent, and most local travel was by schooners or barges. Southern Pacific Railroad and Western Pacific Railroad also constructed rail lines in the vicinity of the project area, which not only connected the Delta to populated centers such as Sacramento and San Francisco, but also encouraged the movement of agricultural products from the Delta to outlying markets (Thomas Brothers 1920).

The 20th century also brought about changes to the canal system. By the 1920s, many of the canals and levees mentioned above were no longer present or were modified. In addition, smaller canals were constructed on Union Island and a portion of the Old River in the vicinity of the Pescadero Tract was rerouted, causing small islands to be formed. Maps from that era also indicate the area currently occupied by CCF was composed of a series of canals, including a portion of the West Canal. During this period, most of the land in the project area was subdivided into smaller parcels and owned by corporations or individual farmers. Major landholders in the project area included E. Bixler, D.M. Burns, California Irrigated Farms, and Old River Farms Company (Anonymous 1890; Budd 1926; San Joaquin Board of Supervisors 1912; U.S. Geological Survey 1914).

By the 1930s, additional crops were introduced to the area, including asparagus, sunflower seeds, and small grains. By the 1960s, CCF was created, and overall improvements were made to the canal system, including extending or rerouting some canals and levees and improving roadways (Contra Costa County Title Company 1928; Metsker 1940; West and Scott 1990).

Throughout the 20th century, the south Delta region continued to be used for agricultural purposes. Currently, large farming corporations and some large family farms own the majority of the project area. Upkeep and maintenance continue on the water system into the present (CALFED Bay-Delta Program 1996:12).

Known Cultural Resources

Based on the records search, a review of historic maps, and the architectural and archaeological surveys, five cultural resources were identified in the SDIP APE. These consist of the Grant Line/Fabian and Bell Canal, the West Canal, a levee system, a farm complex located near Middle River, and a building complex.

Grant Line/Fabian and Bell Canal

The Grant Line/Fabian and Bell Canal is an earthen canal approximately 200 feet wide extending roughly 10 miles from east to west along the southern portion of the APE. Levees are located on either side of the canal. The segment of the canal to the east is a single waterway that divides into two separate parallel canals, creating an island strip in the middle as it extends westward. The canal to the south of the island strip is referred to as the Fabian and Bell Canal, and the canal to the east is the Grant Line Canal.

West Canal

Because of limited access, a formal pedestrian survey of the West Canal was not possible for the purposes of this project. However, based on characteristics observed at nearby irrigation features (i.e., the Grant Line/Fabian and Bell Canal), it is assumed that the West Canal displays design and construction materials and methods similar to the irrigation features located in the vicinity.

Levee System

A system of earthen levees, which borders canals and rivers, is located throughout the project area. The levees vary in width and height but typically measure approximately 40 feet wide and 10 to 15 feet high.

Farm Complex

The farm complex is located on the south bank of the Middle River in the vicinity of the proposed Middle River gate site. The complex contains a wood-frame single-family residence and several metal-framed barns and outbuildings.

Grant Line/Fabian and Bell Canal Buildings

A cluster of historic buildings is located on the island strip in the Grant Line/Fabian and Bell Canal. The buildings are windowless wood-frame structures with gabled roofs.

Environmental Consequences

Assessment Methods

Impact assessments for cultural resources focus on properties eligible for listing in the National Register of Historic Places (NRHP) (historic properties), the California Register of Historic Resources (CRHR), or those properties considered significant resources or unique archaeological resources under CEQA.

Section 106 of the National Historic Preservation Act (NHPA) requires that federal agencies consider the effects of their actions, including activities they fund or permit on properties that may be eligible for listing or are listed in the NRHP. To determine whether an undertaking could affect historic properties, cultural resources (including archaeological, historical, and architectural properties) must be inventoried and evaluated for NRHP eligibility. To be eligible for listing in the NRHP, a property must be 50 years old or older and evaluated as significant (or, if less than 50 years old, be of exceptional historic significance). To qualify for listing in the NRHP, a property must represent a significant theme or pattern in history, architecture, archaeology, engineering, or culture at the local, state, or national level. It must meet one or more of the four criteria listed below and have sufficient integrity to convey its historic significance. The criteria for evaluation of the eligibility of cultural resources for listing in the NRHP are defined in 36 CFR 60.4 as follows:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and
>
> 1. that are associated with events that have made a significant contribution to the broad patterns of our history; or
> 2. that are associated with the lives of persons significant in our past; or
> 3. that embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
> 4. that have yielded, or may be likely to yield, information important in prehistory or history.

The State CEQA Guidelines define three ways that a property may qualify as a historical resource for the purposes of CEQA review:

- if the resource is listed in or determined eligible for listing in the CRHR;
- if the resource is included in a local register of historical resources, as defined in Public Resources Code (Pub. Res. Code) 5020.1(k), or is identified as significant in a historical resource survey meeting the requirements of Pub. Res. Code 5024.1(g) unless the preponderance of evidence demonstrates that it is not historically or culturally significant; or

- the lead agency determines the resource to be significant as supported by substantial evidence in light of the whole record (14 California Code of Regulations [CCR] 15064.5(a)).

Each of these ways of qualifying as a historical resource for the purpose of CEQA is related to the eligibility criteria for inclusion in the CRHR (Pub. Res. Code 5020.1(k), 5024.1, 5024.1(g)). A historical resource may be eligible for inclusion in the CRHR if it:

- is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage;
- is associated with the lives of persons important in our past;
- embodies the distinctive characteristics of a type, period, region, or method of construction, represents the work of an important creative individual, or possesses high artistic values; or
- has yielded, or may be likely to yield, information important in prehistory or history.

Properties that are listed in or eligible for listing in the NRHP are considered eligible for listing in the CRHR, and therefore are significant historical resources for the purpose of CEQA (Pub. Res. Code 5024.1(d)(1)).

In addition, CEQA also distinguishes between two classes of archaeological resources: archaeological sites that meet the definition of a historical resource as above, and "unique archaeological resources." An archaeological resource will be considered unique if it:

- is associated with an event or person of recognized significance in California or American history or recognized scientific importance in prehistory;
- can provide information that is of demonstrable public interest and is useful in addressing scientifically consequential and reasonable research questions;
- has a special or particular quality such as oldest, best example, largest, or last surviving example of its kind;
- is at least 100 years old and possesses substantial stratigraphic integrity; or
- involves important research questions that historical research has shown can be answered only with archaeological methods (Pub. Res. Code 21083.2).

Generally, most archaeological resources that meet the definition of *unique* will also meet the definition of a *historical resource*.

Regulatory Setting

Federal—Section 106 of the National Historic Preservation Act

Section 106 of the NHPA requires that, before beginning any undertaking, a federal agency must take into account the effects of the undertaking on historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on these actions. The 36 CFR 800 regarding compliance with Section 106 state that, although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency is ultimately responsible for ensuring that the Section 106 process is completed according to statute. The Section 106 process has four basic steps:

1. Initiation of the Section 106 process (define APE and scope of identification efforts).
2. Identification of historic properties.
3. Assessment of adverse effects to historic properties.
4. Resolution of adverse effects to historic properties.

The APE for the SDIP is formally defined in the confidential cultural resources inventory and evaluation report prepared for this undertaking (Jones & Stokes 2004b). The APE is confined largely to those areas that will be subject to ground-disturbance during construction and operation of the SDIP.

State—California Environmental Quality Act

CEQA requires that public agencies (in this case, DWR) that finance or approve public or private projects assess the effects of the project on cultural resources. Cultural resources are defined as buildings, sites, structures, districts, or objects, each of which may have historical, architectural, archaeological, cultural, or scientific importance. CEQA requires that if a project results in significant effects on important cultural resources, alternative plans or mitigation measures must be considered; only significant cultural resources, however, need to be addressed. Therefore, prior to the development of mitigation measures, the importance of cultural resources must first be determined. The steps that are normally taken in a cultural resources investigation for CEQA compliance are:

- identify cultural resources,
- evaluate the significance of resources,
- evaluate the effects of a project on *all* resources, and
- develop and implement measures to mitigate the effects of the project only on *significant* resources.

Areas of Controversy

Under CEQA, areas of controversy involve factors that reflect differing opinions among technical experts. Differences of opinion among technical experts stem from differing methodological or theoretical orientations. Although differences of theoretical and methodological approach exist among archaeologists, historians, and cultural anthropologists, these do not appear to affect the assessment of impacts that may result from the SDIP alternatives. Therefore, no areas of controversy relate to cultural resources for the purposes of the SDIP.

Evaluation of Identified Cultural Resources

Grant Line/Fabian and Bell Canal, West Canal, Levee System, Farm Complex, Grant Line/Fabian and Bell Canal Buildings

Five known cultural resources are located in the project area. Fieldwork conducted by Jones & Stokes did not identify additional cultural resources in the project area. An evaluation was conducted to determine whether these features meet the criteria for listing in the NRHP or CRHP (Jones & Stokes 2004b). None of the features appears to meet the criteria for eligibility because of loss of integrity, lack of historical and architectural significance, or non-historic dates of construction. The State Historic Preservation Officer (SHPO) must concur with these determinations pursuant to 36 CFR 800.4. Resource evaluations are summarized below.

Grant Line/Fabian and Bell Canal

Grant Line/Fabian and Bell Canal follows the same alignment as it did in the 19th century from an engineering standpoint, but the canal bears little resemblance to a canal from the period of significance. Rather, it is very much a product of the 20th century that happens to follow a historic alignment. As originally excavated, the canal would have had a wide shallow U-shape with side slopes angles dictated in part by the capabilities of the horses and scrapers as they moved down one slope and up the other. The present canal, as a result of years of dredging and chaining, now has steep slopes (some concrete lined). Furthermore the introduction of modern roads topping the levees on either side of the canal as well as numerous high- and low-power utility poles and wires gives the area a slightly modernized feel and affects the integrity of setting. Grant Line/Fabian and Bell Canal does not appear to meet the NRHP or CRHR eligibility criteria because it lacks integrity of design, materials, feeling, and workmanship to its respective period of historic significance.

West Canal

West Canal does not appear to meet the criteria for listing in the NRHP or the CRHR because it has lost integrity to its period of significance. Construction of CCF caused the canal to suffer integrity of setting. As mentioned above, the canal originally traversed reclaimed agricultural fields. The current, vast water body to the west overshadows the canal and completely changes the sense of setting, feeling, and association. In addition, as with other canals in the area, West Canal suffered a loss of integrity to its design, materials, and workmanship as a result of constant upkeep and maintenance in the form of erosion control, dredging, and repairs along its banks.

Levee System

The levee system has lost integrity since it was initially constructed. The loss of integrity resulted from repeated maintenance and upgrading (West 1994). Levees built in the late 19th and early 20th centuries tended to be small ribbons of mounded earth measuring roughly 30–40 feet wide and 6–8 feet high. The earthen features gradually evolved to massive flat top ridges measuring up to 100 feet wide at the base and roughly 30 feet high. The loss of integrity of design, materials, and workmanship exhibited by the levee system is considerable, with the consequence that it is no longer recognizable as a 19th-century levee system. Because the levee system does not maintain integrity to its period of significance, it does not appear to meet the significance criteria of the NRHP or the CRHR.

Farm Complex and Grant Line/Fabian and Bell Canal Buildings

These historic structures and buildings do not appear to meet the significance criteria of the NRHP or the CRHR. They are not directly associated with events important to the county, state, or nation and are not known to be associated with individuals important to the area. None of the buildings and structures displays a unique design or construction method. Furthermore, the resources are somewhat deteriorated and have lost some integrity over time.

Significance Criteria

Impact assessments for cultural resources are based on the type of resource, a determination of whether a resource is considered eligible for inclusion in the NRHP or the CRHR, the type of impact, and the extent of the impact. Under CEQA, impacts on cultural resources are considered significant if they would adversely affect significant cultural resources. Similarly, pursuant to 36 CFR 800.5 regulations, a federal action or undertaking would have an adverse effect if the undertaking alters the characteristics that make a property eligible for inclusion in the NRHP. Specific actions under the SDIP that may adversely affect cultural resources include the modification of existing levees, construction of operable gates, construction of support structures and access roads, and channel dredging.

As indicated under Assessment Methods, impacts on cultural resources that may result from a federal action include:

- ground disturbance,
- modification and alteration of historic structures,
- visual and auditory intrusions to a resource’s historic setting, and

- vandalism.

Physical damage or destruction to significant cultural resources, particularly archaeological sites, may affect the physical integrity of those resources and thus reduce their information or research potential (NRHP Criterion D or CRHR Criterion 4). Physical damage or alteration may also have deleterious effects on the characteristics of a cultural resource that convey its significant association with an important historical event, person, or architectural/design quality (NRHP Criteria A–C or CRHR Criteria 1–3).

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program.

The discussion of significant impacts and mitigation measures within this section will include a citation of one or more of the following programmatic mitigation measures used to build project-specific mitigation measures to offset significant impacts identified from implementation of the SDIP. These programmatic mitigation measures are numbered as they appear in the ROD, and only those measures relevant to cultural resources are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED programmatic mitigation measures, please refer to Appendix E, "Mitigation Measures Adopted in the CALFED Record of Decision."

1. Conduct cultural resources inventories,
2. Avoid sites through project redesign,
3. Map sites prior to undertaking actions that affect cultural resources,
4. Conduct surface collections,
5. Perform test excavations,
6. Probe for potential buried sites,
7. Prepare reports to document mitigation work,
8. Conduct full-scale excavations of sites slated for destruction as a result of projects,
9. Prepare public interpretive documents,
10. Document historic structures by preparing Historic American Engineering Records of Historic American Building Surveys, and
11. Conduct ethnographic studies for traditional cultural properties.

Alternative 1 (No Action)

No changes in existing conditions would result from Alternative 1. Present use of the canals and levees would continue, including periodic minor modifications of canals and levees at the temporary barrier locations.

2020 Conditions

Under 2020 conditions, the SDIP project components would not be built or operated. Present use of the canals and levees would continue, including periodic minor modifications of canals and levees at the temporary barrier locations.

Alternatives 2A, 2B and 2C

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Implementation of Alternatives 2A–2C may result in direct and indirect impacts on cultural resources. Physical modification to cultural resources would result from construction of a fish control gate at the head of Old River; flow control gates at Old River, Grant Line/Fabian and Bell Canal, and Middle River; and dredging of portions of south Delta waterways. Such activities have the potential to affect both known cultural resources and as-yet-undiscovered (buried) cultural resources such as human remains. Visual intrusions to the historic setting of cultural resources would result from construction of gates. Impacts are discussed below under separate headings and by impact type.

Impact CR-1: Physical Alterations to Levees Resulting in Changes in Historic Integrity. Construction of the fish control gate at the head of Old River would result in physical alterations to levees on either side of Old River. Because the levees at this location have not retained their historic integrity they are not considered a historic property for the purposes of Section 106 of the NHPA and are not a historical resource for the purposes of CEQA. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Construction of the Old River at DMC flow control gate would result in physical alterations to levees on either side of the gate location. The levees at this location do not retain their historic integrity and thus are not considered a historic property for the purposes of Section 106 of the NHPA and are not a historical resource for the purposes of CEQA. Therefore there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Construction of the Middle River flow control gate would result in physical changes to levees on either side of the gate location. The levees at this location do not retain their historic integrity and thus they are not considered a historic property for the purposes of Section 106 of the NHPA and are not a historical resource for the purposes of CEQA. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a "no historic properties affected" determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Construction of the Grant Line/Fabian and Bell Canal flow control gate would result in changes to Grant Line/Fabian and Bell Canal. Grant Line/Fabian and Bell Canal is not a historic property for the purposes of Section 106 of the NHPA and is not a historical resource for the purposes of CEQA. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a "no historic properties affected" determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Impact CR-2: Inadvertent Damage to or Destruction of Buried Archaeological Sites and Human Remains. Construction and staging activities associated with the SDIP have the potential to disturb buried, as-yet-undiscovered archaeological sites (including submerged cultural resources) and human remains. Damage to or destruction of significant or potentially significant buried archaeological remains during construction would be a significant impact under CEQA and NEPA. This impact would be reduced to a less-than-significant level through implementation of Mitigation Measure CR-MM-1.

Similarly, damage to or destruction of human remains during construction would be a significant impact under CEQA and NEPA. This impact would be reduced to a less-than-significant level through implementation of Mitigation Measure CR-MM-2.

Mitigation Measure CR-MM-1: Stop Work If Archaeological Materials Are Discovered during Construction or Dredging. If archaeological materials (such as chipped or ground stone, historic debris, building foundations, or non-human bone) are inadvertently discovered during ground-disturbing activities, the construction contractor shall stop work in that area and within 100 feet of the find until a qualified archaeologist can assess the significance of the find and develop appropriate treatment measures. Treatment measures shall be made in consultation with Reclamation, DWR, the SHPO, and other consulting parties to the Section 106-review process. Treatment measures, consistent with Mitigation Measures 2–5, 7, and 8, typically include development of avoidance strategies or mitigation of impacts through data recovery programs such as excavation or detailed documentation.

If cultural resources are discovered during construction activities, the construction contractor and lead contractor compliance inspector shall verify that work is halted until appropriate treatment measures are implemented. Implementation of this mitigation measure may be sufficient to reduce impacts on archaeological sites to a less-than-significant level.

Mitigation Measure CR-MM-2: Stop Work If Human Remains Are Discovered during Construction or Dredging. If human remains of Native American origin are discovered during ground-disturbing activities, it is necessary for DWR and Reclamation to comply with state laws relating to the disposition of Native American burials, which fall within the jurisdiction of the NAHC (Pub. Res. Code 5097). If human remains are discovered or recognized in any location other than a dedicated cemetery, DWR and Reclamation shall not allow further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

- the Contra Costa or San Joaquin County Coroner has been informed and has determined that no investigation of the cause of death is required; and
- if the remains are of Native American origin,
  - the descendants from the deceased Native Americans have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Pub. Res. Code 5097.98, or
  - the NAHC was unable to identify a descendant or the descendant failed to make a recommendation within 24 hours after being notified by the NAHC.

Impact CR-3: Visual Intrusions to the Historic Setting of Cultural Resources from Gate Construction. Gate construction would result in the addition of structures that are out of character with the historic setting of cultural resources such as historic canals, buildings, and levees:

- Construction of the head of Old River fish control gate would result in visual intrusions to the historic setting of the Old River levees.
- Construction of the Old River flow control structure would result in visual intrusions to the historic setting of the Old River levees.
- Construction of the Middle River flow control gate would result in visual intrusions to the historic setting of the Middle River levees and a historic farm complex.
- Construction of the Grant Line/Fabian and Bell Canal flow control gate would result in intrusions to the historic setting of Grant Line/Fabian and Bell Canal and the building complex on Bell Island.

None of the cultural resources affected in this manner are historic properties for the purposes of Section 106 of the NHPA or historical resources for the purposes of CEQA. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a "no historic properties affected" determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Dredging

Impact CR-4: Disturbance of West Canal. Dredging of south Delta waterways would result in physical changes to the West Canal. The West Canal, however, is not a historic property for the purposes of Section 106 of the NHPA or a historical resource for the purposes of CEQA. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a "no historic properties affected" determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

2020 Conditions

Construction of the physical/structural component of the SDIP under 2020 conditions would result in impacts on cultural resources similar to those analyzed above under 2001 conditions.

Stage 2 (Operational Component)

The operational scenarios of Alternatives 2A–2C will not affect cultural resources because they will not result in significant departures from the range of surface elevations maintained under current rules for water levels in reservoirs affected by the SDIP. An examination of Table 7.4-5 demonstrates that the greatest change in water levels under the SDIP is 1.6% greater than normal. The SDIP will not result in significantly longer exposure of cultural resources or the inundation of cultural resources. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a "no historic properties affected" determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

2020 Conditions

The operational scenarios of Alternatives 2A–2C under 2020 conditions will not affect cultural resources because they will not result in significant departures from the range of surface elevations maintained under current rules for water levels in reservoirs affected by the SDIP. An examination of Table 7.4-5 demonstrates that the greatest change in water levels under the SDIP is 1.6% greater than normal. The SDIP will not result in significantly longer exposure of cultural resources or the inundation of cultural resources. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Interim Operations

Interim operations of the SDIP are not relevant to this cultural resources impact assessment. Interim operations will not affect cultural resources because they would not result in the inundation of additional land.

Alternative 3B

Stage 1 (Physical/Structural Component)

Fish Control and Flow Control Gates

Implementation of Alternative 3B would result in impacts on cultural resources that are similar to those under Alternatives 2A–2C. The impacts under Alternative 3B would be slightly less than those under Alternatives 2A–2C because Alternative 3B does not include the construction of the Grant Line flow control gate. Therefore, impacts CR-1 through CR-4 would occur under Alternative 3B, but to a lesser extent. Required mitigation measures are the same for Alternative 3B as for Alternatives 2A–2C.

2020 Conditions

Implementation of Alternative 3B under 2020 conditions would result in impacts on cultural resources similar to the 2001 conditions described in the paragraph above.

Stage 2 (Operational Component)

The operational scenario of Alternative 3B will not affect cultural resources because they will not result in significant departures from the range of surface elevations maintained under current rules for water levels in reservoirs affected by the SDIP. An examination of Table 7.4-5 demonstrates that the greatest change in water levels under the SDIP is 1.6% greater than normal. The SDIP will not result in significantly longer exposure of cultural resources or the inundation of cultural resources. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

2020 Conditions

Similar to the 2001 conditions described above, the operational scenarios of Alternative 3B under 2020 conditions will not affect cultural resources because they will not result in significant departures from the range of surface elevations maintained under current rules for water levels at reservoirs affected by the SDIP. An examination of Table 7.4-5 demonstrates that the greatest change in water levels under the SDIP is 1.6% greater than normal. The SDIP will not result in significantly longer exposure of cultural resources or the inundation of cultural resources. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Alternative 4B

Stage 1 (Physical/Structural Component)

Fish Control and Flow Control Gates

Implementation of Alternative 4B would result in impacts on cultural resources that would be similar to those under Alternatives 2A–2C and 3B, except that the physical/structural component of Alternative 4B consists only of the head of Old River fish control gate and dredging of south Delta waterways. The impacts under Alternative 4B would be slightly less than under Alternatives 2A–2C and 3B. Therefore, impacts CR-1 through CR-4 would occur under Alternative 4B, but to a lesser extent. Required mitigation measures are the same for Alternative 4B as for Alternatives 2A–2C and 3B.

2020 Conditions

Implementation of Alternative 4B under 2020 conditions would result in impacts on cultural resources similar to the 2001 conditions described in the paragraph above.

Stage 2 (Operational Component)

The operational scenario of Alternative 4B will not affect cultural resources because they will not result in significant departures from the range of surface elevations maintained under current rules for water levels in reservoirs affected by the SDIP. An examination of Table 7.4-5 demonstrates that the greatest change in water levels under the SDIP is 1.6% greater than normal. The SDIP will not result in significantly longer exposure of cultural resources or the inundation of cultural resources. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

2020 Conditions

Similar to the 2001 conditions described above, the operational scenarios of Alternative 4B under 2020 conditions will not affect cultural resources because they will not result in significant departures from the range of surface elevations maintained under current rules for water levels in reservoirs affected by the SDIP. An examination of Table 7.4-5 demonstrates that the greatest change in water levels under the SDIP is 1.6% greater than normal. The SDIP will not result in significantly longer exposure of cultural resources or the inundation of cultural resources. Therefore, there is no impact under CEQA and no mitigation is required. Pursuant to 36 CFR 800 regulations, if Reclamation makes a “no historic properties affected” determination for the SDIP, and the SHPO concurs, the SDIP would not result in adverse effects to historic properties and no mitigation would be required to comply with Section 106 of the NHPA.

Cumulative Evaluation of Impacts

Cumulative impacts on cultural resources are analyzed in Chapter 10, “Cumulative Impacts.” This chapter summarizes the other foreseeable future projects that may contribute to these impacts.

7.8 Public Health and Environmental Hazards

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on public health and environmental hazards, including hazardous material use and storage, emergency response and evacuation plans, and health hazards to the public in the south Delta region. Issues related to public health and environmental hazards are accidental spills or releases of hazardous materials or waste during construction, impedance of emergency response in the south Delta, and the potential to create mosquito breeding habitat. Sections 5.3, Water Quality; 5.9, Air Quality; and 5.7, Groundwater Resources, provide additional information about contaminant dispersion and control procedures.

Summary of Significant Impacts

No significant public health impacts are expected to occur as a result of constructing and operating any of the project alternatives.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- Environmental Data Report (EDR) (Please see Appendix P),
- California Department of Health Services web site,
- Interim South Delta Program EIR/EIS, and
- CALFED Programmatic EIS/EIR.

Hazardous Materials

Hazardous materials and wastes are those substances that, because of their physical, chemical, or other characteristics, may pose a risk of endangering human health or safety or of endangering the environment (California Health and Safety Code Section 25260). Types of hazardous materials include petroleum hydrocarbons, pesticides, and volatile organic carbons (VOCs). In the Delta, most hazardous waste sites are associated with agricultural production activities and may include storage facilities and agricultural pits or ponds contaminated with fertilizers, pesticides, or herbicides. There have also been oil and gas drilling activities in the south Delta region; if not properly managed and closed, these drilling locations could be considered hazardous waste sites.

The locations of hazardous waste sites in the Delta were mapped using EDR. EDR queries hundreds of federal, state, and local databases to search for contaminants within a 1-mile radius of the proposed gate sites. These databases showed no known areas of contamination or sites where hazardous materials are used or disposed of within the SDIP project site.

Emergency Response/Evacuation Plans

Hazardous Materials

The San Joaquin County OES is responsible for planning emergency response actions to hazardous material incidents. Area response plans incorporate hazardous materials inventory data, training for emergency responses, and evacuations.

Law Enforcement

The San Joaquin County Sheriff's Department staffs a Boating Safety Division, which provides law enforcement on 600 miles of waterways in the county, including the south Delta. They own five boats and have six full-time officers, hiring additional staff during summer months when recreational activities increase. By authority and responsibility, the Sheriff's office is the designated "scene manager" for any disaster, from hazardous materials spills to major flood activity. Public protection plans are coordinated with other public agencies in preparing for disasters.

Emergency response is carried out using vehicles or boats, depending on the location's accessibility, predicted response time, and availability of resources. The average emergency response time in the south Delta is approximately 1 hour. Sheriffs have access to all gates and may use fields as well as levee roads to access channel areas in the Delta.

Currently, the Sheriff's Department uses the boat ramps to bypass the temporary barriers and to launch boats into the channels. They may also launch boats from Dos Rios, Tracy Oasis Marina, Mossdale Marina, and several private marina areas throughout the south Delta.

U.S. Coast Guard

In addition to the Sheriff's Department, the U.S. Coast Guard provides search and rescue and emergency response by boat to those areas of Delta not accessible by vehicle. Because of the Delta's many meandering sloughs and canals, response is typically faster by driving to the nearest boat launch. The U.S. Coast Guard station in Rio Vista maintains a trailerable boat that can be launched at either River's End Marina, near CCF, or at Mossdale Marina, east of Manteca.

Currently, the U.S. Coast Guard crosses the temporary barriers using the boat ramps. It takes approximately 10 minutes to load the boat and re-launch on the other side of the barrier.

In 2002, there were 119 accidents in the Delta, including 60 injuries and 7 fatalities (California Department of Boating and Waterways 2002). Response time to these incidences by boat is approximately 1 hour (Doty pers. comm.).

Health Hazards

Water Quality

The Delta is a source of drinking water for approximately 23,000,000 Californians. If Delta projects compromise the quality of the water, more extensive treatment may be required. When water is treated, byproducts are formed that may also adversely affect drinking water quality.

THM, a byproduct of chlorination, is of particular concern as it is associated with increased cancer risk. THM concentrations in drinking water are affected by two factors: the THM formation potential of exported Delta waters and the method of disinfection. THM is discussed in more detail in Section 5.3, Water Quality.

Other potential sources that could compromise water quality are two-stroke boat engines (which use an oil-gas mixture) and four-stroke boat engines (which use pure gasoline). These petroleum products could be accidentally discharged into the south Delta, compromising water quality. Continuous testing and monitoring of Delta water by federal, state, and local agencies minimizes the impact of hazardous waste discharges on public health.

Mosquito Breeding Conditions, Habitat, and Disease Transmission

All mosquito species require standing water to complete their growth cycles; any body of standing water that remains undisturbed for more than three days represents a potential mosquito breeding site. Mosquitoes breed year-round on Delta islands, but breeding diminishes substantially during cooler weather, typically from October through April.

Two general classes of habitats, open water and flooded, provide suitable conditions for mosquito production. Open-water habitats include permanently inundated wetlands, ditches, sloughs, and ponds. Flooded habitats include managed wetlands and agricultural lands that may seasonally retain surface water. Water bodies with water levels that slowly increase or recede produce greater numbers of mosquitoes than water levels that are stable or that rapidly fluctuate.

Mosquitoes are primary vectors for disease in the Delta. They can transmit diseases among species, such as from a horse to a bird, or from a bird to a human. In the south Delta, current mosquito control efforts focus on species that transmit malaria, encephalitis, or the West Nile virus. The West Nile virus is expected to become a permanent disease throughout the United States as mosquito vectors carry it west from the New York area. As of 2005, there have been three reported human cases of the West Nile virus in San Joaquin County (Office of Emergency Services 2005).

Pesticides

The south Delta area is used predominantly for agricultural practices, and aerial pesticide spraying of crops is common. Currently, there are four companies that are hired by local farmers to conduct aerial spraying: Haley's, Trinkle and Boys, Aerial Control, and Cavanagh. Most of these companies have scouts that investigate the area that is to be sprayed prior to spraying. However, there is no standard method for warning people that may be in the vicinity of the pesticide spraying area. State law prohibits the spraying of any pesticide or insecticide off site of the specified crop or field and requires that the applicator check the area for people before spraying. If people are in any danger of being sprayed, the applicator is required not to spray. (Williamson pers. comm.)

Environmental Consequences

This section discusses the potential for release of hazardous materials, interference with emergency response plans, and exposure of people to sources of potential health hazards. The nature of construction procedures, the operational characteristics of the SDIP, and the setting of the project area are such that the implementation of the project would not increase fire hazard in the south Delta.

Assessment Methods

The evaluation of potential impacts on public health and environmental hazards addresses the potential for health and safety hazards during project construction and operation of project facilities after construction. Information was collected through site visits, information gathered through the incorporation of findings from Sections 5.5, Flood Control and Levee Stability, and 5.3, Water Quality, and from assumptions made using the EDR reports. The analysis includes potential effects on workers related to construction activities, as well as general facility safety and hazards to both workers and the public posed by the new facilities and their operation. Table 7.8-1 shows the number of people and type of equipment at each project site.

Table 7.8-1. Equipment and Workers for Project Components

Site	Activity	Number of workers	Equipment
Head of Old River Fish Control Gate	Construction	80	Back hoe, bottom dumps, water trucks, roller, grader, dewatering pumps, excavator, scraper, dozer, dump trucks, loader, crane, concrete trucks, pile driver, concrete pump, vibratory hammer, 40-ton crane
	Channel Dredging	6	Clamshell or hydraulic dredge, dozer, barge, large scrapers, large sheepsfoot compactor
	Operation	1 (April–May, September–October)	
	Maintenance	Up to 10	Crane and service truck
Middle River	Construction	50	Loader, dump trucks, clam shell dredge, excavator, dozer, grader, vibratory roller, water truck, 40-ton crane, barge, pile driver, 80-ton crane, concrete trucks, power tools, 25-ton crane, vibratory hammer, oil spreader, rubber tire roller, steel roller, post driver
	Channel Dredging	30	Clamshell or hydraulic dredge, dozer, barge, large scrapers, large sheepsfoot compactor
	Operation	1	
	Maintenance	Up to 10	Crane and service truck
Grant Line Canal	Construction	90	Back hoe, dozer, crane, pile driver, excavator, dump trucks, loader, concrete trucks, crane with bucket, concrete pump, bottom dumps, scraper, sheepsfoot rollers, water trucks, grader, clam shell
	Operation	1	
	Maintenance	Up to 10	Crane and service truck.
Old River at DMC	Construction	100	Back hoe, dozer, excavator, scraper, dump trucks, loader, water trucks, pile driver, concrete trucks, delivery trucks, crane, concrete pump, bottom-dumps, compactor, roller, grader, sheepsfoot, roller, clam shell, hydroseed
	Operation	1	
	Maintenance	Up to 10	Crane and service truck
West Canal	Channel Dredging	15	Clamshell or hydraulic dredge, dozer, barge, large scrapers, large sheepsfoot compactor

DMC = Delta Mendota Canal.

Regulatory Setting

Regulations and policies considered relevant to the SDIP project alternatives are summarized below.

Federal Regulations

The principal federal regulatory agency responsible for the safe use and handling of hazardous materials is the EPA. Two key federal regulations pertaining to hazardous wastes are described below. Other applicable federal regulations are contained primarily in CFR Titles 29, 40, and 49.

Resource Conservation and Recovery Act

The federal Resource Conservation and Recovery Act enables the EPA to administer a regulatory program that extends from the manufacture of hazardous materials to their disposal, thus regulating the generation, transportation, treatment, storage, and disposal of hazardous waste at all facilities and sites in the nation.

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund) was passed to facilitate the cleanup of the nation's toxic waste sites. In 1986, the act was amended by the Superfund Amendment and Reauthorization Act Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership.

State Regulations

California regulations are equal to or more stringent than federal regulations. The EPA has granted the State of California primary oversight responsibility to administer and enforce hazardous waste management programs. State regulations require planning and management to ensure that hazardous wastes are handled, stored, and disposed of properly to reduce risks to human and environmental health. Several key laws pertaining to hazardous wastes are discussed below.

Hazardous Materials Release Response Plans and Inventory Act of 1985

The Hazardous Materials Release Response Plans and Inventory Act, also known as the Business Plan Act, requires businesses using hazardous materials to prepare a plan that describes their facilities, inventories, emergency response plans, and training programs. Hazardous materials are defined as unsafe raw or unused material that is part of a process or manufacturing step. They are not considered hazardous waste. Health concerns pertaining to the release of hazardous materials, however, are similar to those relating to hazardous waste.

Hazardous Waste Control Act

The Hazardous Waste Control Act created the state hazardous waste management program, which is similar to but more stringent than the federal Resource Conservation and Recovery Act program. The act is implemented by regulations contained in Title 26 CCR, which describes the following required aspects for the proper management of hazardous waste:

- identification and classification;
- generation and transportation;
- design and permitting of recycling, treatment, storage, and disposal facilities;
- treatment standards;
- operation of facilities and staff training; and
- closure of facilities and liability requirements.

These regulations list more than 800 materials that may be hazardous and establish criteria for identifying, packaging, and disposing of such waste. Under the Hazardous Waste Control Act and Title 26, the generator of hazardous waste must complete a manifest that accompanies the waste from generator to transporter to the ultimate disposal location. Copies of the manifest must be filed with the California Department of Toxic Substances and Control.

Emergency Services Act

Under the Emergency Services Act, the state developed an emergency response plan to coordinate emergency services provided by federal, state, and local agencies. Rapid response to incidents involving hazardous materials or hazardous waste is an important part of the plan, which is administered by the California OES. The office coordinates the responses of other agencies, including EPA, the CHP, RWQCBs, air quality management districts, and county disaster response offices.

Local and Regional Laws, Regulations, and Programs

San Joaquin County Mosquito Vector Control District

This district was formed by the San Joaquin County Board of Supervisors in 1945 under the authority of Section 2000 of the California Health and Safety Code. The District is funded by local property taxes and a special tax, based on land use type. They are responsible for all mosquito vector control in the county. Mosquito control is performed using the district’s Integrated Pest Management Plan. The plan includes surveillance, biological control, physical control, chemical control, community outreach/public education, and legal abatement. If a mosquito breeding area is found that was previously not known, staff will contact the property owner to work out the details for accessing the property, controlling the existing mosquito population, and developing a plan to reduce or eliminate the mosquito breeding conditions for the future.

Other Laws, Regulations, and Programs

Various other state regulations have been enacted that affect hazardous waste management, including:

- Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), which requires labeling of substances known or suspected by the state of California to cause cancer; and
- California Government Code Section 65962.5, which requires the Office of Permit Assistance to compile a list of possible contaminated sites in the state.

State and federal regulations also require that hazardous materials sites be identified and listed in public records. These lists include:

- Comprehensive Environmental Response, Compensation, and Liability Information System;
- National Priorities List for Uncontrolled Hazardous Waste Sites;
- Resource Conservation and Recovery Act;
- California Superfund List of Active Annual Workplan Sites; and
- Lists of state-registered underground and leaking underground storage tanks.

Significance Criteria

Criteria used for determining the significance of an impact on public health and environmental hazards are based on the State CEQA Guidelines and professional standards and practices. Impacts were considered significant if an alternative would:

- create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials;
- create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials to the environment;
- be located on a site that is on a list of hazardous materials sites compiled pursuant to California Government Code 65962.5, and as a result would create a significant hazard to the public or the environment;
- impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan;
- expose people to a significant risk of contracting a disease;

- place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam; or
- adversely affect drinking water quality.

CALFED Programmatic Mitigation Measures

The August 2000 CALFED Programmatic ROD includes mitigation measures for agencies to consider and use where appropriate in the development and implementation of project-specific actions. The mitigation measures address the short-term, long-term and cumulative effects of the CALFED Program.

These Programmatic Mitigation Measures are numbered as they appear in the ROD, and only those measures relevant to the SDIP resource area are listed below; therefore, numbering may appear out of sequence. To see a full listing of CALFED Programmatic Mitigation Measures, please refer to Appendix E, "Mitigation Measures Adopted in the CALFED Record of Decision."

Public Health and Environmental Hazards Mitigation Measures

1. Use various mosquito control methods, such as biological agents, chemical agents, and ecological manipulation of mosquito breeding habitat.
2. Support actions to establish or find funding for mosquito abatement activities.
6. Follow established and proper procedures and regulations for identifying, removing and disposing of contaminated materials.
9. Conduct core sampling and analysis of proposed dredged areas and engineer solutions to avoid or prevent environmental exposure to toxic substances after dredging.

Alternative 1 (No Action)

Under the No Action Alternative, the project area would not be altered. The public's risk of exposure to hazardous materials, disease, flooding, and fires would not change. Therefore, there are no impacts on public health and environmental hazards as a result of the No Action Alternative.

2020 Conditions

Under the future no action (2020 conditions), SDIP would not be implemented. Development within the south Delta region is likely to occur and may result in changes in the ambient levels of hazardous materials present in the south Delta. However, the public's risk of exposure to hazardous materials, disease, flooding, and fires would be similar to current levels. Therefore, there would be no impacts on public health and safety under 2020 conditions.

Alternatives 2A, 2B, and 2C

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact HAZ-1: Exposure to or Release of Hazardous Materials during Construction. Fuel, oils, grease, solvents and other petroleum-based products are commonly used in construction activities. Accidental releases of the products could contaminate soils and degrade surface water and groundwater quality, resulting in a safety hazard to construction workers. The potential to expose workers to hazardous materials will be minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, "Project Description." The impact on worker safety is considered less than significant. No mitigation is required.

Impact HAZ-2: Increase in Emergency Response Times. Delta waterways are occasionally used by emergency service providers. The permanent flow control gates and fish control gate would slightly increase emergency response times in the event the channels blocked by the gates are used as access routes. It is estimated that passing through the boat locks would take approximately five minutes longer than the existing method of trailering boats around the temporary barriers. The gates would not impede emergency access provided over levee roads. The gates would not significantly impact emergency response times or services. No mitigation is required.

Impact HAZ-3: Exposure to or Release of Hazardous Materials during Operation. Operating and maintaining the gates may include the use of fuels, lubricants and other hazardous materials. Accidental releases of these products could contaminate soils and degrade surface water and groundwater quality, resulting in a worker or public safety hazard. The potential to expose workers or the public to hazardous materials will be minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, "Project Description." The impact on worker safety is considered less than significant. No mitigation is required.

Dredging

Impact HAZ-4: Increase in Mosquito Breeding Habitat from Creation of Settling Ponds. Hydraulic dredging activities would require settling ponds to decant water from the dredged material. These settling ponds would be located adjacent to levees and away from populated areas. The ponds would vary in size, with a maximum configuration of 1,600 feet by 3,600 feet. The decant water would be discharged back to the Delta channels approximately 35 days after the dredged material is placed in the ponds. The settling ponds would be used only during dredging activities and will likely be continuously filled as space within them becomes available. Dredging activities would take place between August 1 and October 14, but by the time the pond is left standing in mid-October, mosquito breeding season will no longer be at its peak. Environmental Commitments in Chapter 2 include notification and coordination with the San Joaquin County Mosquito Abatement District. The impact on public health is considered less than significant because of the distance of the ponds to urban areas and the environmental commitment of working with the mosquito abatement district. This impact is less than significant. No mitigation is required.

Impact HAZ-5: Water Quality Degradation, Resuspension of Contaminants, and Exposure to Hazardous Materials from Dredging Activities. It is possible that dredged material is toxic or contains hazardous materials. Dredging activities and placement of this material on land adjacent to waterways has the potential to degrade water quality or expose people or the environment to a toxic risk. Other channels recently dredged in the south Delta have shown that it is unlikely that the proposed dredged material is toxic. More detail is contained in Section 5.3, Water Quality. This impact is less than significant. No mitigation is required.

2020 Conditions

Risks to public health and safety associated with implementation of Alternatives 2A–2C under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar to those described above. All impacts are less than significant, and no mitigation is required.

Stage 2 (Operational Component)

There would be no impacts as a result of the implementation of the operational component because increased diversions would have no effects on public health and environmental safety.

2020 Conditions

There would be no operation-related effects to public health and safety under 2020 conditions.

Interim Operations

There would be no impacts as a result of the implementation of the interim operations because increased diversions would have no effects on public health and environmental safety.

Alternative 3B

Stage 1 (Physical/Structural Component)

Fish Control Gate and Flow Control Gates

Impact HAZ-1: Exposure to or Release of Hazardous Materials during Construction. This impact would be similar to that described under Alternatives 2A–2C, but to a lesser extent because there would be gates only at head of Old River, Old River, and Middle River. The potential for accidental release hazardous material release is less because less material would be used during construction. The potential to expose workers to hazardous materials will be minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, "Project Description." The impact on worker safety is considered less than significant. No mitigation is required.

Impact HAZ-2: Increase in Emergency Response Times. The impact on emergency response times would be similar to the impact described for Alternatives 2A, 2B, and 2C but to a lesser extend because on less gate would be constructed. The gates would slightly increase emergency response times in the event the channels crossed by the gates are used as access routes. It is estimated that passing through the boat locks would take approximately five minutes longer compared to the existing method of trailering boats around the temporary barriers. The gates would not impede emergency access provided by levee roads. The location and operation of the gates would not significantly impact emergency response times or services. No mitigation is required.

Impact HAZ-3: Exposure to or Release of Hazardous Materials during Operation. Operating and maintaining the gates may include the use of fuels, lubricants and other hazardous materials. Accidental releases of these products could contaminate soils and degrade surface water and groundwater quality, resulting in a worker or public safety hazard. The potential to expose workers or the public to hazardous materials will be minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, "Project Description." The impact on worker safety is considered less than significant. No mitigation is required.

Dredging

Impact HAZ-4: Increase in Mosquito Breeding Habitat from Creation of Settling Ponds. This impact would be slightly less than Alternatives 2A–2C because fewer settling ponds would be required. The impact on public health is considered less than significant because of the distance of the ponds from urban areas and the environmental commitment of coordinating with the San Joaquin County Mosquito Abatement District. No mitigation is required.

Impact HAZ-5: Increases in Water Quality Degradation, Resuspension of Contaminants, and Exposure to Hazardous Materials from Dredging Activities. This impact is similar to the impact under Alternatives 2A–2C, except there would be slightly less dredging because one fewer gate would be constructed. This impact is less than significant. No mitigation is required.

2020 Conditions

Risks to public health and safety associated with implementation of Alternative 3B under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar to those described above. All impacts are less than significant and no mitigation is required.

Stage 2 (Operational Component)

There would be no impacts as a result of the implementation of the operational component because increased diversions would have no effects on public health and environmental safety.

2020 Conditions

There would be no operation-related effects to public health and safety under 2020 conditions.

Alternative 4B

Stage 1 (Structural/Physical Component)

Fish Control Gate and Flow Control Gates

Impact HAZ-1: Exposure to or Release of Hazardous Materials during Construction. This impact would be similar to that described under Alternatives 2A, 2B, and 2C, but to a lesser extent because only one gate would be constructed at head of Old River. The potential for accidental release hazardous material release is less because less material would be used during construction. The potential to expose workers to hazardous materials will be minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, “Project Description.” The impact on worker safety is considered less than significant. No mitigation is required.

Impact HAZ-2: Increase in Emergency Response Times. The impact on emergency response times would be similar to the impact described for Alternatives 2A, 2B, and 2C but to a lesser extend because only one gate would be constructed. The gate would slightly increase emergency response times in the event the channels crossed by the gate are used as access routes. It is estimated that passing through the boat lock would take approximately five minutes longer compared to the existing method of trailering boats around the temporary barriers. The gate would not impede emergency access provided by levee roads. The location and operation of the gate would not significantly impact emergency response times or services. No mitigation is required.

Impact HAZ-3: Exposure to or Release of Hazardous Materials during Operation. Operating and maintaining the gate may include the use of fuels, lubricants and other hazardous materials. Accidental releases of these products could contaminate soils and degrade surface water and groundwater quality, resulting in a worker or public safety hazard. The potential to expose workers or the public to hazardous materials will be minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, “Project Description.” The impact on worker safety is considered less than significant. No mitigation is required.

Dredging

Impact HAZ-4: Increase in Mosquito Breeding Habitat from Creation of Settling Ponds. This impact would be slightly less than Alternatives 2A–2C because fewer settling ponds would be required. The impact on public health is considered less than significant because of the distance of the ponds from urban areas and the environmental commitment of working with the San Joaquin County Mosquito Abatement District. No mitigation is required.

Impact HAZ-5: Increases in Water Quality Degradation, Resuspension of Contaminants, and Exposure to Hazardous Materials from Dredging Activities. This impact is similar to the impact under Alternatives 2A–2C, except there would be slightly less dredging because only one gate would be constructed. This impact is less than significant. No mitigation is required.

2020 Conditions

Risks to public health and safety associated with implementation of Alternative 4B under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar to those described above. All impacts are less than significant and no mitigation is required.

Stage 2 (Operational Component)

There would be no impacts as a result of the implementation of the operational component because increased diversions would have no effects on public health and environmental safety.

2020 Conditions

Risks to public health and safety associated with implementation of Alternative 4B under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar to those described above. All impacts are less than significant, and no mitigation is required.

Cumulative Evaluation of Impacts

Cumulative impacts on public health are analyzed in Chapter 10, "Cumulative Impacts." This chapter also summarizes the other foreseeable future projects that may contribute to these impacts.

7.9 Environmental Justice

Introduction

This section describes the existing environmental conditions and any issues related to environmental justice resulting from the project. Specifically, it evaluates and discusses the consequences associated with construction and operation of the project on low-income and/or minority populations. Significance of impacts is determined by any disproportionate effects on these populations.

Summary of Significant Impacts

There are no significant environmental justice impacts as a result of implementation of any of the alternatives. The Environmental Consequences section contains a detailed discussion of all impacts and mitigation measures for Alternatives 2A, 2B, 2C, 3B, and 4B.

Affected Environment

Sources of Information

The primary information source for the Environmental Justice demographics information is the U.S. Census Bureau Census 2000. Information regarding Program effects and their severity was developed in other sections of this EIS/EIR.

Study Area Demographics

Local Setting

The project area is located in San Joaquin County and Contra Costa County. Alameda County is in sufficient proximity that project impacts may occur there. Therefore, the local setting is considered to be San Joaquin County, Contra Costa County, and Alameda County. In addition, the same information for the State of California is presented for comparison.

Of the total local area 2000 population, San Joaquin, Contra Costa, and Alameda Counties have minority percentages of 35.8%, 29.5%, and 45.4%, respectively (Table 7.9-1). For the State of California, 35.7% is considered to be of a minority race. For both San Joaquin County and the State of California, the largest percentage minority category within the study area was “some other race,” which included approximately 16.3% of the total population for both the county and the state. The “some other race” category includes all responses not included in "White," "Black or African American," "American Indian and Alaska Native," "Asian" and "Native Hawaiian and Other Pacific Islander" race categories (U.S. Department of Commerce, Census Bureau 2003a). Census write-in entries such as Hispanic/Latino are included here; Hispanic/Latino is believed to constitute the majority of the "some other race" category. For Contra Costa County and Alameda County, the largest minority populations were categorized as Asian, at 11.0% and 20.4%, respectively.

Table 7.9-1. Race/Origin Characteristics by County, Census 2000 (%)

		San Joaquin County	Contra Costa County	Alameda County	State of California
Race	White	58.1	65.5	48.8	59.5
	Black or African American	6.7	9.4	14.9	6.7
	American Indian and Alaska Native	1.1	0.6	0.6	1.0
	Asian	11.4	11.0	20.4	10.9
	Native Hawaiian, other Pacific Islander	0.3	0.4	0.6	0.3
	Some Other Race	16.3	8.1	8.9	16.8
	Two or more races	6.0	5.1	5.6	4.7
Origin	Hispanic	30.5	17.7	19.0	32.4

Percentages may add to more than 100% because individuals may report more than one race. "Hispanic is considered an origin by the Census Bureau. Therefore, those of Hispanic Origin are also counted in one of the race categories.

Source: U.S. Department of Commerce, Census Bureau 2003a

As an added measure to ensure the study area minority populations are adequately identified census data was gathered for Hispanic origin. Hispanic is considered an origin not a race by the U.S. Census Bureau. An origin can be viewed as the heritage, nationality group, lineage, or country of birth of the person or the person's parents or ancestors before their arrival in the United States (U.S. Department of Commerce, Census Bureau 2003b). People that identify their origin as Spanish, Hispanic, or Latino may be of any race. Therefore, those who are counted as Hispanic are also counted under one or more race categories. San Joaquin County had the highest percentage of Hispanic origin population at 30.5% (Table 7.9-1). Contra Costa County and Alameda County had a 17.7% and 19.0% Hispanic origin population respectively. The State of California had a Hispanic origin population of 32.4%.

As shown in Table 7.9-2 below, 13.5% of households within San Joaquin County were determined to have an income in 1999 below the poverty level. Contra Costa County and Alameda County had lower percentages with 5.4% and 7.7% of their households having incomes below the poverty level respectively. The State of California had 10.6% of households below the poverty level during the same period.

Table 7.9-2. Household Poverty Status in 1999 (%)

	San Joaquin County	Contra Costa County	Alameda County	State of California
Percent below poverty level	13.5	5.4	7.7	10.6

Source: U.S. Department of Commerce, Census Bureau 2003c.

Census poverty thresholds are the same for all parts of the country and reflect the national Consumer Price Index. However, due the high cost of living in the Bay Area a higher poverty threshold is needed to accurately characterize the number of low-income households. As part of their 2001 Regional Transportation Plan Equity Analysis and Environmental Justice Report, the Metropolitan Transportation Commission (MTC) used the criteria of 30% of households at or below the poverty level to determine a Community of Concern. Analysis from the 2001 MTC study identified communities that have high shares of low-income residents. While both Contra Costa County and Alameda County have Communities of Concern related to poverty level, none of these areas are in the vicinity of the SDIP project improvements. The nearest Community of Concern is approximately 10 miles northwest of project improvements, in the community of Brentwood (Metropolitan Transportation Commission 2001). San Joaquin County is not in the MTC service area, and was not included in the study.

Regional Setting

The regional setting is defined by those SWP service areas affected by the project: the South Bay service area (eastern portion of Alameda County and all of Santa Clara County), the Central Coast service area (all of San Luis Obispo and Santa Barbara counties), the San Joaquin Valley service area (all of Kings County and western Kern County), and the Southern California service area (almost all of Los Angeles, Orange, Riverside, San Bernardino, and San Diego counties and portions of Kern, Imperial and Ventura counties). Additionally, the same information for the State of California is presented for comparison.

The service area with the highest minority percentage of population is the South Bay service area, which has a 48.5% minority population (Table 7.9-3). The service area with the lowest minority population is the Central Coast service area, with a 22.7% minority population. For comparison, the State of California had a 40.5% minority population in the same year.

The service areas with the largest Hispanic origin population are the San Joaquin Valley service area and the Southern California service area, which had 39.2% and 38.5% Hispanic origin populations, respectively. The lowest Hispanic origin population was in the South Bay service area, with 21.7%. During the same year, the State of California had a 32.4% Hispanic origin population.

Table 7.9-3. Race/Origin Characteristics 2000 by Service Area[a] (%)

		South Bay Service Area	Central Coast Service Area	San Joaquin Valley Service Area	Southern California Service Area	State of California
Race	White	51.5	77.3	60.3	56.9	59.5
	Black or African American	8.4	2.2	6.4	7.3	6.7
	American Indian and Alaskan Native	0.7	1.1	1.5	0.9	1.0
	Asian	23.2	3.5	3.3	9.9	10.9
	Native Hawaiian and Other Pacific Islander	0.5	0.2	0.2	0.3	0.3
	Some other race	10.7	11.8	24.0	20.1	16.8
	Two or more races	5.1	4.0	4.2	4.7	4.7
Origin	Hispanic	21.7	27.4	39.2	38.5	32.4

Note:

Percentages may add to more than 100% because individuals may report more than one race. “Hispanic is considered an origin by the Census Bureau. Therefore, those of Hispanic Origin are also counted in one of the race categories.

[a] Statistics are for the entire county, even if only a portion is included in the service area.

Source: U.S. Department of Commerce, Census Bureau 2003a.

The service areas with the highest poverty levels were the San Joaquin service area and the Southern California service area, which both had a higher percentage of households below the poverty level than the State as a whole. The South Bay service area and the Central Coast service area had poverty levels below the State as a whole. (See Table 7.9-4.)

Table 7.9-4. Household Poverty Status in 1999 (%)

	South Bay Service Area	Central Coast Service Area	San Joaquin Valley Service Area	Southern California Service Area	State of California
Percent below poverty level	6.2	7.8	16.6	11.9	10.6

Source: U.S. Department of Commerce, Census Bureau 2003c.

Environmental Consequences

Assessment Methods

The following methodology is based on the EPA's Environmental Justice Guidance (U.S. Environmental Protection Agency 1998). The EPA's Environmental Justice Guidance states that, "Minority populations should be identified where either (a) the minority population of the affected area exceeds 50%, or (b) the population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of analysis." As such, demographic data for each County in the local setting and each service area in the regional setting was compared to demographic data from the next highest unit of analysis, the State of California, to determine whether that specific area had a "meaningfully greater" percentage of minority or low-income population.

Demographic information was gathered for the local setting counties, the regional setting service area, and the State of California. The proposed SDIP alternatives Environmental Justice impacts were analyzed by comparing census data from the local setting and regional setting with data for the State of California. Data was primarily collected from the U.S. Department of Commerce, Census Bureau 2000 Census. The population data that are key to the analysis of Environmental Justice include the following race, income, and age characteristics:

- percent of minority population (Black or African American; American Indian and Alaskan Native; Asian; Native Hawaiian and Other Pacific Islander; some other race; and two or more races),
- percent persons of Hispanic origin, and
- percent of population below the poverty level.

These data are presented in the previous sections.

Significant adverse effects from the alternatives were identified through the analysis process for the environmental disciplines in this EIS/EIR. For this analysis the EIS/EIR sections were reviewed, and the areas affected by each significant unmitigated impacts were identified using maps or text from the technical sections. The following questions are then used:

- Is there a significant, adverse, unmitigable effect?
- Does the potentially affected population include minority or low-income populations?
- Would the significant, adverse environmental or human health effects be likely to fall disproportionately on minority or low-income populations?

Regulatory Setting

Executive Order (EO) 12898, Environmental Justice, includes the requirement that, to the greatest extent practicable and permitted by law, “each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” EO 12898 charges each cabinet department to “make achieving environmental justice part of its mission,” with the EPA responsible for implementation of EO 12898. The CEQ has oversight of the Federal government’s compliance with EO 12898 and NEPA.

Following the lead of EO 12898, the State of California passed a series of environmental justice regulations in 2001. These laws define environmental justice as “the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.” The Bay-Delta Public Advisory Committee has an Environmental Justice Subcommittee comprised of federal and state agency representatives, tribal members, community-based organizations, advocacy groups, and others. The Environmental Justice Subcommittee has developed an Environmental Justice Workplan that outlines a two-tiered approach to addressing environmental justice in the program. A Draft Workplan was completed in January 2003.

Significance Criteria

Significance criteria for environmental justice effects were developed in the CALFED Final Programmatic EIS/EIR (2000b). The following significance criteria were used to determine if adverse human health effects are disproportionately high:

- Whether the health effects, which may be measured in risks and rates, are above the generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
- Whether the risk or rate of hazard exposure by a minority population or low-income population to an environmental hazard exceeds or is likely to exceed the risk or rate to the general population or appropriate comparison group.
- Whether health effects occur in a minority population or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

The following factors were considered when determining whether adverse environmental effects are disproportionately high:

- Whether there is or will be an impact on the natural or physical environment that adversely affects a minority or low-income population.

- Whether environmental effects are significant and may result in an adverse effect on minority or low-income populations that appreciably exceeds or is likely to appreciable exceed the effect on the general population or other appropriate comparison group.
- Whether the environmental effects occur or would occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

CALFED Programmatic Mitigation Measures

Environmental justice effects are related to adverse human health or environmental impacts from the project, which are disproportionately felt by minority or low-income populations. The most effective mitigation for environmental justice effects is to avoid or mitigate the human health or environmental impact to a less-than-significant level. If this occurs, then the environmental justice impact would also be mitigated, because the significant, adverse effect would no longer exist for any population, including minority or low-income populations.

Alternative 1 (No Action)

With the No Action Alternative, the SDIP would not be implemented. The SWP would continue to operate under its currently permitted pumping capacity of 6,680 cfs. No environmental justice impacts would occur.

2020 Conditions

Under Future No Action (2020 conditions) the SDIP would not be implemented and the SWP would continue to operate under its current permits and restrictions. No environmental justice impacts would occur.

Alternative 2A, 2B, and 2C

Under Alternatives 2A–2C, there would be a slight increase in pumping capacity for the SWP. All environmental or human health impacts for this alternative have been determined to be less than significant or have been mitigated to a level that is less than significant, as described in previous sections of this EIS/EIR. No population, including minority or low-income populations, would bear a significant environmental or human health impact. Therefore, no environmental justice impacts would occur.

2020 Conditions

Implementation of Alternatives 2A–2C under 2020 conditions would be similar to implementation under existing conditions. There would be no impact.

Alternative 3B

Impacts would be similar to Alternatives 2A–2C. Environmental justice impacts are not anticipated.

2020 Conditions

Implementation of Alternative 3B under 2020 conditions would be similar to implementation under existing conditions. There would be no impact.

Alternative 4B

Impacts would be similar to Alternatives 2A–2C. Environmental justice impacts are not anticipated.

2020 Conditions

Implementation of Alternative 4B under 2020 conditions would be similar to implementation under existing conditions. There would be no impact.

Cumulative Evaluation of Impacts

The SDIP would not result in any impacts on environmental justice and therefore would not contribute to any cumulative impacts.

7.10 Indian Trust Assets

Introduction

This section describes the existing environmental conditions and the consequences of the SDIP alternatives on Indian Trust Assets (ITAs) such as real property, physical assets, or intangible property rights. Specifically, it evaluates and discusses the consequences associated with construction and operation of the project. Significance of impacts is determined by the presence of an ITA within the project area, or potential effects of a project on ITAs, regardless of the project's proximity to the ITAs in question.

Reclamation's ITA policy states that Reclamation will carry out its activities in a manner that protects ITAs and avoids adverse impacts when possible. When Reclamation cannot avoid adverse impacts, it will provide appropriate mitigation or compensation.

ITAs are legal interests in assets held in trust by the federal government for Indian tribes or individual Indians. The trust relationship usually stems from a treaty, executive order, or act of Congress. ITAs are anything that holds monetary value, which can include real property, physical assets, or intangible property rights. Examples of trust assets are lands, minerals, hunting and fishing rights, and water rights.

Summary of Significant Impacts

There are no significant impacts on ITAs as a result of implementation of any of the alternatives. All impacts are discussed in detail under the Environmental Consequences section.

Affected Environment

Sources of Information

The following key sources of information were used in the preparation of this section:

- geographic information systems (GIS) coverage of Indian reservations, and rancherias for the State of California maintained by Reclamation;
- maps of ITAs and their proximity to the project area;
- assessment of potential effects on tribal fisheries as a result of SDIP implementation; and
- technical evaluation of upstream and downstream effects of the project on ITAs.

Indian Trust Assets

There are no ITAs in the vicinity of the proposed fish control gate, flow control gates, or channel dredging sites. Impacts on south-of-Delta ITAs were not considered because the project could result in a more reliable water supply within the SWP service area and therefore could not adversely affect ITAs south of the Delta.

The nearest ITA to the project area, in the north-of-Delta-area, is the Colusa Rancheria, which lies adjacent to the Sacramento River approximately 90 air miles north of the project area. In the north-of-Delta area, the Hoopa Valley Tribe has fishing rights on the Trinity River. The Hoopa Valley Indian Reservation was established along the Trinity River in the late 1800s. Historically, Trinity River fisheries provided the primary dietary staple and also supported commercial and subsistence fishing for Indians in the area. The fisheries also played a significant role in the tribes' religious beliefs (U.S. Department of the Interior 2000). The Environmental Consequences subsection below concludes there are no adverse effects on the trust assets of the Hoopa Valley Tribe, and the Colusa Rancheria.

Environmental Consequences

Assessment Methods

Reclamation maintains GIS coverage of Indian reservations and rancherias for the state of California. Impact assessments for ITAs were based on this GIS coverage, maps of ITAs for the area, and a technical evaluation of upstream and downstream effects of the project on ITAs.

Significance Criteria

The presence of an ITA within the project area or the potential effects of a project on an ITA (regardless of the project's proximity to it) triggers evaluation of potential impacts on ITAs. If during the course of this evaluation an impact on ITAs is determined, consultation with the potentially affected tribes would ensue to ensure that the affected tribe(s) may fully evaluate the potential impact of the proposed SDIP alternatives on ITAs. Project effects that could conceivably affect ITAs, such as water rights or other assets that might be located off reservation, also trigger further evaluation and consultation with affected tribes.

Alternative 1 (No Action)

The No Action Alternative would not result in any construction-related or operations-related impacts on ITAs.

2020 Conditions

Under the Future No Action Conditions (2020 Conditions) SDIP would not be implemented. It is expected that the temporary barriers program would continue to be implemented and that no significant impacts on ITAs would result. Conditions would be similar to those described under existing conditions.

Alternatives 2A, 2B, and 2C

Stage 1 (Physical/Structural Component)

Because there are no ITAs in or near the project area, no impacts on ITAs are expected from construction-related activities.

2020 Conditions

There would be no construction-related effects on ITAs under 2020 conditions.

Stage 2 (Operational Component)

Under Alternatives 2A–2C, none of the operational scenarios would have an effect on the Trinity River flows or Shasta Reservoir storage according to CALSIM II modeling results (See Section 5.1, 6.1 and <http://modeling.water.ca.gov> for details). Specific detail is also provided in Appendix Q. Therefore, there would be no adverse effects on Hoopa Valley Tribe fishery as a result of implementation of the SDIP. There is no impact and no mitigation is required.

Although the Colusa Rancheria is located adjacent to the Sacramento River, the river flows are not expected to fluctuate outside of the normal range with the implementation of the SDIP alternatives. Natural patterns of erosion and sedimentation along the river are expected to stay the same with the implementation of Alternatives 2A–2C. There is no impact and no mitigation is required.

Alternatives 2A–2C each call for a different pumping scenario. However, the water that is proposed for pumping has already been contracted for, and all of the water used for the SDIP has been previously allocated. This project does not result in any new allocation of water. There is no impact. No mitigation is required.

2020 Conditions

Risks to ITAs associated with implementation of Alternatives 2A–2C under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar as those described above. All impacts are less than significant and no mitigation is required.

Alternative 3B

Stage 1 (Physical/Structural Component)

Because there are no ITAs in or near the project area, no impacts on ITAs are expected from construction-related activities.

2020 Conditions

There would be no structural/physical effects on ITAs under 2020 conditions.

Stage 2 (Operational Component)

Alternative 3B, would not have an effect on the Trinity River flows or Shasta Reservoir storage according to CALSIM II modeling results (See Section 5.1, 6.1 and <http://modeling.water.ca.gov> for details). Therefore, there would be no adverse effects on Hoopa Valley Tribe fishery as a result of implementation of the SDIP. There is no impact and no mitigation is required.

Although the Colusa Rancheria is located adjacent to the Sacramento River, the river flows are not expected to fluctuate outside of the normal range with the implementation of Alternative 3B. Natural patterns of erosion and sedimentation along the river are expected to stay the same with the implementation of Alternative 3B. There is no impact and no mitigation is required.

The water that is proposed for pumping has already been contracted for, and all of the water used for the SDIP has been previously allocated. This project does not result in any new allocation of water. There is no impact and no mitigation is required.

2020 Conditions

Risks to ITAs associated with implementation of Alternative 3B under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar as those described above. All impacts are less than significant and no mitigation is required.

Alternative 4B

Stage 1 (Physical/Structural Component)

Because there are no ITAs in or near the project area, no impacts on ITAs are expected from construction-related activities.

2020 Conditions

There would be no structural/physical effects on ITAs under 2020 conditions.

Stage 2 (Operational Component)

Alternative 4B would not have an effect on the Trinity River flows or Shasta Reservoir storage according to CALSIM II modeling results (See Section 5.1, 6.1 and <http://modeling.water.ca.gov> for details). Therefore, there would be no adverse effects on Hoopa Valley Tribe fishery as a result of implementation of the SDIP. There is no impact and no mitigation is required.

Although the Colusa Rancheria is located adjacent to the Sacramento River, the river flows are not expected to fluctuate outside of the normal range with the implementation of Alternative 4B. Natural patterns of erosion and sedimentation along the river are expected to stay the same with the implementation of Alternative 4B. There is no impact and no mitigation is required.

The water that is proposed for pumping has already been contracted for, and all of the water used for the SDIP has been previously allocated. This project does not result in any new allocation of water. There is no impact and no mitigation is required.

2020 Conditions

Risks to ITAs associated with implementation of Alternative 4B under 2020 conditions would be similar to risks that would occur under 2001 conditions. Therefore, the impacts under 2020 conditions would be similar as those described above. All impacts are less than significant and no mitigation is required.

Cumulative Evaluation of Impacts

The SDIP would not result in any impacts on ITAs and therefore would not contribute to any cumulative impacts.

Chapter 8

Compliance with Applicable Laws, Policies, and Plans and Regulatory Framework

This chapter provides preliminary information on the major requirements for permitting and environmental review and consultation for implementation of the SDIP. Certain local, state, and federal regulations require issuance of permits before project implementation; other regulations require agency consultation but may not require issuance of any entitlements before project implementation. The SDIP's requirements for permits and environmental review and consultation may change during the EIS/EIR review process as discussions with involved agencies proceed.

Regulatory Framework

Setting

The south Delta region is a diverse mix of multiple uses, functions, and values and includes agricultural lands, water conveyance networks, wildlife habitats, recreation opportunities, and recreation-based businesses. Because of the diverse nature of the region, proposed actions within this region are often subject to compliance and conformity with multiple laws, regulations, policies, plans, and agency requirements. Agencies responsible for the management and health of specific Delta functions and values, and for corresponding regulations, often have jurisdictions that overlap geographically. Thus, some agencies have collaborated with other agencies to create focused Delta region oversight agencies with goals and responsibilities guided and governed by plans, policies, and guidance documents.

CALFED Bay-Delta Program

The CALFED Bay-Delta Program is a cooperative effort of more than 24 state and federal agencies with regulatory and management responsibilities in the Bay-Delta to develop and implement a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. SDIP is a program element of the conveyance program of the Bay-Delta Plan, and is thus subject to the plan's requirements (refer to the CALFED

ROD for other program elements and Chapter 1 for additional CALFED discussion).

The SDIP is a proposed action subject to regulation by multiple agencies but is also a product of the collaboration of goals and responsibilities of DWR and Reclamation. These two agencies are involved because of the interrelated nature of federal CVP and state SWP operations and based on the 1987 COA. Through this agreement, DWR and Reclamation coordinate the operations of the SWP and CVP to meet the various Delta regulatory requirements (refer to Chapter 1 for additional COA discussion).

Laws, regulations, policies, plans, and agency requirements for the SDIP are discussed further below and are organized by federal and state requirements collectively, federal and state requirements separately, state and regional plan consistency, and by local plan consistency and regulatory requirements.

Federal and State Requirements

Federal and State Compliance Integration

National Environmental Policy Act and California Environmental Quality Act

The preparation of this joint EIS/EIR document for the SDIP requires close coordination and cooperation among the federal, state, and local agencies involved. Most agency involvement with the SDIP is limited to specific permitting and approvals related to each agency's authority and responsibility. As the federal and state lead agencies, Reclamation and DWR are responsible for the preparation of a NEPA- and CEQA-compliant EIS/EIR document for this project.

Federal and state guidelines, statutes, and regulations developed by CEQ and the OPR encourage and provide frameworks for agencies to comply with the requirements of both CEQA and NEPA concurrently. Such frameworks are summarized below.

Sections 15222 and 15226 of Chapter 3, Guidelines for Implementation of the CEQA, Title 14, CCR, state:

> If a lead agency finds that an EIS or finding of no significant impact would not be prepared by the federal agency by the time when a lead agency will need to consider an EIR or negative declaration, the lead agency should try to prepare a combined EIR-EIS or negative declaration–finding of no significant impact. To avoid the need for the federal agency to prepare a separate document for the same project, the lead agency must involve the federal agency in preparation of the joint document. This involvement is necessary because federal law generally prohibits a federal agency from using an EIR prepared by a state

> agency unless the federal agency was involved in the preparation of the document and State and local agencies should cooperate with federal agencies to the fullest extent possible to reduce duplication between the California Environmental Quality Act and the National Environmental Policy Act. Such cooperation should, to the fullest extent possible, include: (a) Joint planning processes, (b) Joint environmental research and studies, (c) Joint public hearings, (d) Joint environmental documents.

Under 40 CFR 1506.2, the NEPA CEQ regulations similarly encourage federal agencies to cooperate with local agencies:

> (a) Agencies authorized by law to cooperate with State agencies of statewide jurisdiction pursuant to section 102(2)(D) of the Act may do so.
>
> (b) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include: (1) Joint planning processes. (2) Joint environmental research and studies. (3) Joint public hearings (except where otherwise provided by statute). (4) Joint environmental assessments.
>
> (c) Agencies shall cooperate with State and local agencies to the fullest extent possible to reduce duplication between NEPA and comparable State and local requirements, unless the agencies are specifically barred from doing so by some other law. Except for cases covered by paragraph (a) of this section, such cooperation shall to the fullest extent possible include joint environmental impact statements. In such cases one or more Federal agencies and one or more State or local agencies shall be joint lead agencies. Where State laws or local ordinances have environmental impact statement requirements in addition to but not in conflict with those in NEPA, Federal agencies shall cooperate in fulfilling these requirements as well as those of Federal laws so that one document will comply with all applicable laws.

In California, environmental review for this size and scope of project requires an EIR. The EIR records the scope of the applicant's proposal and analyzes all its known environmental effects. Project information is used by state and local permitting agencies in their evaluation of the proposed project. (OPR, Overview of the California Environmental Review and Permit Approval Process.)

Because this project requires federal involvement, it is also subject to the requirements of NEPA. Under NEPA, the federal equivalent of the EIR is the EIS. The processes of preparation, review, and acceptance of the EIR and EIS share many similarities but differ in the following ways: oversight agencies, level of detail in discussion of alternatives, mitigation requirements, terminology, and more. Additional details about NEPA and CEQA and the compliance requirements of SDIP are discussed further under Federal Requirements and State Requirements in this chapter.

Bay-Delta Framework Agreement

In June 1994, state-federal cooperation for the management and regulatory responsibility in the San Francisco Bay/Sacramento–San Joaquin River Delta Estuary (Bay-Delta Estuary) was formalized with the signing of a framework agreement by the state and federal agencies involved. The framework agreement pledged that the state and federal agencies would work together in three areas of Bay-Delta management:

- water quality standards formulation,
- coordination of SWP and CVP operations with regulatory requirements, and
- long-term solutions to problems in the Bay-Delta Estuary. (2001 CALFED Bay-Delta Program History.)

Bay-Delta Accord and Water Quality Standards

In December 1994, state and federal agencies reached agreement known as the Bay-Delta Accord on water quality standards and related provisions that would remain in effect for 3 years. This agreement was based on a proposal developed by the stakeholders. Elements of the agreement include:

- springtime export limits expressed as a percentage of Delta inflow,
- regulation of the salinity gradient in the estuary so that a salt concentration of two parts per thousand (X2) is positioned where it may be more beneficial to aquatic life,
- specified springtime flows on the lower San Joaquin River to benefit Chinook salmon, and
- intermittent closure of the Delta Cross Channel gates to reduce entrainment of fish into the Delta.

A second category of provisions is intended to reconcile operational flexibility and compliance with ESA). Compliance with provisions of the ESA is intended to result in no reduction in water supply from what would be available for export under other operational requirements of the agreement. This will be accomplished in part by better monitoring for the presence of aquatic organisms of concern, faster interpretation of monitoring information, and immediate response in the operation of export facilities. This is known as real-time monitoring.

A third category of provisions—referred to as *Category III*—is intended to improve conditions in the Bay-Delta Estuary that are not directly related to Delta outflow. Some of these Category III measures may include screening water diversions, waste discharge control, and habitat restoration. Parties to the agreement committed to implementation and financing of such measures and estimated that a financial commitment of $60 million would be required in each of the 3 years of the agreement.

The 1994 Accord is reflected in the State Water Board's *Draft Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* dated December 1994 and the *Final Water Quality Plan*, which was adopted May 22, 1995.

The Accord was extended in 1997 for 1 year, and again in 1998, to allow the CALFED Program to continue working with stakeholders to develop a long-term solution for problems in the Bay-Delta system.

The CALFED ROD expressly replaced the provisions of the Accord in their entirety. The SDIP is a project level component of the ROD.

California-Federal Operations Group

The 1994 Bay-Delta Framework Agreement also established the California-Federal Operations Group (CALFED Ops Group) to coordinate SWP and CVP operations. The CALFED Ops Group consists of representatives from the project agencies (Bureau of Reclamation and the California Department of Water Resources), the management agencies (U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Game), the U.S. Environmental Protection Agency and staff of the State Water Resources Control Board. Its functions include reviewing, discussing, coordinating, and cooperating with others on activities related to operating the CVP and SWP to meet requirements of the winter-run salmon and delta smelt biological opinions, applicable state and federal water quality standards, and the CVPIA. The group recommends changes in combined Delta operations that allow for Delta exports while minimizing incidental take and satisfying other ESA biological opinion requirements based on real-time fish monitoring results. Other responsibilities of the CALFED Ops Group include satisfying 1995 WQCP water quality objectives, and cooperating with the IEP to (1) determine factors that affect Delta habitat and the health of fisheries, and (2) identify appropriate corrective measures for the CVP and SWP. The IEP is a consortium of agencies that work together to develop a better understanding of the estuary's ecology and the effects of water project operations on the physical, chemical, and biological conditions of the Bay-Delta Estuary. The IEP provides information about the factors that affect ecological resources in the Bay-Delta Estuary that allows for more efficient management of the estuary. The IEP has 10 member agencies including DWR, DFG, State Water Board, USFWS, Reclamation, USGS, the Corps, NOAA Fisheries, USEPA, and the San Francisco Estuary Institute (a nongovernmental organization). Currently, the CALFED Ops Group functions as a stakeholder group for various CALFED projects, including SDIP.

Water Operations Management Team and Data Assessment Team

The Water Operations Management Team (WOMT) is a group composed of executives from DWR, Reclamation, DFG, USFWS, and NOAA Fisheries. The group has the responsibility of making decisions about CVP and SWP operations for the following week based on proposed project operations. The WOMT does not normally include stakeholders, however they may be invited depending on the subject of the meeting. The Data Assessment Team (DAT) is an advisory group composed of biologists and SWP and CVP operations staff. This group meets on an as needed basis to make agency recommendations to WOMT. The DAT identifies abundance and distribution of special-status species to determine if changes in operation and pumping would reduce take. This input is presented to the WOMT for consideration in making final decisions about operations of CVP and SWP facilities. Implementation of the SDIP would require decisions by the WOMT regarding operations of the gates.

Long-Term Solutions

The third element of the Framework Agreement called for a joint state-federal process to develop long-term solutions to problems in the Bay-Delta Estuary related to fish and wildlife, water supply reliability, natural disasters, and water quality. The intent is to develop a comprehensive and balanced plan that addresses all of the resource problems. This effort is carried out under the policy direction of the CALFED agencies.

The public has a central role in the development of a long-term solution. A group of more than 30 citizen-advisors selected from California's agriculture, environmental, urban, business, fishing, and other interests with a stake in finding long-term solutions for the problems of the Bay-Delta Estuary was chartered under the Federal Advisory Committee Act as the Bay-Delta Advisory Council (BDAC). BDAC advised the CALFED agencies on its mission and objectives, the problems to be addressed, and proposed actions. BDAC also provided a forum for public participation and reviewed reports and other materials prepared by CALFED staff.

In 2000 the BDAC was terminated and was replaced by the Bay-Delta Public Advisory Committee (BDPAC) which was chartered in 2001. The purpose of this new committee is to provide recommendations to the Secretary of the Interior, the Governor of California, other participating federal agencies, and California Bay-Delta Authority (Authority) on the implementation of the CALFED ROD. This committee is expected to exist until the completion of Stage 1 of the CALFED Program in 2008 (California Bay-Delta Authority 2003).

The CALFED Program is managed by an interdisciplinary, interagency staff team and assisted by technical experts from state and federal agencies as well as consultants. The program is following a three-phase process to achieve broad agreement on long-term solutions.

First, a clear definition of the problems to be addressed and a range of solution alternatives were developed. Second, to comply with CEQA and NEPA, a program-level or first-tier EIS/EIR was prepared to identify impacts associated with the various alternatives. Finally, a project-level or second-tier EIS/EIR will be prepared for each element of the selected solution.

In the first phase, the CALFED Program developed a range of alternatives, consisting of hundreds of actions. The program conducted meetings and workshops to obtain public input, prepared a notice of intent and notice of preparation pursuant to NEPA and CEQA, and held public scoping sessions to determine the focus and content of the EIS/EIR. The first phase concluded in September 1996 with the development of a range of alternatives for achieving long-term solutions to the problems of the Bay-Delta Estuary.

During Phase II, the program conducted a comprehensive programmatic environmental review process. A draft programmatic EIS/EIR and interim Phase II Report identifying three draft alternatives and program plans was released on March 16, 1998. The release of the documents was followed by a 105-day public comment period. On June 25, 1999, CALFED again released a draft programmatic EIS/EIR followed by a 90-day comment period. The final programmatic EIS/EIR was released July 21, 2000, followed by the ROD on August 28, 2000. The ROD completed Phase II.

The CALFED Program is now in Phase III—implementation of the preferred alternative. The first 7 years of this phase is referred to as Stage 1 and will lay the foundation for the following years. Site-specific, detailed environmental review will occur during this phase prior to the implementation of each proposed action. Implementation of the CALFED Bay-Delta solution is expected to take 30 years.

As of January 1, 2003, the Authority formally assumed responsibility for the implementation of the Bay-Delta Program. This new agency was established by Senate Bill (SB) 1653 (Costa) enacted in 2002 which provides a permanent governance structure to the state-federal effort that began in 1994.

SB 1653 (Costa) requires the Authority to provide accountability, ensure balanced implementation of the Program, use sound science and ensure public involvement and outreach. This legislation also provides for the Authority to sunset on January 1, 2006, unless federal legislation has been enacted to authorize the participation of appropriate federal agencies in the Authority (California Bay-Delta Authority 2001).

Since the inception of the program, progress has been made in all three areas. These management efforts have included close cooperation not only among state and federal agencies, but involvement of urban and agricultural water users, fishing interests, environmental organizations, business, and others. These groups—the stakeholders in resources of the Bay-Delta Estuary—play an important role in the collaborative process of solving problems.

The Multi-Species Conservation Strategy

The Multi-Species Conservation Strategy (MSCS) is an approach that entities implementing CALFED actions may use to fulfill the requirements of the ESA, CESA, and the Natural Community Conservation Plan Act (NCCPA). The MSCS serves as the CALFED programmatic BA under Section 7 of the ESA and the Natural Community Conservation Plan (NCCP) under the NCCPA. In instances in which a nonfederal entity proposes to implement a CALFED action that does not require federal permits, funding, or other authorization, the MSCS can also act as a programmatic level habitat conservation plan (HCP) under the Section 10 process.

Specifically, the MSCS:

- analyzes CALFED's effects on 244 *evaluated species* and 20 natural communities (*NCCP communities*)—comprising 18 habitats and two ecologically based fish groups composed of anadromous and estuarine fish species for ESA, CESA, and NCCPA purposes;
- identifies species goals (*recovery, contribute to recovery*, or *maintain*) for each of the 244 evaluated species, as well as conservation measures to achieve the goals;
- identifies goals for each of the 20 NCCP communities, as well as conservation measures to achieve the goals; and
- provides for the preparation of ASIPs, which will strengthen and simplify the CALFED Program's compliance with ESA, CESA, and NCCPA.

The MSCS contains two types of conservation measures:

- measures to avoid, minimize, and compensate for adverse effects to NCCP communities and evaluated species caused by individual program actions; and
- measures to enhance NCCP communities and evaluated species that are not directly linked to adverse effects from program actions.

On February 2, 2002, Governor Davis signed SB 107, which completely repealed and replaced the NCCPA with a new NCCPA. SB 107 became effective on January 1, 2003. However, in accordance with Section 2830 (c) of SB 107, the MSCS will remain in place as an approved NCCP, and DFG may authorize take of covered species pursuant to the MSCS and DFG's NCCP approval.

Action Specific Implementation Plans

The MSCS requires CALFED project proponents and lead agencies (if different from the project proponent) to coordinate preparation of ASIPs with USFWS, NOAA Fisheries, and DFG. This coordination initiates informal consultation under Section 7 of the ESA. The SDIP ASIP serves as the SDIP biological assessment under Section 7 of the ESA and as the SDIP NCCP under the NCCPA.

ASIPs, which are consistent with information presented in the MSCS, present the information necessary for USFWS and/or NOAA Fisheries to issue incidental take authorization under Section 7 of the ESA for six species covered under the CALFED USFWS Programmatic BO and three species covered under the CALFED NOAA Fisheries Programmatic BO, and for DFG to issue incidental take authorization under Section 2835 of the NCCPA for 25 species covered under the CALFED Programmatic NCCP Determination.

To fulfill the requirements of ESA Sections 7 and 10 and California Fish and Game Code Sections 2835 and 2081, as applicable, each ASIP must include the following:

- detailed project description of the CALFED action or group of actions to be implemented, including site-specific and operational information;
- a list of evaluated species and any other special-status species that occur in the action area;
- an analysis identifying the direct, indirect, and cumulative impacts on the evaluated species other special-status species occurring in the action area (along with an analysis of impacts on any designated critical habitat) likely to result from the proposed CALFED action or group of actions, as well as actions related to and dependent on the proposed action;
- measures the implementing entity will undertake to avoid, minimize, and compensate for such impacts and, as appropriate, measures to enhance the condition of NCCP communities and evaluated species, along with a discussion of: (1) a plan to monitor the impacts and the implementation and effectiveness of these measures, (2) the funding that will be made available to undertake the measures, and (3) the procedures to address changed circumstances;
- measures the implementing entity will undertake to provide commitments to cooperating landowners, consistent with the discussion in Section 6.3.5 below;
- a discussion of alternative actions the applicant considered that would not result in take, and the reasons why such alternatives are not being used;
- additional measures USFWS, NOAA Fisheries, and DFG may require as necessary or appropriate for compliance with ESA, CESA, and NCCPA; and
- a description of how and to what extent the action or group of actions addressed in the ASIP will help the CALFED Program achieve the MSCS's goals for the affected species (i.e., how the ASIP implements the MSCS).

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) in general requires federal agencies to coordinate with USFWS and state fish and game agencies whenever streams or bodies of water are controlled or modified. This coordination is intended both to promote the conservation of wildlife resources by providing equal consideration for fish & wildlife in water project planning and to provide for the development and improvement of wildlife resources in connection with water projects. Federal agencies undertaking water projects are required to include recommendations made by USFWS and state fish and game agencies in project reports, and give full consideration to these recommendations.

In conjunction with the issuance of a draft EIS/EIR, USFWS will provide a Coordination Act Report in accordance with the FWCA.

Federal Requirements

NEPA

NEPA is the nation's broadest environmental law, applying to all federal agencies and most of the activities they manage, regulate, or fund that affect the environment. It requires federal agencies to disclose and consider the environmental implications of their proposed actions. NEPA establishes environmental policies for the nation, provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account.

NEPA requires the preparation of an appropriate document to ensure that federal agencies accomplish the law's purposes. The President's CEQ has adopted regulations and other guidance that provide detailed procedures that federal agencies must follow to implement NEPA. Reclamation would use this EIS/EIR to comply with CEQ's regulations and document NEPA compliance.

Federal Endangered Species Act

Section 7 of the ESA requires federal agencies, in consultation with USFWS and/or NOAA Fisheries, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of these species. The required steps in the Section 7 consultation process are as follows:

- Agencies must request information from USFWS and/or NOAA Fisheries on the existence in a project area of special-status species or species proposed for listing.

- Following receipt of the USFWS/NOAA Fisheries response to this request, agencies generally prepare a BA to determine whether any special-status species or species proposed for listing are likely to be affected by a proposed action.
- Agencies must initiate formal consultation with USFWS and/or NOAA Fisheries if the proposed action may adversely affect special-status species.
- USFWS and/or NOAA Fisheries must prepare a BO to determine whether the action would jeopardize the continued existence of special-status species or adversely modify their critical habitat.
- If a finding of jeopardy or adverse modifications is made in the biological opinion, USFWS and/or NOAA Fisheries must recommend reasonable and prudent alternatives that would avoid jeopardy, and the federal agency must modify project approval to ensure that special-status species are not jeopardized and that their critical habitat is not adversely modified (unless an exemption from this requirement is granted).

The SDIP ASIP serves as the SDIP BA under Section 7 of the ESA.

Clean Water Act Section 404, 404(b)(1) Guidelines and Section 401

Section 404

Section 404 of the CWA requires that a permit be obtained from the Corps for the discharge of dredged or fill material into "waters of the United States, including wetlands."

Waters of the United States include wetlands and lakes, rivers, streams, and their tributaries. Wetlands are defined for regulatory purposes, at 33 CFR 328.3 as:

> (1) All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of tide; (2) All interstate waters, including interstate wetlands; (3) All other waters such as intrastate lakes, rivers, streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce; (4) All impoundments of waters otherwise defined as waters of the United States under the definition; (5) Tributaries of waters identified in paragraphs 1–4 in this section; (6) The territorial seas; and (7) Wetlands adjacent to waters identified in paragraphs 1–6 in this section.

CWA Section 404(b) requires that the Corps process permits in compliance with guidelines developed by EPA. These guidelines (404(b)(1) Guidelines) require that there be an analysis of alternatives available to meet the project purpose and need including those that avoid and minimize discharges of dredged or fill materials in waters. Once this first test has been satisfied, the project that is permitted must be the least environmentally damaging practical alternative before the Corps may issue a permit for the proposed activity.

Actions typically subject to Section 404 requirements are those that would take place in wetlands or stream channels, including intermittent streams, even if they have been realigned. Within stream channels, a permit under Section 404 would be needed for any discharge activity below the ordinary high water mark, which is the line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, or the presence of litter or debris.

The CALFED ROD for the Final Programmatic EIS/EIR includes a CWA Section 404 memorandum of understanding (MOU) signed by Reclamation, EPA, the Corps, and DWR. Under the terms of the MOU, when a project proponent applies for a Section 404 individual permit for CALFED projects, the proponent is not required to reexamine program alternatives already analyzed in the Programmatic EIS/EIR. The Corps and EPA will focus on project-level alternatives that are consistent with the PEIS/EIR when they select the least environmentally damaging practicable alternative at the time of a Section 404 permit decision.

A 404 (b)(1) Alternatives information package will be prepared for the SDIP and submitted to the Corps and EPA.

Note: Section 404 does not apply to authorities under the Rivers and Harbors Act of 1899 except that some of the same waters may be regulated under both statutes; the Corps typically combines the permit requirements of Section 10 and Section 404 into one permitting process.

Section 401

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval [such as issuance of a Section 404 permit]) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the State Water Board, and applications for water quality certification under CWA Section 401 are typically processed by the RWQCB with local jurisdiction. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States.

For purposes of this project, Reclamation will obtain certification from the Central Valley RWQCB under Section 401 of the CWA.

River and Harbors Appropriation Act of 1899

The River and Harbors Appropriation Act of 1899 addresses activities that involve the construction of dams, bridges, dikes, etc., across any navigable water, or placing obstructions to navigation outside established federal lines and excavating from or depositing material in such waters, require permits from the Corps. Navigable waters are defined in section 329.4 as:

> Those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce. A determination of navigability, once made, applies laterally over the entire surface of the waterbody, and is not extinguished by later actions or events which impede or destroy navigable capacity.

In the Corps Sacramento District, navigable waters of the U.S. in the project area that are subject to the requirements of the River and Harbors Appropriation Act include Middle River, San Joaquin River, Old River, and all waterways in the Sacramento–San Joaquin drainage basin affected by tidal action (U.S. Army Corps of Engineers 2003). Sections of the River and Harbors Act applicable to the SDIP are:

Section 9

Section 9 (33 USC 401) prohibits the construction of any dam or dike across any navigable water of the United States in the absence of Congressional consent and approval of the plans by the Chief of Engineers and the Secretary of the Army. Where the navigable portions of the water body lie wholly within the limits of a single state, the structure may be built under authority of the legislature of that state, if the location and plans or any modification thereof are approved by the Chief of Engineers and by the Secretary of the Army.

Section 10

Section 10 (33 USC 403) prohibits the unauthorized obstruction or alteration of any navigable water of the United States. This section provides that the construction of any structure in or over any navigable water of the United States, or the accomplishment of any other work affecting the course, location, condition, or physical capacity of such waters, is unlawful unless the work has been authorized by the Chief of Engineers.

Section 13

Section 13 (33 USC 407) provides that the Secretary of the Army, whenever the Chief of Engineers determines that anchorage and navigation will not be injured thereby, may permit the discharge of refuse into navigable waters. In the absence of a permit, such discharge of refuse is prohibited. While the prohibition of this section, known as the Refuse Act, is still in effect, the permit authority of the Secretary of the Army has been superseded by the permit authority provided the

Administrator, EPA, and the states under Sections 402 and 405 of the CWA, respectively.

Central Valley Project Improvement Act

The CVP is the largest federal Reclamation project and was originally authorized by the Rivers and Harbors Act of 1935. It was reauthorized in 1937 for the purposes of several beneficial uses including improving navigation, regulating the flow of the San Joaquin River and the Sacramento River, controlling floods, providing for storage and for the delivery of stored water, to accommodate reclamation of arid and semiarid lands, and electricity generation. This Act also designated the order of priority for which each use would have. Since then, subsequent amendments have refined and further defined the objectives and agencies roles in the CVP's operations. The CVPIA, signed in October 1992, made significant changes to the management of the CVP and created a complex set of new programs and requirements applicable to the project. These changes and programs cover five primary areas:

- limitations on new and renewed CVP contracts,
- water conservation and other water management actions,
- water transfers,
- fish and wildlife restoration actions, and
- establishment of an environmental restoration fund.

With a few exceptions, new contracts for CVP water are prohibited until several requirements have been met, including completion of a programmatic EIR.

The CVPIA requires that 800,000 acre-feet of project yield be dedicated to fish and wildlife habitat purposes each year. In 1993, the secretary approved a memorandum signifying roles of Reclamation and USFWS in regard to implementing the CVPIA. The USFWS's role was defined as having "primary responsibility for decisions on biological resource issues; for studies on fish and wildlife, their populations and habitat requirements; for fishery restoration program direction; and for the planning, design, and decisions on the administration of fish and wildlife facilities."

For the SDIP, the CVPIA section 3406(b)(15) provides Reclamation the authority to revise operations and construct a fish control gate in the south Delta at the head of Old River to increase survival rates of outmigrating salmon.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a management system for national marine and estuarine fishery resources. This legislation requires that all federal agencies consult with NOAA Fisheries regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect "essential fish habitat." Essential fish habitat is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds are considered essential fish habitat. The phrase *adversely affect* refers to the creation of any impact that reduces the quality or quantity of essential fish habitat. Federal activities that occur outside of an essential fish habitat but that may, nonetheless, have an impact on essential fish habitat waters and substrate must also be considered in the consultation process.

Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan must also be considered. The Magnuson-Stevens Act states that consultation regarding essential fish habitat should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other federal statutes, such as NEPA, FWCA, CWA, and ESA. Essential fish habitat consultation requirements can be satisfied through concurrent environmental compliance if the lead agency provides NOAA Fisheries with timely notification of actions that may adversely affect essential fish habitat and if the notification meets requirements for essential fish habitat assessments. Reclamation and associated cooperating agencies will use the EIS/EIR and ASIP to comply with Magnuson-Stevens Act regulations.

National Historic Preservation Act

Section 106 of the NHPA requires federal agencies to evaluate the effects of their undertakings on historic properties, which are those properties eligible for listing on, or listed on, the NRHP. Implementing regulations at 36 CFR Part 800 require that federal agencies, in consultation with the SHPO, identify historic properties within the APE of the proposed project and make an assessment of adverse effects if any are identified. If the project is determined to have an adverse effect on historic properties, the agency is required to consult further with the SHPO and the Advisory Council on Historic Preservation (ACHP) to develop methods to resolve the adverse effects. The Section 106 process has four basic steps:

1. Initiation of the Section 106 process (define APE and scope of identification efforts).
2. Evaluation of historic properties.

3. Determination from adverse effects to historic properties.
4. Resolution of adverse effects to historic properties.

This EIS/EIR summarizes the efforts taken to identify cultural resources within the APE and evaluates their eligibility for listing in the NRHP (See Section 7.7). Reclamation has initiated the Section 106 process, and will complete consultation with the SHPO prior to the issuance of the SDIP EIS/EIR ROD.

Farmland Protection Policy Act and Memoranda on Farmland Preservation

Two policies require federal agencies to include assessments of the potential effects of a proposed project on prime and unique farmland. These policies are the FPPA and the Memoranda on Farmland Preservation, dated August 30, 1976, and August 11, 1980, respectively, from the CEQ. Under requirements set forth in these policies, federal agencies must determine these effects before taking any action that could result in converting designated prime or unique farmland for nonagricultural purposes. If implementing a project would adversely affect farmland preservation, the agencies must consider alternative actions to lessen those effects. Federal agencies also must ensure that their programs, to the extent practicable, are compatible with state, local, and private programs to protect farmland. NRCS is the federal agency responsible for ensuring that these laws and policies are followed.

In this EIS/EIR, the effects to agricultural lands from implementation of the SDIP have been assessed using methods described in Section 7.1, Land and Water Use, and through consultation with NRCS. One impact, the potential for substantial loss of important farmland as a result of constructing the permanent operable gates and dredging in the local project area, was identified. Mitigation is proposed to address this impact and minimize (or compensate for) agricultural losses.

Executive Order 11988 (Floodplain Management)

Executive Order 11988 (May 24, 1977) requires federal agencies to prepare floodplain assessments for proposed actions located in or affecting floodplains. If an agency proposes to conduct an action in a floodplain, it must consider alternatives to avoid adverse effects and incompatible development in the floodplain. If the only practicable alternative involves siting in a floodplain, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed in the floodplain.

The SDIP project elements are being integrated into the existing comprehensive flood control system of the Delta.

Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 (May 24, 1977) requires federal agencies to prepare wetland assessments for proposed actions located in or affecting wetlands. Agencies must avoid undertaking new construction in wetlands unless no practicable alternative is available and the proposed action includes all practicable measures to minimize harm to wetlands. Section 6.2 of this EIS/EIR, Vegetation and Wetlands, describes impacts on wetlands and mitigation measures for reducing significant impacts.

Executive Order 12898 (Environmental Justice)

Executive Order 12898 (February 11, 1994) requires federal agencies to identify and address adverse human health or environmental effects of federal programs, policies, and activities that could be disproportionately high on minority and low-income populations. Federal agencies must ensure that federal programs or activities do not directly or indirectly result in discrimination on the basis of race, color, or national origin. Federal agencies must provide opportunities for input into the NEPA process by affected communities and must evaluate the potentially significant and adverse environmental effects of proposed actions on minority and low-income communities during environmental document preparation. Even if a proposed federal project would not result in significant adverse impacts on minority and low-income populations, the environmental document must describe how Executive Order 12898 was addressed during the NEPA process.

Executive Order 13007 (Indian Sacred Sites) and April 29, 1994, Executive Memorandum

Executive Order 13007 (May 24, 1996) requires federal agencies with land management responsibilities to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies are to maintain the confidentiality of sacred sites. Among other things, federal agencies must provide reasonable notice of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. The agencies must comply with the April 29, 1994, Executive Memorandum, "Government-to-Government Relations with Native American Tribal Governments."

Based on the analysis, no sacred sites would be adversely affected by the implementation of SDIP.

Federal Clean Air Act

The federal Clean Air Act (CAA) was enacted to protect and enhance the nation's air quality in order to promote public health and welfare and the productive capacity of the nation's population. The CAA requires an evaluation of any federal action to determine its potential impact on air quality in the project region. California has a corresponding law, which also must be considered during the EIR process.

For specific projects, federal agencies must coordinate with the appropriate air quality management district as well as with EPA. This coordination would determine whether the project conforms to the CAA and the State Implementation Plan (SIP).

Section 176 of the CAA prohibits federal agencies from engaging in or supporting in any way an action or activity that does not conform to an applicable SIP. Actions and activities must conform to a SIP's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards and in attaining those standards expeditiously. EPA promulgated conformity regulations (codified in 40 CFR 93.150 *et seq.*).

The potential air quality impacts of the SDIP are discussed in Section 5.9 of this EIS/EIR.

Federal Water Project Recreation Act

The Federal Water Project Recreation Act requires federal agencies with authority to approve water projects to include recreation development as a condition of approving permits. Recreation development must be considered along with any navigation, flood control, reclamation, hydroelectric, or multipurpose water resource project. The act states that "consideration should be given to opportunities for outdoor recreation and fish and wildlife enhancement whenever any such project can reasonably serve either or both purposes consistently."

Compliance with the act is achieved through the documentation of the consideration of recreation opportunities in Corps reports and NEPA documents. Within this joint CEQA/NEPA EIS/EIR document, DWR and Reclamation have taken into consideration, and addressed, outdoor recreation and fish and wildlife enhancement in the south Delta region.

The SDIP addresses outdoor recreation and fish and wildlife enhancement through the implementation of a fish control gate, boat locks, boat ramps, and public restroom facilities. The proposed fish control gate, located at the confluence of Old River with the San Joaquin River, is designed to enhance both fish and wildlife, and recreational fishing, through the implementation of a gate that would minimize downstream movement of special-status fish species into the south Delta waterways from the San Joaquin River. Boat locks proposed at Old River and Grant Line Canal would provide access for recreational/fishing boat users; and public restroom facilities would be provided at all four gate locations.

State Requirements

California Environmental Quality Act

CEQA requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The environmental review required imposes both procedural and substantive requirements. At a minimum, an initial review of the project and its environmental effects must be conducted. CEQA's primary objectives are to:

- disclose to decision makers and the public the significant environmental effects of proposed activities,
- identify ways to avoid or reduce environmental damage,
- prevent environmental damage by requiring implementation of feasible alternatives or mitigation measures,
- disclose to the public reasons for agency approval of projects with significant environmental effects,
- foster interagency coordination in the review of projects, and
- enhance public participation in the planning process.

CEQA applies to all discretionary activities proposed to be carried out or approved by California public agencies, including state, regional, county, and local agencies, unless an exemption applies. It requires that public agencies comply with both procedural and substantive requirements. Procedural requirements include the preparation of the appropriate public notices (including notices of preparation), scoping documents, alternatives, environmental documents (including mitigation measures, mitigation monitoring plans, responses to comments, findings, and statements of overriding considerations); completion of agency consultation and State Clearinghouse review; and provisions for legal enforcement and citizen access to the courts.

CEQA's substantive provisions require agencies to address environmental impacts disclosed in an appropriate document. When avoiding or minimizing environmental damage is not feasible, CEQA requires agencies to prepare a written statement of overriding considerations when they decide to approve a project that will cause one or more significant effects on the environment that cannot be mitigated. CEQA establishes a series of action-forcing procedures to ensure that agencies accomplish the purposes of the law. In addition, under the direction of CEQA, the California Resources Agency has adopted regulations, known as the State CEQA Guidelines, which provide detailed procedures that agencies must follow to implement the law. DWR would use this EIS/EIR to comply with State CEQA requirements.

California Endangered Species Act

The CESA requires a state lead agency to consult formally with DFG when a proposed action may affect state-listed endangered or threatened species. The provisions of the ESA and CESA will often be activated simultaneously. The assessment of project effects on species listed under both the ESA and CESA is addressed in USFWS's and NOAA Fisheries' BOs. However, for those species listed only under CESA, DWR must formally consult with DFG, and DFG must issue a BO separate from USFWS's BO. The preparation of an ASIP serves to comply with Section 2081 of the CESA and Section 2835 of the NCCPA. The ASIP will be distributed subsequent to the EIS/EIR during the public review period.

Natural Community Conservation Planning Act

The NCCPA, California Fish and Game Code, Section 2800, et seq., was enacted to form a basis for broad-based planning to provide for effective protection and conservation of the state's wildlife heritage, while continuing to allow appropriate development and growth. The purpose of natural community conservation planning is to sustain and restore those species and their habitat identified by DFG that are necessary to maintain the continued viability of biological communities affected by human changes to the landscape. An NCCP identifies and provides for those measures necessary to conserve and manage natural biological diversity within the plan area while allowing compatible use of the land. DFG may authorize the take of any identified species, including listed and non-special-status species, pursuant to Section 2835 of the NCCPA, if the conservation and management of such species is provided for in an NCCP approved by DFG. For the SDIP, an ASIP has been prepared to serve as the equivalent of an NCCP. Pursuant to the NCCPA, DFG, as a responsible agency and trustee agency, may rely on the EIS/EIR and the ASIP to authorize take of covered species identified in the ASIP. DFG may issue an NCCP permit for the Physical/Structural Component under existing operations, and for existing SWP operations, described for the Stage 1 decision-making process. After DWR completes any further analysis for the Stage 2 decision-making process relative to the Operational Component, DFG may amend the NCCP permit to authorize take associated with this stage.

Section 1602 of the California Fish and Game Code

DFG regulates work that will substantially affect resources associated with rivers, streams, and lakes in California, pursuant to Fish and Game Code Sections 1600–1607. Any action from a public project that substantially diverts or obstructs the natural flow or changes the bed, channel, or bank of any river, stream, or lake, or uses material from a streambed must be previously authorized by DFG in a Lake or Streambed Alteration Agreement under Section 1602 of the Fish and Game Code. This requirement may in some cases apply to any work undertaken within the 100-year floodplain of a body of water or its tributaries, including intermittent streams and desert washes. As a general rule, however, it applies to any work done within the annual high-water mark of a wash, stream, or lake that contains or once contained fish and wildlife, or that supports or once supported riparian vegetation.

Activities associated with SDIP that require 1602 authorization and a Streambed Alteration Agreement include the modification and setting back of the existing levees, placement of fish and flow control gates, and conveyance improvements. These actions would result in the alteration of the flow within water bodies and occur within the annual high-water mark of water bodies that contain and wildlife, and support riparian vegetation.

The current temporary barriers program operates under DFG 1602 authorization. This EIS/EIR document will be used as the CEQA review document by DWR for either continued authorization of activities under the existing agreement, or for the issuance of a new Streambed Alteration Agreement (California Fish and Game Code 1600).

Porter-Cologne Water Quality Control Act of 1969

In 1967, the Porter-Cologne Act established the State Water Board and nine RWQCBs as the primary state agencies with regulatory authority over California water quality and appropriative surface water rights allocations. Under this act (and the CWA), the state is required to adopt a water quality control policy and WDRs to be implemented by the State Water Board and nine RWQCBs. The State Water Board also establishes WQCPs) and statewide plans. The RWQCBs carry out State Water Board policies and procedures throughout the state.

WQCPs, also known as basin plans, designate beneficial uses for specific surface water and groundwater resources and establish water quality objectives to protect those uses. WQCPs and water resource management plans relevant to SDIP include the WQCP for the Sacramento and San Joaquin River Basins; San Francisco Bay Basin WQCP; WQCP for the Tulare Lake Basin; Inland Surface Waters Plan; the Enclosed Bays and Estuaries Plan; and the Delta Plan. Delta-specific beneficial uses protected through water quality objectives are municipal and domestic water supply, agricultural supply, industrial supply (process and service), recreation (water contact and non-contact), freshwater habitat (warm- and coldwater), fish migration (warm- and coldwater), fish spawning (warmwater fish), wildlife habitat, and navigation. The basin plans define surface water quality objectives for several parameters, including suspended material, turbidity, pH, DO, bacteria, temperature, salinity, toxicity, ammonia, and sulfides.

The SDIP has the potential to affect water quality in surface water or groundwater in the Central Valley region and the San Francisco Bay region, which are governed by the Central Valley RWQCB and the San Francisco Bay RWQCB, respectively. Each SDIP alternative considered in this EIS/EIR was analyzed for compliance with the water quality objectives set forth in the applicable WQCPs. Section 5.3 of this EIS/EIR describes SDIP water quality compliance specific to these basin plans.

Water Use Efficiency

The California Constitution prohibits the waste or unreasonable use of water. Further, Water Code Section 275 directs DWR and the State Water Board to "take all appropriate proceedings or actions before executive, legislative, or judicial agencies to prevent waste or unreasonable use of water." Several legislative acts have been adopted to develop efficient use of water in the state:

- Urban Water Management Planning Act of 1985,
- Water Conservation in Landscaping Act of 1992,
- Agricultural Water Management Planning Act,
- Agricultural Water Suppliers Efficient Management Practices Act of 1990,
- Water Recycling Act of 1991, and
- Agricultural Water Conservation and Management Act of 1992.

The purpose of the SDIP is to improve the efficiency of conveying existing water supplies to CVP and SWP; thus, the proposed action would not result in the waste or unreasonable use of water.

Public Trust Doctrine

When planning and allocating water resources, the State of California is required to consider the public trust and preserve for the public interest the uses protected by the trust. The public trust doctrine embodies the principle that certain resources, including water, belong to all and, thus, are held in trust by the state for future generations.

In common law, the public trust doctrine protects navigation, commerce, and fisheries uses in navigable waterways. However, the courts have expanded the doctrine's application to include protecting tideland, wildlife, recreation, and other public trust resources in their natural state for recreational, ecological, and habitat purposes as they affect birds and marine life in navigable waters. *The National Audubon Society v. Superior Court of Alpine County* (1983) 33 Cal 3d 419 decision extended the public trust doctrine's limitations on private rights to appropriative water rights, and also ruled that longstanding water rights could be subject to reconsideration and could possibly be curtailed. The doctrine, however, generally requires the court and the State Water Board to perform a balancing test to weigh the potential value to society of a proposed or existing diversion against its impact on trust resources.

The 1986 Rancanelli decision applied the public trust doctrine to decisions by the State Water Board and held that this doctrine must be applied by the State Water Board in balancing all the competing interests in the uses of Bay-Delta waters (*United States v. State Water Resources Control Board* (1986) 182 Cal. App. 3d 82).

The SDIP is consistent with the public trust doctrine as its primary goals include a balance between fisheries, ecosystem restoration, and improved water supply reliability.

Davis-Dolwig Act

The Davis-Dolwig Act declares that recreation and fish and wildlife enhancement are among the purposes of state water projects. It specifies that costs for recreation and fish and wildlife enhancement not be included in prices, rates, and charges for water and power to urban and agricultural users. Under the Davis-Dolwig Act, land for recreation and fish and wildlife enhancement must be planned and initiated at the same time as any other land acquisition for the project. Implementation of the SDIP would include the construction of recreation facilities such as boat locks, drinking fountains and restrooms. The head of Old River fish control gate would serve to increase the population of outmigrating fish. Therefore, SDIP would be consistent with this Act.

State and Regional Plan Consistency

San Francisco Estuary Project's Comprehensive Conservation and Management Plan

The San Francisco Estuary Project (SFEP) was established by EPA in 1987 because of growing public concern related to the health of the bay and the Delta. SFEP is jointly sponsored by EPA and the State of California and is part of the National Estuary Program. The National Estuary Program was created by Congress in response to growing public concern over the decline of the nation's estuaries. The program's purpose is to protect and improve the water quality and natural resources of estuaries throughout the country by addressing the environmental problems specific to each. As directed by Section 320 of the CWA, representatives of each estuary in the National Estuary Program must develop a Comprehensive Conservation and Management Plan (CCMP).

The primary focus of the SFEP CCMP is to "restore and maintain the chemical, physical, and biological integrity of the bay and Delta." The CCMP provides a thorough implementation strategy describing 145 actions to protect the Bay-Delta Estuary. Ten program areas are identified in the CCMP. For each program area, the CCMP presents a problem statement, discusses existing management, identifies program area goals, recommends approaches, and states objectives and actions specific to the program. With regard to wetlands, the CCMP focuses on the restoration and ultimate enhancement of ecological productivity and habitat value. SFEP defines the estuary as the waters of San Francisco Bay, San Pablo Bay, Suisun Bay, and the Sacramento–San Joaquin River Delta. The proposed project boundaries include these waters, their watersheds, and lands in the Delta as delineated by Section 12220 of the State Water Code. Implementation of the SDIP would be consistent with this program as it would assist DWR and Reclamation in improving water quality within the south Delta.

Area of Origin

During the years when the SWP and CVP were being developed, area of origin legislation was enacted to protect local northern California supplies from being depleted. County of origin statutes provide for the reservation of water supplies for counties in which the water originates when, in the judgment of the State Water Board, an application for the assignment or release from priority of a State water right filing would deprive the county of necessary water for present and future development. The proposed project will have little effect on water supplies for North of Delta users; therefore, this project is consistent with the area of origin legislation (see Section 5.1, Water Supply, for more detail).

Delta Protection Act of 1959

The Delta Protection Act, enacted in 1959 (not to be confused with the Delta Protection Act of 1992, which relates to land use), declares that the maintenance of an adequate water supply in the Delta—to maintain and expand agriculture, industry, urban, and recreational development in the Delta area and provide a common source of fresh water for export to areas of water deficiency—is necessary for the peace, health, safety, and welfare of the people of the state, subject to the County of Origin and Watershed Protection laws. The act requires the SWP and the CVP to provide an adequate water supply for water users in the Delta through salinity control or through substitute supplies in lieu of salinity control. In 1984, additional area of origin protections were enacted to prohibit the export of groundwater from the Sacramento River and the Delta basins unless export is in compliance with local ground water plans. Water Code Section 1245 also holds municipalities liable for economic damages resulting from their diversion of water from a watershed. (Bulletin 160-93.) Implementation of the SDIP would improve water quality and quantity for south Delta users, while allowing a greater diversion and pumping capacity at SWP Banks for south of Delta water contractors.

Water Rights Contracts

When the federal government undertook to construct the CVP nearly 40 years ago, the scheme of reservoirs and conveyances it contemplated threatened to substantially alter the natural flows of the Sacramento River, among other rivers. Because there were various irrigation, reclamation, and other water districts holding senior and vested water rights under California law to divert surface water from the Sacramento River, the government was forced to reckon with those water right holders in order to construct and operate the CVP.

Accordingly, Reclamation entered into long-term settlement contracts with these local districts, recognizing the districts' senior water rights to divert certain natural flows of the Sacramento River and also providing a contractual entitlement to additional water supplies during the summer months from the CVP's yield. The SWP also has water rights settlement with prior rights holders on the Feather River and in the Delta. The proposed project will allow the CVP and SWP more flexibility in the operations of the south Delta and will therefore have the potential to deliver more of the water that is contracted to south of Delta users.

Water Right Decision D-1485 and the 1978 Water Quality Control Plan

In 1978, the State Water Board adopted the WQCP for the Delta and Suisun Marsh (1978 Delta Plan). At the same time, the State Water Board adopted Water Right Decision D-1485, which required compliance with water quality objectives in the 1978 Delta Plan that were designed to protect natural resources by maintaining Delta conditions as they would exist in the absence of the CVP and SWP. This decision also mandated an extensive monitoring program and required special studies of the Delta and Suisun Marsh areas. D-1485 standards require that the SWP and CVP make operational decisions to maintain Delta water quality and to meet Delta freshwater outflow within specified limits.

Various interests challenged D-1485, and it was overturned in 1984. In 1986, the State Water Board was required by the Appellate Court to separate its water quality planning and water rights functions and maintain a "global perspective" in identifying beneficial uses and in allocating responsibility for implementing water quality objectives. Thus, the State Water Board revised its water quality standards and issued revised water quality objectives in the 1991 Delta WQCP for Salinity, Temperature and Dissolved Oxygen (1991 Delta Plan).

In response to D-1485, DWR and Reclamation signed the Coordinated Operation Agreement in 1986, which specified the respective responsibilities of each project. The agreement sets a formula for sharing the obligation of meeting water quality standards and other in-basin uses. The sharing formula provides for CVP/SWP proportionate splits of 75/25 responsibility for meeting in-basin use from stored water releases and 55/45 for capture and export of excess flow.

In 1992, interim standards were proposed in Water Right Decision 1630 (D-1630). EPA, however, rejected D-1630 and then announced its own proposed standards to replace those proposed by the State Water Board. Debate over the management of Delta waters resulted in the signing of the Joint Federal and State Delta Agreement between EPA and the State of California. Implementation of SDIP would improve water quality in the south Delta.

San Joaquin Valley Drainage Program

The Statewide Drainage Management Program/San Joaquin Valley Drainage Implementation Program (SJVDIP) is a function of the Office of Water Use Efficiency within the DWR. SJVDIP is an interagency program established in 1991 by an MOU signed among four state and four federal agencies. The MOU created the SJVDIP Management Group to help implement recommendations of the San Joaquin Valley Drainage Program published as the Rainbow Report in 1990. The 1990 report recommended a number of in-valley options to manage agricultural drainage and drainage-related problems. In 2000, the 1990 report was updated, and a new drainage management strategy was introduced to implement the updated recommendations. Because objectives of the SDIP include the improvement of water circulation and reduction of water pollution, SDIP would be consistent with the goals of the SJVDIP.

Land Use and Resource Management Plan for the Primary Zone of the Delta

The Delta Protection Act of 1992 (Public Resources Code Section 29760 *et. seq*.) requires the Delta Protection Commission to prepare and adopt and thereafter review and maintain a comprehensive long-term resource management plan for land uses within the Primary Zone of the Delta (resource management plan). The goals of the plan as set out in the act are to "protect, maintain, and where possible, enhance and restore the overall quality of the Delta environment, including but not limited to agriculture, wildlife habitat, and recreational activities; assure orderly, balanced conservation and development of Delta land resources and improve flood protection by structural and nonstructural means to ensure an increased level of public health and safety." Also pursuant to the act, to the extent that any of the requirements specified in this Land Use and Resource Management Plan are in conflict, nothing in this plan shall deny the right of the landowner to continue the agricultural use of the land (Land Use and Resource Management Plan for the Primary Zone of the Delta, Adopted February 23, 1995 [Delta Protection Commission 1995]).

The Commission adopted the plan on February 23, 1995, and provided it to the five counties within its jurisdiction to incorporate into their general plans and zoning codes. The Counties will then carry out the plan through their day-to-day activities. The proposed project will minimize and mitigate, to the extent possible, any impacts to land uses in the area. In addition, the SDIP will increase water supply reliability for south Delta water users and irrigated farmlands. Therefore, this project is consistent with the Land Use and Resource Management Plan (see Section 7.1 for more detail).

Delta Protection Commission

The DPC is a state agency created in 1993 to address concerns that increasing pressures for residential, residential/recreation, and commercial/industrial users would continue to encroach into the Delta, an area of statewide agricultural significance. The commission is charged with preparation of the regional plan (mentioned previously) for the heart of the Delta, which includes portions of Solano, Yolo, Sacramento, San Joaquin, and Contra Costa Counties. SDIP is consistent with this regional plan.

The DPC has appeal authority over local government actions. Thus, if any person believes a local government has taken an action, or approved a project, that is not in conformance with the act and plan, that local government action can be appealed to the commission. The appeal "suspends" the local permit, allowing the commission the opportunity to review the action. If the commission finds the local government action to be in conformance with the act and plan, the action can go forward. If the commission finds the local government action is not in conformance with the act and plan, the commission will forward its findings to the local government for further review. In 1999, the sunset date of the commission was extended to January 1, 2010.

1995 Water Quality Control Plan

The 1995 WQCP was written to replace/update both the 1991 and 1978 WQCPs. The State Water Board reviews the WQCP every 3 years. The differences between the 1995 plan and the 1991 and 1978 plans is that it revised the existing standards for flow and salinity in the Delta's channels and ordered Reclamation and DWR to meet these standards by reducing pumping or releasing water stored in upstream reservoirs or both. It also includes objectives for flow and water project operations that the other plans did not.

In 1994, the State Water Board initiated development of new water quality objectives and released a draft version, the same day the Bay-Delta Accord was signed. The State Water Board subsequently released an environmental report that documented the effects of implementing the plan. The WQCP was adopted in May 1995 (1995 WQCP) and incorporated several elements of EPA, NOAA Fisheries, and USFWS regulatory objectives for salinity and endangered species protection. Implementation of the SDIP will assist the DWR and Reclamation in meeting these objectives.

Clean Water Act—Section 303(d)

Under CWA Section 303(d), the RWQCB and the State Water Board list water bodies as impaired when not in compliance with designated water quality objectives and standards. A TMDL program must be prepared for waters identified by the state as impaired. A TMDL is a quantitative assessment of a problem that affects water quality. The problem can include the presence of a pollutant, such as a heavy metal or a pesticide, or a change in the physical property of the water, such as DO or temperature. A TMDL specifies the allowable load of pollutants from individual sources to ensure compliance with water quality standards. Once the allowable load and existing source loads have been determined, reductions in allowable loads are allocated to individual pollutant sources.

The currently applicable basin plan chronic water quality standard for nickel in San Francisco Bay north of the South San Francisco Bay segment is 7.1 mg/l total recoverable nickel (San Francisco Bay Regional Water Quality Control Board 1995, p. 3–9). The state's analysis of available data found that this standard has been exceeded 102 times since 1993 (Strauss 2003a). The state erroneously applied the dissolved nickel criterion in assessing the data and reached the conclusion that the bay meets the nickel standards based on the application of an inapplicable standard. EPA identified the Sacramento–San Joaquin Delta (portion in San Francisco Bay Region) segment for inclusion on the 2002 Section 303(d) list based on the state's analysis of available nickel data in comparison with the applicable basin plan objective. EPA established a low priority ranking for this listing as the state is in the process of developing site-specific water quality standards for nickel that will likely be attained. Therefore, it is most reasonable to proceed with water quality standards modification that will likely obviate the need to complete a nickel TMDL for the bay. (Strauss 2003a) and (Waters added to 303(d) list for California, Enclosure to letter from Alexis Strauss, EPA Region 9 to Celeste Cantú, State Water Resources Control Board, July 25, 2003 (Strauss 2003b). Implementation of the SDIP would assist DWR and Reclamation in meeting these standards.

Water Rights

The State of California recognizes riparian and appropriative surface water rights. Riparian rights are correlative entitlements to water that are held by owners of land bordering natural watercourses. California requires a statement of diversion and use of natural flows on adjacent riparian land under a riparian right. Appropriative water rights allow the diversion of a specified amount of water from a source for reasonable and beneficial use during all or a portion of the year. In California, previously issued appropriative water rights are superior to and take precedence over newly granted rights. The State Water Board has authority to issue permits to grant appropriative water rights.

SDWA states that adequate water for agricultural purposes in the south Delta is dependent upon water quality and water levels that are influenced by a variety of factors, including tides and water exports from the SWP and CVP. To protect SDWA water rights, there is a need to maintain adequate water quality and levels for the consumptive use needs of south Delta agricultural users. This is one of the needs for the proposed project.

Local Plan Consistency and Regulatory Requirements

In addition to the federal, state regulatory and local plan requirements, SDIP may be subject to certain zoning or other ordinances and general plans of the Counties of San Joaquin, Contra Costa, and Alameda. Such regulatory requirements may include compliance with general plan elements, grading permits, and compliance with Williamson Act land programs. For more discussion on local plans and requirements applicable to SDIP, refer to the Regulatory Setting part of the specific resource sections of interest within this document.

Chapter 9
Growth-Inducing Impacts

Introduction

NEPA and CEQA require that an EIS and EIR discuss how a project, if implemented, could induce growth. This chapter presents an analysis of the potential growth-inducing impacts of Alternatives 2A, 2B, 3B, 4B, and 2C. This chapter provides the following:

- summary of the conclusions of the chapter's analysis,
- background information related to water supply and growth-inducement,
- the methodology used to conduct analysis of growth-inducing impacts,
- the results of the analysis, and
- the impact conclusions.

Summary of Analysis Conclusions

Each SDIP Alternative could remove an obstacle to growth and could encourage or facilitate other activities that could result in environmental effects. The direct effects of the project, through the cultivation of once-fallowed agricultural lands or through the stimulation of the local economy by project construction, are not expected to accommodate or induce growth. However, the indirect effects of the project, resulting from increases in water supplies for those receiving water exported from the Delta, could accommodate additional growth. This growth could result in impacts on special-status species, changes in stormwater runoff quantity and quality, the modification of slopes, and impacts on air and water quality, traffic, noise, various public services, and other sensitive resources. Mitigation of these impacts, should they occur, would be the responsibility of the local jurisdictions in which the growth would occur, not DWR or Reclamation. The impacts of this growth, if any, would be analyzed in detail either in General Plan EIRs for the local jurisdictions or in project-level CEQA compliance documents. Mitigation measures could include locating the growth in areas where sensitive resources are not located, minimizing the loss of these resources, or replacing any loss.

Growth-related impacts may be greatest under Alternative 2A because it would result in the greatest increase in south-of-Delta water deliveries. Alternatives 2B, 3B, and 4B and Alternative 2C would also remove obstacles to growth, or encourage and facilitate other activities that could result in environmental effects, but to a lesser extent than Alternative 2A. The growth-inducing impacts under Alternatives 2B, 3B, and 4B would be least because water deliveries compared to study baselines (2001 and 2020 conditions) would either not increase or increase only slightly depending on the baseline condition. Growth-inducing impacts occurring under Alternative 2C would be expected to fall between those of Alternative 2A and Alternatives 2B, 3B, and 4B.

The following supporting material provides a more detailed evaluation on which these general conclusions are based.

Context and Background

The information contained in this section is needed to provide context to the analysis and to help the reader understand the structure of the analysis. This background information includes:

- the legal requirements for analyzing growth-inducing impacts in CEQA and NEPA documents;
- the guidance provided by the CALFED ROD regarding growth-inducing impacts;
- a brief description of SB 610 and SB 221 of 2001, which address the relationship between water supply and land use planning;
- a description of the DWR Water Supply Reliability Report and its relevance to this analysis; and
- a summary of growth projections for southern California.

CEQA and NEPA Requirements

Section 21100(b)(5) of CEQA requires an EIR to discuss how a proposed project, if implemented, may induce growth and the impacts of that induced growth (see also, State CEQA Guidelines Section 15126). CEQA requires the EIR to specifically discuss “the ways in which the proposed project could foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment” (State CEQA Guidelines Section 15126.2[d]).

In addition, under authority of NEPA, CEQ Regulations require EISs to consider the potential indirect impacts of a proposed action. The indirect effects of an action include those that occur later in time or farther away in distance, but are still reasonably foreseeable, and “may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate” (40 CFR Section 1508.8[b]).

Evaluation of the growth-inducing effects of the SDIP is based on a qualitative analysis of the direct effects of constructing and operating the SDIP, and the indirect effects that could result from use of the additional increment of water supply provided by the SDIP in the SWP and CVP contractor service areas. The evaluation of growth effects is based on water supply analyses that conclude that the water supply reliability for SWP and CVP contractors will incrementally improve with implementation of the SDIP. Specifically, this evaluation of potential growth-inducing impacts addresses whether the project would directly or indirectly: foster economic, population, or housing growth; remove obstacles to growth; increase population growth that would tax community service facilities; or encourage or facilitate other activities that cause significant environmental effects.

Section 15126.2 of the State CEQA Guidelines states specifically, "It must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment." In other words, growth inducement is not to be considered adverse *per se*; impacts on resources resulting from growth may be too far removed from the actions of the water supply agency to require mitigation by the agency. The goal of the EIS/EIR in this regard, therefore, is one of disclosure.

Guidance in the CALFED Programmatic Record of Decision

The SDIP is considered a CALFED project because it is specifically included in the CALFED ROD. For background, therefore, it is useful to understand what conclusions were included in the CALFED ROD regarding the relationship between increased water supply and growth. The following text is excerpted from CALFED ROD, Attachment 1—CEQA Requirements, CEQA Findings of Fact (August 28, 2000); the full text is incorporated by reference. It is important to note, however, that the SDIP EIS/EIR stands on its own and does not rely on the analysis contained in the Programmatic EIS/EIR. It includes an independently developed analysis of the impacts of the SDIP, including the analysis of growth-inducing impacts.

> The Preferred Program Alternative is expected to result in an improvement in water supply reliability for beneficial use in the Bay Region, Sacramento River Region, and San Joaquin River Region, and South-of-Delta SWP and CVP Service Areas…. Modifications in Delta conveyance will result in improved water supply reliability, protection and improvement of Delta water quality, improvements in ecosystem health, and reduced risk of supply disruption due to catastrophic breaching of Delta levees.
>
> Consistent with the stated purposes of the CALFED Program since its outset in 1995, it is not the intent of this Program to address or solve all of the water supply problems in California. The CALFED Program is directly or indirectly tied to a number of specific project proposals that would help toward meeting California's water needs for a wide variety of beneficial uses. CALFED is an important piece of a much larger picture that is the continuing responsibility of local, regional, State and Federal jurisdictions.

There are differences of opinion as to whether improvements in water supply reliability would stimulate growth. The causal link between the CALFED Program and any increase in population or economic growth, or the construction of additional housing is speculative at this time. However, because this issue cannot be determined with certainty at this programmatic level of analysis, the assumption was made for this document that the improvement in water supply reliability that is associated with the Program could stimulate growth. This assumption assures that the EIS/EIR discloses the environmental consequences, at a programmatic level, associated with growth in the event that Program actions ultimately lead to this type of change.

At this programmatic level, it is unknown what level of growth or the likely location of any increases in population or construction of additional housing would take place. Increases in the population in the solution area are projected over the next 30 years, regardless of CALFED actions. When population growth occurs, it could lead to additional adverse impacts in certain locations, which local, regional, State, and Federal agencies will need to address when more information on those impacts and how to mitigate them is known. These impacts could include impacts on water quality and air quality, transportation, loss of open space, and other resource areas addressed in the EIS/EIR.

When additional growth occurs, these changes will be subject to local land use and regulatory decisions by individual cities and counties in the areas where they occur. Future development at the local level is guided by many considerations, only one of which is the reliability of water supply. These other factors include the policies in local general plans and zoning ordinance restrictions; the availability of a wide range of community services and infrastructure, such as sewage treatment facilities and transportation infrastructure; the availability of developable land; the types and availability of employment opportunities; and the analysis and conclusions based on an environmental review of proposed projects pursuant to CEQA. When additional population growth or new development occurs, and additional information is available, local, regional, State, and Federal governments will need to consider and address these potential adverse environmental impacts and methods to avoid or mitigate them.

Relationship to Senate Bill 610 and Senate Bill 221, 2001

Land use planning agencies in California plan growth based on a number of different factors, many unrelated to available water supplies, including economic factors and population dynamics. Also, according to California law, water suppliers are required to serve the needs of users within their service areas (see, e.g., *Swanson v. Marin Municipal Water Dist.* (1976) 56 Cal.App.3d 512, 524 [water district has a “continuing obligation to exert every reasonable effort to augment its available water supply in order to meet increasing demands”]).

The coordination between water supply and land use planning was strengthened in 2001 by the passage of SB 610 and SB 221, which require cities and counties to obtain assessments of the availability of water to supply new developments over a certain size and to obtain assurance from water suppliers that sufficient water is available before approving these new developments. The combined effect of SB 610 and SB 221 is to impose upon cities and counties the ultimate responsibility for determining the sufficiency and availability of water as part of their environmental review and approval processes. In addition, a recent court case (*Save Our Peninsula Committee v. Monterey County Board of Supervisors* [2001] 87 Cal.App.4th 99) discussed how water supply sufficiency and the impacts of the proposed project on limited local supply sources were the key factors in deciding the adequacy of an EIR. Water supply availability in this instance was also clearly a determining factor in whether development was allowable.

SB 610 and 221 require only that water supply agencies inform land use jurisdictions regarding the availability of water supplies, type of infrastructure necessary to deliver the water, and impact of new development on supply reliability. SB 610 allows for local land use agencies to approve development despite a water agency's conclusion that the supplier's reliability levels would be compromised. Specifically, a water supplier could report to the local land use agency that water supplies are insufficient and development could still proceed regardless, should the land use authority decide to procure alternate supplies or, in the case of SB 610, adopt a statement of overriding considerations with respect to significant water supply impacts. Further, while SB 610 and SB 221 do attempt to increase the consideration of water supply factors in development decision-making, many proposed projects are not of a large enough scale to trigger the requirement to prepare a water supply assessment pursuant to SB 610 (500 or more residences, non-residential uses that would supply more than 1,000 persons, or mixed-use projects that would have a water demand equivalent to the demand of 500 residential units).

California Department of Water Resources Water Delivery Reliability Report

In 2002 DWR published the first in a biannual series of SWP delivery reliability reports to provide information on the ability of the SWP to deliver water under existing and future development. DWR issued this report to assist SWP contractors to assess the adequacy of the SWP component of their overall water supplies. The report states, "Information in this report may be used by local agencies in preparing or amending their water management plans and identifying the new facilities or programs that may be necessary to meet future water needs." The report also states, "Agencies will also find this report useful in conducting analyses mandated by legislation authored by Senator Sheila Kuehl (SB 221) and Senator Jim Costa (SB 610)."

The heart of the report is an analysis that provides forecasts of the delivery capability of the SWP under a variety of hydrologic circumstances with both 2001 and 2021 demands. These forecasts were created using the CALSIM II hydrologic model. This information was not used directly in the analysis for this EIS/EIR, but it was described here because it provides some context for the SDIP within the overall water supply capabilities of DWR.

Growth Projections

There is no doubt that California is expected to experience substantial growth over the next two decades. Numerous state, regional, and local agencies prepare estimates of growth to assist in planning for the effects of that growth, including the need for water supply, additional housing, roads and bridges, sewerage infrastructure, schools, hospitals, police and fire services, and to mitigate the projected negative impacts. Table 9-1 shows the population growth between 2000 and 2020 (in 5-year increments) projected by the California Department of Finance for all counties south of the Delta that could receive additional water as a result of the SDIP.

Table 9-1. South-of-the-Delta Population Forecast

County	2000	2005	2010	2015	2020
Alameda	1,466,900	1,580,200	1,671,200	1,735,800	1,811,800
Calaveras	41,000	47,800	53,400	57,900	62,200
Contra Costa	963,000	1,021,400	1,071,400	1,108,100	1,152,900
Fresno	816,400	893,300	970,900	1,043,100	1,134,600
Imperial	149,000	182,500	217,500	252,000	294,200
Kern	678,500	771,300	871,600	972,700	1,088,600
Kings	134,500	149,600	165,300	180,800	198,700
Los Angeles	9,716,000	10,169,100	10,605,200	10,983,900	11,584,800
Madera	127,700	152,600	178,900	203,000	229,200
Mariposa	17,300	19,600	21,500	23,000	24,300
Merced	214,400	239,900	266,700	292,400	322,700
Monterey	408,700	450,300	493,100	535,700	590,700
Orange	2,893,100	3,099,700	3,266,700	3,384,300	3,541,700
Riverside	1,577,700	1,864,700	2,159,700	2,459,600	2,817,600
San Benito	54,500	63,600	72,000	79,100	86,800
San Bernardino	1,742,300	1,980,000	2,231,600	2,487,700	2,800,900
San Diego	2,856,300	3,149,900	3,388,400	3,591,300	3,863,500
San Joaquin	573,600	645,600	727,800	803,400	887,600
San Luis Obispo	249,900	287,000	323,100	357,000	390,900
San Mateo	717,900	765,800	794,600	809,100	834,500
Santa Barbara	406,100	434,400	467,700	505,200	552,700
Santa Clara	1,709,500	1,867,400	1,987,800	2,063,000	2,163,000
Santa Cruz	259,300	284,500	311,900	339,900	370,600
Stanislaus	454,600	522,700	587,600	646,800	712,100
Tulare	375,100	422,000	469,800	515,600	570,900
Tuolumne	55,200	62,200	68,200	72,800	77,200
Ventura	765,300	818,600	877,400	934,000	1,007,200

Source: California Department of Finance, Interim County Projections, Estimated July 1, 2000, and Projections for 2005, 2010, 2015, and 2020.

Methodology

Level of Analysis Needed

CEQA states that the EIR should discuss "increases in the population [that] may tax existing community service facilities, requiring construction of new facilities that could cause significant environmental effects. Also [the EIR should] discuss the characteristic of some projects which may encourage and facilitate other activities that could significantly affect the environment, either individually or cumulatively."

Some specific guidance is provided by the Court's ruling in *Napa Citizens for Honest Government v. Napa County Board of Supervisors* ([2001] 91 Cal. App. 4th 342). The sufficiency of analysis of growth-inducing impacts was an issue contested in that case. In its decision, the Court provided the following guidance:

> …the EIR must discuss growth-inducing impacts even though those impacts are not themselves a part of the project under consideration, and even though the extent of the growth is difficult to calculate.
>
> It does not follow, however, that an EIR is required to make a detailed analysis of the impacts of a project on housing and growth. Nothing in the [CEQA] Guidelines, or in the cases, requires more than a general analysis of projected growth. The detail required in a particular case necessarily depends on a multitude of factors, including, but not limited to, the nature of the project, the directness or indirectness of the contemplated impact and the ability to forecast the actual effects the project will have on the physical environment…Indeed, the purpose of CEQA would be undermined if the appropriate governmental agencies went forward without an awareness of the effects a project will have on areas outside of the boundaries of the project area. That the effects of a project will be felt outside of the project area, however, is one of the factors that determines the amount of detail required in any discussion. Less detail, for example, would be required where those effects are more indirect than effects felt within the project area, or where it [would] be difficult to predict them with any accuracy.
>
> Because it cannot be known if the Project will cause growth in any particular area, and because the Project most likely will not be the sole contributor to growth in any particular area, it is not, however, reasonable to require the FSEIR to undertake a detailed analysis of the results of such growth.
>
> Neither CEQA itself, nor the cases that have interpreted it, require an EIR to anticipate and mitigate the effects of a particular project on growth [in] other areas.
>
> The FSEIR need not forecast the impact that the housing will have on as yet unidentified areas and propose measures to mitigate that impact. That process is best reserved until such time as a particular housing project is proposed.

In a recent CEQA case, *Defend the Bay v. City of Irvine* (No. G032062, 4th App. Dist., Div.3; 7/1/04 Daily J. D.A.R. 7965, June 29, 2004), the court reiterated the basic requirement regarding growth, referencing the *Napa Citizens* case by stating that "If a project will create jobs and bring people into the area, the EIR must discuss the resulting housing needs, but not in minute detail. It is enough to identify the housing required and its probable location [if known]."

Two CEQA-related concepts are important to keep in mind in determining the level of analysis to be provided. First, CEQA is concerned with identifying impacts related only to physical changes in the environment. In order to evaluate the growth-related physical changes in the environment that may occur from a project, it is necessary to identify where and to what extent future growth will occur. The direct growth-related effects of a water supply project would involve localized economic effects such as job growth and temporary increased demand for housing related to project construction. The indirect effects of water supply projects are related to the physical changes (i.e., new construction) that would occur as a result of the additional water supplies being available to local governments. It can be difficult to identify with any degree of precision potential indirect growth-related effects resulting from an increase in water supply.

The second important concept to consider is that CEQA does not require undue speculation in predicting actual environmental consequences. (See CEQA Guidelines §§15144, 15145.) Thus, while it is acknowledged that additional water supplies can be growth-inducing, it is the responsibility of the lead agencies to describe the impacts of their project only to the extent that those impacts can be either known or reasonably predicted. Further, they are not required to adopt mitigation for impacts that require a great deal of speculation even to describe, and that are ultimately not within their control or statutory authority. (*Napa Citizens for Honest Government v. Board of Supervisors* [2001] 91 Cal.App.4th 342.)

Methods Used

The growth-inducing impact of each SDIP alternative was evaluated by comparing the total amount of current deliveries to CVP contractors and Table A deliveries to SWP contractors to the estimated changes in deliveries for each alternative. Article 21 water was not included in the growth analysis because of the annual uncertainty and variability of deliveries. Each SDIP alternative includes Operational Scenario A, B, or C. For purposes of this evaluation, the growth-inducing impacts expected under Alternatives 2B, 3B, and 4B would be identical because each alternative includes Operational Scenario B.

Implementing the SDIP could result in growth through four mechanisms. During Stage 1, growth could occur in the vicinity of the project site in the southern portion of the Delta as a result of the economic activity generated by constructing the fish control and flow control gates. Three types of operations-related impacts could occur during Stage 2: effects resulting from changes in agricultural land and water use patterns because of increased CVP and SWP water deliveries; growth in urban areas resulting from increases in CVP and SWP water deliveries; and growth in urban areas resulting from third-party water transfers facilitated by the increase in allowable exports.

For the purposes of this analysis, third parties can include DWR acquiring water through a Dry Year Program, SWP and CVP acquiring water through the Sacramento Valley Water Management Agreement, or other parties such as Metropolitan acquiring water in the Sacramento Valley and exporting it from the Delta. Each of these four mechanisms is described below.

Construction-Related Effects

Assessing the growth-inducing impacts of the construction-related effects is relatively straightforward. As the construction-related effects of the SDIP are within the control of the lead agencies, a fairly detailed level of analysis can be provided. The assessment of construction-related effects involves analyzing whether the relative magnitude of temporary and permanent jobs that would be created by the project would be large enough to require additional housing, or otherwise spur economic growth in the area surrounding the project, and determining whether that growth would have environmental impacts.

The construction of the SDIP would temporarily cause an increase in employment in the project area. The construction of the gates would last up to 30 months, and it is assumed that approximately 60% of the workers would originate from the local study area. The increase in population created by construction workers and their dependents may need to be accommodated from available local housing. It is assumed that there would be approximately three persons per family. The total number of jobs created and the number of housing units needed to accommodate the workers was compared against the total population in the project area.

Effects Resulting from Changes in Agricultural Land and Water Use because of Increased Central Valley Project and State Water Project Deliveries

The assessment of agricultural effects involves determining whether any fallowed lands could be brought into production as a result of implementing the SDIP, and whether farming those lands would have environmental impacts. Such impacts would occur if this additional water would result in land and water use changes that had environmental effects. For instance, impacts could occur if agricultural lands that had previously lain fallow for several years and had become habitat for sensitive species were put back into production as a result of the water made available by each SDIP alternative.

Hydrologic modeling results were used to estimate increases in allocations to SWP and CVP agricultural water contractors resulting from the higher allowable pumping rates associated with each alternative. Tables 9-2 and 9-3 show the increases in SWP and CVP allocations expected under 2001 and 2020 conditions, for each water year type and averaged over the 73-year study period. Table 9-4 shows the same information for changes in third-party water transfers. Table 9-5 shows the percentage allocations of SWP water to each contractor, based on Table A and the changes in allocations that would result. By far, the largest SWP agricultural water contractor is the Kern County Water Agency. Table 9-6 shows projected changes in deliveries to individual CVP contractors, derived from CALSIM II results. CALSIM modeling aggregates deliveries to various contractors, so it was necessary to manually disaggregate the modeling results to derive projected deliveries to individual CVP contractors.

Table 9-2. Comparison of Average Changes to SWP Table A Deliveries Resulting from Implementing the SDIP Alternatives by Water Year Type (thousand acre-feet)

	SWP Deliveries						
Water Year Type (1922–1994)	2001 Baseline	2001 Alt 2A	2001 Alt 2B. 3B, 4B	2001 Alt 2C	Change under Alt 2A	Change under Alt 2B, 3B, 4B	Change under Alt 2C
Wet	3,474	3,477	3,464	3,478	3	-10	4
Above normal	3,396	3,401	3,395	3,404	5	-2	7
Below normal	3,429	3,453	3,404	3,437	24	-25	8
Dry	2,791	2,837	2,752	2,804	46	-39	13
Critically Dry	1,720	1,747	1,703	1,718	27	-18	-3
73-Year Average	3,017	3,038	2,998	3,023	21	-19	6

Water Year Type (1922–1994)	2020 Baseline	2020 Alt 2A	2020 Alt 2B, 3B, 4B	2020 Alt 2C	Change under Alt 2A	Change under Alt 2B, 3B, 4B	Change under Alt 2C
Wet	3,824	3,828	3,812	3,828	4	-12	4
Above normal	3,707	3,737	3,703	3,740	30	-4	33
Below normal	3,567	3,611	3,548	3,617	44	-19	50
Dry	2,769	2,847	2,792	2,838	77	22	69
Critically dry	1,712	1,764	1,744	1,770	52	32	59
73-Year Average	3,180	3,219	3,183	3,220	39	3	40

Table 9-3. Comparison of Average Changes to CVP Deliveries Resulting from Implementing the SDIP Alternatives by Water Year Type (thousand acre-feet)

Water Year Type (1922–1994)	CVP Deliveries						
	2001 Baseline	2001 Alt 2A	2001 Alt 2B. 3B, 4B	2001 Alt 2C	Change under Alt 2A	Change under Alt 2B, 3B, 4B	Change under Alt 2C
Wet	3,115	3,315	3,142	3,153	200	28	39
Above normal	2,958	3,183	2,992	2,997	225	34	39
Below normal	2,779	2,885	2,815	2,813	106	36	34
Dry	2,425	2,408	2,425	2,427	-17	0	1
Critically Dry	1,701	1,709	1,708	1,707	8	8	6
73-Year Average	2,645	2,752	2,666	2,670	107	21	24

Water Year Type (1922–1994)	2020 Baseline	2020 Alt 2A	2020 Alt 2B, 3B, 4B	2020 Alt 2C	Change under Alt 2A	Change under Alt 2B, 3B, 4B	Change under Alt 2C
Wet	3,063	3,249	3,074	3,098	186	11	35
Above normal	2,863	3,063	2,879	2,886	200	16	23
Below normal	2,715	2,802	2,743	2,745	87	28	30
Dry	2,337	2,361	2,363	2,362	24	26	25
Critically Dry	1,714	1,703	1,704	1,703	-11	-10	-11
73-Year Average	2,588	2,689	2,603	2,611	101	15	23

Table 9-4. Comparison of Average Changes to Third-Party Transfer Capacity Resulting from Implementing the SDIP Alternatives by Water Year Type (thousand acre-feet)

	Transfer Capacity						
	2001 Baseline	2001 Alt 2A	2001 Alt 2B, 3B, 4B	2001 Alt 2C	Change under Alt 2A	Change under Alt 2B, 3B, 4B	Change under Alt 2C
73-Year Average Transfers (1922–1994)	250	343	349	353	93	99	103
7-Year Average Transfers (1928–1934)	497	549	542	550	52	45	53

Table 9-5. 2003 SWP Contractor Delivery Percentage

Region	Contractor	Percentage of Table A Deliveries	Alternative 2A		Alternative 2B, 3B, and 4B		Alternative 2C	
			2001 (taf)	2020 (taf)	2001 (taf)	2020 (taf)	2001 (taf)	2020 (taf)
North Bay Area (not exported from the Delta)	Napa County FC & WCD	0.7	0.14	0.27	0.1	0.02	0.04	0.28
	Solano County Water Agency	1.1	0.23	0.43	0.2	0.03	0.07	0.44
	Total	**1.8**	**0.37**	**0.71**	**0.3**	**0.1**	**0.11**	**0.72**
South Bay Area	Alameda County FC & WCD	1.9	0.39	0.74	0.4	0.06	0.11	0.76
	Alameda County Water District	1.0	0.21	0.39	0.2	0.03	0.06	0.40
	Santa Clara Valley Water District	2.4	0.50	0.94	0.5	0.07	0.14	0.96
	Total	**5.3**	**1.10**	**2.08**	**1.0**	**0.2**	**0.32**	**2.12**
Central Coast Area	San Luis Obispo County FC & WCD	0.6	0.12	0.24	0.1	0.02	0.04	0.24
	Santa Barbara County FC & WCD	1.1	0.23	0.43	0.2	0.03	0.07	0.44
	Total	**1.7**	**0.35**	**0.67**	**0.3**	**0.1**	**0.10**	**0.68**
San Joaquin Valley Area	Dudley Ridge Water District	1.4	0.29	0.55	0.3	0.04	0.08	0.56
	Empire West Side Irrigation District	0.07	0.01	0.03	0.0	0.00	0.00	0.03
	Kern County Water Agency	24.0	4.97	9.41	4.6	0.72	1.44	9.60
	County of Kings	0.1	0.02	0.04	0.0	0.00	0.01	0.04
	Oak Flat Water District	0.1	0.02	0.04	0.0	0.00	0.01	0.04
	Tulare Lake Basin Water Storage District	2.7	0.56	1.06	0.5	0.08	0.16	1.08
	Total	**28.3**	**5.86**	**11.09**	**5.4**	**0.9**	**1.70**	**11.35**
Southern California Area	Antelope Valley–East Kern Water Agency	3.4	0.70	1.33	0.6	0.10	0.20	1.36
	Castaic Lake Water Agency	2.3	0.48	0.90	0.4	0.07	0.14	0.92
	Coachella Valley Water District	0.6	0.12	0.24	0.1	0.02	0.04	0.24

Region	Contractor	Percentage of Table A Deliveries	Alternative 2A		Alternative 2B, 3B, and 4B		Alternative 2C	
			2001 (taf)	2020 (taf)	2001 (taf)	2020 (taf)	2001 (taf)	2020 (taf)
	Crestline–Lake Arrowhead Water Agency	0.1	0.02	0.04	0.0	0.00	0.01	0.04
	Desert Water Agency	0.9	0.19	0.35	0.2	0.03	0.05	0.36
	Little Rock Creek Irrigation District	0.1	0.02	0.04	0.0	0.00	0.01	0.04
	Mojave Water Agency	1.8	0.37	0.71	0.3	0.05	0.11	0.72
	Palmdale Water District	0.5	0.10	0.20	0.1	0.02	0.03	0.20
	San Bernardino Valley Municipal Water District	2.5	0.52	0.98	0.5	0.08	0.15	1.00
	San Gabriel Valley Municipal Water District	0.7	0.14	0.27	0.1	0.02	0.04	0.28
	San Gorgonio Pass Water Agency	0.4	0.08	0.16	0.1	0.01	0.02	0.16
	Metropolitan Water District of Southern California	48.2	9.98	18.89	9.2	1.45	2.89	19.28
	Ventura County Flood Control District	0.5	0.10	0.20	0.1	0.02	0.03	0.20
	Total	**61.9**	**12.81**	**24.26**	**11.8**	**1.9**	**3.72**	**24.80**
Feather River Area (not exported from the Delta)	City of Yuba City	0.2	0.04	0.08	0.0	0.01	0.01	0.08
	County of Butte	0.7	0.14	0.27	0.1	0.02	0.04	0.28
	Plumas County FC & WCD	0.06	0.01	0.02	0.0	0.00	0.00	0.02
	Total	**1.0**	**0.21**	**0.39**	**0.2**	**0.0**	**0.06**	**0.38**
State Water Project Total		**100**	**20.7**	**39.2**	**19.0**	**3.0**	**6.01**	**40.05**

FC & WCD = Flood Control and Water Conservation District.

Table 9-6. Estimated Changes in Average CVP Deliveries Occurring under Alternatives 2A, 2B, 2C, 3B, and 4B (thousand acre-feet)

		Alt 2A		Alt 2B, 3B, 4B		Alt 2C	
Beneficiary	Contractor Type	2001	2020	2001	2020	2001	2020
Westlands Water District	Agricultural Service	58	56	11.4	8.2	13	12.6
San Luis Water District	Agricultural Service	6	6	1.2	0.9	1.3	1.4
Panoche Water District	Agricultural Service	5	5	1	0.7	1.1	1.1
Other	Agricultural Service	24	22	4.7	3.2	5.4	5
Santa Clara Valley Water District	Municipal and Industrial	0	1	0	0.1	0	0.2
City of Tracy	Municipal and Industrial	0	0	0	0	0	0
San Benito County Water District	Municipal and Industrial	0	0	0	0	0	0
Kern-Tulare Irrigation District	Cross Valley Canal	4	3	0.8	0.4	0.9	0.7
Lower Tule River Irrigation District	Cross Valley Canal	3	3	0.6	0.4	0.7	0.7
Pixley Irrigation District	Cross Valley Canal	3	3	0.6	0.4	0.7	0.7
Other	Cross Valley Canal	4	3	0.8	0.4	0.9	0.7
Grasslands Water District	Refuge	0	0	0	0	0	0
San Luis National Wildlife Refuge	Refuge	0	0	0	0	0	0
Mendota Wildlife Management Area	Refuge	0	0	0	0	0	0
Exchange Contractors		0	0	0	0	0	0
Total		**107**	**101**	**21**	**15**	**24**	**23**

Note: "Other" includes other south-of-Delta water districts receiving CVP water. The major districts include Del Puerto Water District, Firebaugh Canal, and Broadview Water District.

Effects Resulting from Changes in Urban Land Use because of Increased Central Valley Project and State Water Project Deliveries

Making a connection between changes in the availability of water for urban uses resulting from implementing the SDIP and changes in growth patterns in particular jurisdictions (and the environmental impacts of that growth) is rather speculative.

While the allocations of any additional water made available by the SDIP to SWP and CVP contractors can be known, several of the SWP and CVP urban water contractors are water wholesalers who make independent decisions about which local jurisdictions or next-level wholesalers in their service area would receive additional water. Furthermore, these wholesalers may make allocations that vary over time depending on available supplies and shifting demands among retailers. Thus it is not possible to know where additional supplies from the export pumps would ultimately be delivered.

Further uncertainty is created by the following:

- Some contractors such as Metropolitan, the San Diego County Water Authority, and the Santa Clara Valley Water District have multiple sources of water that provide varying amounts of water over time or with varying reliability, making it difficult to determine whether an increment of additional SWP or CVP water would remove a barrier to growth or rather be put to use offsetting existing groundwater pumping or other surface water supplies.
- Some local jurisdictions have sufficient supplies to serve all projected growth in their general plans, so additional supplies would not induce or accommodate additional growth.
- Growth in some jurisdictions may be limited by water supplies but also may be constrained by other factors, such as the availability of land, utilities (such as sewer service and electrical service), transportation facilities, schools, wastewater treatment facilities or local growth management ordinances. These other factors may continue to limit growth, even if water supply reliability increases.
- Jurisdictions where growth is limited by water supply can attempt to obtain water from new sources if additional SWP water is not provided through this project.
- Some retailers and jurisdictions have the ability to store water during years when supplies are plentiful and hold it over to be used in years when supplies are scarce. This makes it more difficult to assess the growth-related effects of additional supplies for local jurisdictions.
- Local jurisdictions, not water suppliers, have control over land use decisions, both how much and where growth will occur. It would be extremely difficult to determine specific lands that would be developed as a result of the additional increment of water provided by the SDIP, and what resources would be affected by that additional growth.
- Local jurisdictions in southern California have typically based land-use planning on growth forecasts, which are usually based on factors such as demographic and economic forces, and not constrained by the availability of adequate water supplies (LSA Associates, Inc. 2003; EIP Associates 2004).

Some contractors, such as the Central Coast Water Authority, may rely solely on SWP supplies. The Santa Barbara/Goleta area and the area served by the Newhall County Water District are two examples of regions of California in which local governments have imposed limits on growth based on limits in their supply of water, and where additional water could lead to additional growth. While the Santa Barbara/Goleta area receives water from the SWP, the Monterey Peninsula area relies exclusively on local supplies. In areas that rely on the SWP or CVP and in which growth is limited by water supplies, providing additional water could lead to additional growth.

In summary, it would be remote, and speculative to identify specific pieces of land that would be developed and specific resource impacts that would occur as a result of implementing the SDIP alternatives, and neither CEQA nor NEPA requires such an analysis if it is too remotely connected to the proposed project alternatives or too speculative. However, it is possible to describe, in general terms, the amount of additional water that could be provided to each SWP and CVP contractor as a result of operational changes stemming from implementing the SDIP and to roughly calculate maximum amount of new development that could be supported from the water provided to urban suppliers. Information supporting the third-party water transfer analysis comes from the transfer analysis presented in Section 5.1.

Therefore, the analysis of these effects will be limited to providing an assessment of the additional CVP and SWP supplies for M&I users that may result from implementing Alternative 2A and a general discussion of the total amount of growth that could occur and the types of effects that could result from that amount of additional growth.

Determining How Much Additional Water May Result from South Delta Improvements Program Implementation

Hydrologic modeling results were used to estimate increases in deliveries to SWP and CVP contractors for each alternative. The CALSIM II results compared deliveries occurring under baseline conditions to 2001 and 2020 deliveries for all water year types for all SDIP alternatives.

Determining How Much Additional Water Each State Water Project Contractor May Receive

The SWP has approximately 29 contractors.. The percentage breakdown of SWP deliveries to each of its contractors is provided in Table 9-5. Of the 29 contractors, Metropolitan is the largest. Metropolitan has 26 member agencies, including cities and municipal water districts (Table 9-7). Metropolitan supplies varying amounts to each of these member agencies ranging from 100% to 0% of their total supply (The Metropolitan Water District of Southern California 2003a). There are also 12 other contractors in southern California that receive water from the SWP (Table 9-3).

Table 9-7. The Metropolitan Water District of Southern California Member Agencies

Member Agency	Number of Water Purveyors Sold to	Percentage of Water Received from Metropolitan
Calleguas Municipal Water District	20	76
Central Basin Municipal Water District	28	35
City of Anaheim	0	25
City of Beverly Hills	0	100
City of Burbank	0	50
City of Compton	0	53
Eastern Municipal Water District	8	75
Foothill Municipal Water District	7	60
City of Fullerton	0	25
City of Glendale	0	85
Inland Empire Utilities Agency	7	30
Las Virgenes Municipal Water District	0	100
City of Long Beach	0	42
City of Los Angeles	0	30
Municipal Water District of Orange County	29	50
City of Pasadena	0	60
San Diego County Water Authority	24	25
City of San Fernando	0	0
City of San Marino	0	10–15
City of Santa Ana	0	25
City of Santa Monica	0	82
Three Valleys Municipal Water District	11	60
City of Torrance	0	92
Upper San Gabriel Valley Municipal Utility District	8	80
West Basin Municipal Utility District	12	20
Western Municipal Water District of Riverside County	9	24

Source: The Metropolitan Water District of Southern California 2003b.

Determining How Much Additional Urban Growth Could Occur

Additional growth that could be supported by the additional water supply described above was calculated using data from *The Regional Water Management Plan for The Metropolitan Water District of Southern California* (The Metropolitan Water District of Southern California 2000). Table A.1-13 from that document provides projected per capita demand within the

Metropolitan service area. These values range from 186 gallons per person per day in 2000 to 192 gallons per person per day in 2020. To be conservative, the lowest per capita value of 186 gallons per day was used. It should be noted that this value represents all water use, so it includes both household and employment-related consumption. The value of 186 gallons per person per day was converted to 0.2083 acre-feet per person per year. Finally this consumption number was divided into the additional water supply value to calculate the number of additional persons that could be supported.

This estimate is intended to provide an upper boundary to the level of impact that could occur, not to imply that this amount of growth would occur as a result of the project.

Effects Resulting from Additional Third-Party Water Transfers

Increased supplies could also result from third parties acquiring water north of the Delta and transferring it to south of the Delta using some of the increase in allowable pumping at the SWP export pumps. For third-party supply effects, the linkage is more speculative than for changes in CVP and SWP deliveries. While changes in allocations attributable to project supply effects can be determined, there is a great deal of uncertainty regarding how much of this capacity would be used, which agencies will use the capacity to increase their water supply, and by how much.

Although recent water transfer history may provide some information, it would be speculative to attempt to apply that to future land use decisions. Also, historically, most water transfers have been short-term (e.g., 1-year) agreements that do not provide enough certainty to remove a barrier to additional growth in water-short regions. While some of the export capacity may be taken up by long-term transfers, and some information about potential long-term north-to-south water transfers is available, determining the buyers and the ultimate destination of the water would be speculative.

A transfer analysis was prepared based on the amount of unused July-September pumping capacity as indicated by the CALSIM modeling conducted for SDIP. A detailed discussion of the water transfer analysis is provided in Chapter 5, "Water Supply and Management."

Results

Construction-Related Effects

Over the duration of gate construction, approximately 140 jobs would be created directly under Alternatives 2A, 2B, 2C, and 3B and 120 jobs would be created under Alternative 4B. This increase in employment is expected to cause the population in the project area to increase by approximately 190 people under Alternatives 2A, 2B, 2C, and 3B and 120 people under Alternative 4B. It is assumed that there are three persons per housing unit, and approximately 40 housing units would be needed to accommodate the increase in population during construction. Currently there are approximately 1,094,400 housing units in the three-county area; therefore, the increase in demand for housing attributable to the proposed project alternatives would be minimal and would be met by existing supplies.

Because the population in the project area is 3.1 million, this increase in population under each alternative would not be expected to cause housing or other economic development and, therefore, would not result in the project being considered growth-inducing.

Effects Resulting from Changes in Agricultural Land and Water Use because of Increased Central Valley Project and State Water Project Deliveries

Currently the CVP delivers approximately 7.0 maf per year to 253 contractors. Table 9-3 indicates that CVP deliveries under Alternative 2A; Alternatives 2B, 3B, and 4B; and Alternative 2C would increase on average approximately 107 taf, 21 taf, and 24 taf, respectively. The greatest increase in deliveries would be to Westlands Water District (Table 9-6).

Although the SDIP alternatives would result in additional water going to CVP contractors, this is not considered a growth inducing-impact for the following reasons:

- Water will be used to compensate for recent reductions of historical deliveries/supplies to CVP contractors.
- Water will be delivered to the same service areas and places of use as it has been historically.
- Water will be delivered in the same manner, physically identical, to past CVP deliveries.
- There will be no change in the contract amounts of CVP contractors.
- There are other sources of water available to some water districts.
- The largest amount of water being made available (Alternative 2A) is only an approximate 5% increase over the approximate 2.6-maf deliveries on average south of the Delta.

SWP delivers water mainly for M&I purposes but does deliver water to some agricultural water suppliers, principally KCWA. However, KCWA typically has enough water to meet its requirements, so additional supplies are not expected to result in the conversion of any new lands to agriculture. Therefore, no agricultural growth inducement related to SWP contractors is expected. KCWA may bank and sell water to third-party SWP contractors. This is also not expected to result in agricultural growth inducement because it would not become a reliable source for these third-party contractors.

It should be acknowledged that the banking and transfer of water in the southern San Joaquin County is very complex. Therefore, some additional level of water transfers between SWP and CVP contractors could result from these increases in supplies. It would be remote and speculative to attempt to determine how much additional water could be transferred, and who the selling and receiving parties might be.

Effects Resulting from Changes in Urban Land Use because of Increased Central Valley Project and State Water Project Deliveries

Alternative 2A

As shown in Table 9-2, average SWP deliveries would increase under 2001 conditions by an average of 21 taf with implementation of Alternative 2A. Under 2020 conditions, deliveries would increase by an average of 39 taf.

Table 9-6 shows that no increase in CVP M&I deliveries is expected under 2001 conditions and a very minor increase is expected under 2020 conditions.

Based on the CALSIM II results, SWP M&I contractors would receive on average 15 taf of additional water. (Of this total, Metropolitan is expected to receive 10 taf of additional water during average and dry years. Other M&I users would receive 5 taf of additional water during average and dry years.)

The additional water that would be delivered to Metropolitan could go to any of its 26 member agencies. Determining the specific localities that would receive additional water or amounts of additional water delivered to each member agency would be highly speculative.

Based on an average per capita consumption of 0.208 acre-feet per person per year, the additional 15 taf of water could support approximately 72,000 additional people and their employment. It is not known, however, how much, if any, of this additional water would be allocated to new development.

Alternatives 2B, 3B, and 4B

Under Alternatives 2B, 3B, and 4B, average annual SWP deliveries would decrease under 2001 conditions by an average of 19 taf (Table 9-2). Under 2020 conditions, deliveries would increase by an average of 3 taf.

Table 9-6 shows that no increase in CVP M&I deliveries is expected under 2001 conditions, and a very minor increase is expected under 2020 conditions.

Based on the CALSIM II results, deliveries to SWP M&I contractors would be reduced by 14 taf. (Of this total, deliveries to MWD would be reduced by 9 taf.)

No growth-inducing impacts are expected under Alternatives 2B, 3B, and 4B because deliveries to M&I contractors would decrease under 2001 conditions and very slightly increase under 2020 conditions.

Alternative 2C

Under Alternative 2C, annual SWP deliveries would increase under 2001 by an average of 6 taf (Table 9-2). Under 2020 conditions, deliveries would increase by an average of 40 taf.

Table 9-6 shows that no increase in CVP M&I deliveries is expected under 2001 conditions and a very minor increase is expected under 2020 conditions.

Based on the CALSIM II results, SWP M&I contractors would receive on average 4.5 taf of additional water. (Of this total, MWD is expected to receive approximately 3 taf of additional water during average years.) Other M&I users would receive approximately 1.5 taf of additional water during average years.)

The additional water that would be delivered to MWD could go to any of its 26 member agencies. Determining the specific localities that would receive additional water or amounts of additional water delivered to each member agency would be highly speculative.

Based on an average per capita consumption of 0.208 acre-foot per person per year, the additional 4.5 taf of water could support approximately 21,600 additional people and their employment. It is not known, however, how much, if any, of this additional water would be allocated to new development.

Effects Resulting from Additional Third-Party Water Transfers

Potential increases in third-party water transfers under 2001 conditions are shown in Table 9-4, comparing the 2001 baseline to the 2001 for Alternative 2A;

Alternatives 2B, 3B, and 4B; and Alternative 2C. Under Alternative 2A, 76 taf more could be transferred during average years and 32 taf more could be transferred in dry years. Under Alternatives 2B, 3B, and 4B, 80 taf more could be transferred during average years and 32 taf more could be transferred in dry years. Under Alternative 2C, 77 taf more could be transferred during average years and 40 taf more could be transferred in dry years. Impacts associated with third-party water transfers would be nearly the same for all alternatives because the range of the increase in amount of water is very narrow (80 taf to 76 taf) among the alternatives.

The increase in the transfer capacity attributable to the SDIP is not expected to result in growth inducing impacts because the additional capacity would most likely be used to supplement existing supplies because transfers have historically been used to meet a short-term demand and do not remove a barrier to growth. In addition, the analysis of transfer-related impact in the area of use would be the responsibility of entities receiving the transferred water.

Impact Conclusions

Each alternative could remove an obstacle to growth. Although, the effects of the project, through the cultivation of once-fallowed agricultural lands or through the stimulation of the local economy by project construction, are not expected to accommodate or induce growth, the effects of the project, resulting from increases in water supplies for those receiving water exported from the Delta, could accommodate additional growth. This growth could result in the conversion of agricultural and other open land to urban uses that may adversely impact agricultural and biological resources (including special-status species and other sensitive resources) at those locations subject to such conversion. In addition this conversion could lead to changes in stormwater runoff quantity and quality, the modification of soils and slopes, and impacts on cultural resources. Increases in population could lead to impacts on air and water quality, traffic and noise conditions, and increases in the demand for such public services as schools, fire, police, sewer, solid waste disposal, and electrical and gas utilities. In addition, the expansion of such services could result in additional adverse impacts. Local jurisdictions could impose feasible mitigation measures on development that would reduce or eliminate these impacts, but as the location of any new growth cannot reasonably be predicted, estimating the potential for this would also be remote and speculative.

It would be extremely speculative to identify specific areas where growth could occur or the indirect effects on specific community service facilities in a particular service area. Overall, the potential exists that implementation of the SDIP could have some effect on growth and community facilities in service areas identified in Tables 9-5 and 9-7, but these effects, if they occur, would likely be extremely small, especially compared to other social and economic variables that can influence growth and services.

It is also possible that implementation of the SDIP could encourage or facilitate other activities that could result in growth-related effects. Because the SDIP is one of the key water conveyance projects identified in the CALFED ROD, it is conceivable that other possible water conveyance and storage projects could benefit or be facilitated by implementing the SDIP actions. Although conveyance and storage projects identified in the CALFED ROD are also independent actions that could be implemented with or without other proposed actions, these projects are clearly interrelated and have the potential to be complementary in improving SWP and CVP water supply reliability. Therefore, the SDIP may also be growth-inducing to the extent that the additional export capacity is used in the future to convey additional water supply from north-of-Delta storage facilities to south-of-Delta service areas. Because the amount and distribution of future water supplies are highly uncertain, the extent to which these potential growth effects could result in environmental impacts in service areas is considered too speculative to quantify.

Mitigation of these impacts, should they occur, would be the responsibility of the local jurisdictions in which the growth would occur, not DWR or Reclamation. The impacts of this growth, if any, would be (and in some cases have been) analyzed in detail either in general plan EIRs for the local jurisdictions or in project-level CEQA compliance documents. Mitigation measures could include locating the growth in areas where sensitive resources are absent, minimizing the loss of these resources, or replacing any loss.

Comparison of Alternatives

The analysis above addressed the growth-inducing impacts of each alternative. Tables 9-2, 9-3, and 9-4 provide a comparison of the changes in average SWP and CVP water deliveries and of third-party water transfers by water year type for Alternatives 2A; Alternatives 2B, 3B, and 4B; and Alternative 2C.

Increases in average deliveries would be greatest under Alternative 2A, reflecting a combined SWP Table A/CVP deliveries of 128 taf. Changes in average deliveries would be smallest under Alternatives 2B, 3B, and 4B, which reflected a combined SWP/CVP delivery of 2 taf. In some year types, primarily under Alternatives 2B, 3B, and 4B, deliveries actually would be expected to decrease compared to the 2001 and 2020 study baseline.

Alternative 2B would result in declines in CVP and SWP deliveries under 2001 study conditions, and only small increases in deliveries under 2020 study conditions. Alternative 2C would result in greater CVP and SWP deliveries, but less than the increase estimated for Alternative 2A. Over a 73-year averaging period, the SWP delivery increases would be less than that for Alternative 2A. It is expected that the agricultural and urban growth inducement potential and resultant impacts would be less under Alternatives 2B, 3B, and 4B and Alternative 2C than under Alternative 2A. Similarly, the capacity to facilitate third-party water transfers under Alternatives 2B, 3B, and 4B and Alternative 2C would be roughly equivalent to that under Alternative 2A.

None of the alternatives is expected to result in growth-related effects during construction of the flow control gates because construction would be temporary and would result in a very small change in the population in the project area.

In summary, the growth-inducing impacts expected to occur under Alternative 2A would be greater than those under Alternatives 2B, 3B, and 4B and Alternative 2C because the largest increase in SWP and CVP deliveries would occur under Alternative 2C. Similarly, growth-inducing impacts under Alternative 2C would be greater than under Alternatives 2B, 3B, and 4B. The location and extent of the impacts of any growth induced by each alternative cannot be known at this time. Growth-related effects would be the responsibility of local jurisdictions to identify and mitigate.

Chapter 10
Cumulative Impacts

10.1 Summary

State CEQA Guidelines and NEPA regulations require that the cumulative impacts of a proposed project be addressed in an EIS/EIR. The cumulative impact analysis determines the combined effect of the SDIP and other closely related, reasonably foreseeable, projects. This chapter introduces the methods used to evaluate cumulative effects, lists related projects and describes their relationship to the SDIP, identifies cumulative impacts by resource area, and recommends mitigation for significant cumulative effects. The cumulative impact analysis uses both quantitative tools (i.e., hydrologic modeling) and qualitative assessments to determine the potential combined impact of the SDIP and other related projects.

10.2 Approach to Cumulative Impact Analysis

Legal Requirements

State CEQA Guidelines and NEPA regulations require that the cumulative impacts of a proposed project be addressed in an EIS/EIR when the cumulative impacts are expected to be significant and, under CEQA, when the project's incremental effect is cumulatively considerable (Guidelines 15130[a], 40 CFR 1508.25[a][2]). Cumulative impacts are impacts on the environment that result from the incremental impacts of a proposed action when added to other past, present, and reasonably foreseeable future actions (Guidelines 15355[b], 40 CFR 1508.7). Such impacts can result from individually minor but collectively significant actions taking place over time.

Section 15130 of the State CEQA Guidelines states that the discussion of cumulative impacts need not provide as much detail as the discussion of effects attributable to the project alone. The level of detail should be guided by what is practical and reasonable.

Methodology

According to the State CEQA Guidelines (Section 15130), an adequate discussion of significant cumulative impacts should contain the following elements:

- an analysis of related future projects or planned development that would affect resources in the project area similar to those affected by the proposed project (Table 10-1),
- a summary of the expected environmental effects to be produced by those projects with specific reference to additional information stating where that information is available, and
- a reasonable analysis of the cumulative impacts of the relevant projects. An EIR shall examine reasonable, feasible options for mitigating or avoiding the project's contribution to any significant cumulative effects.

To identify the related projects, the State CEQA Guidelines (15130[b]) recommend either the "list" or "projection" approach. This analysis uses the list approach, which entails listing past, present, and probable future projects producing related or cumulative impacts, including, if necessary, those projects outside the control of the agency. This approach is consistent with the methods used in the CALFED Programmatic EIS/EIR cumulative impact analysis.

Although NEPA does not provide specific guidance as to how to conduct a cumulative impact assessment, Reclamation's NEPA Handbook states that an EIS should "identify associated actions (past, present, or future) which, when viewed with the proposed or alternative actions, may have cumulative significant impacts. Future cumulative impacts should not be speculative but should be based on known long-range plans, regulations, or operating agreements." (Bureau of Reclamation Draft NEPA Handbook, pp. 8–18.)

Both CEQA and NEPA allow the scope of a cumulative impact analysis to be limited through the use of tiering (40 CFR 1508.28, State CEQA Guidelines 15130). Tiering can be used when cumulative impacts have been adequately addressed in a previous document certified for a programmatic plan and the current project is consistent with the plan. The CALFED Programmatic EIS/EIR evaluated cumulative impacts. The CALFED Programmatic EIS/EIR compiled a list of major projects for consideration in the cumulative impact analysis. The list focused on future actions that could affect the physical features of the Bay-Delta system, and on the future federal and state policies that could affect the CVP and SWP. Although the CALFED Programmatic EIS/EIR analysis helps identify cumulative projects, this chapter includes a more thorough analysis of cumulative impacts resulting from the SDIP alternatives, OCAP, and other projects that have the potential to affect similar resources in the vicinity of SDIP improvements. The Programmatic EIS/EIR list of cumulative projects and the CALFED ROD were used to develop the list of projects for this analysis.

Table 10-1. Projects Considered for the Cumulative Impact Analysis

Project	Criterion 1: Is the action under active consideration?	Criterion 2: Does the action have recently completed environmental documentation or are environmental documents in some stage of active development?	Criterion 3: Would the action be completed or operational within the timeframe being considered for the SDIP (assumed to be 2020)?	Criterion 4: Does the action, in combination with the SDIP alternatives, have the potential to affect the same resources?	Role in Cumulative Assessment		Notes
					Quantitative	Qualitative	
CALFED Storage Program							
Shasta Lake Enlargement	Y	N	N	Y		X	It will take Reclamation approximately 15 years to complete a dam expansion process. The EIS/EIR will not be complete until 2008. The project will be not be completed and operating until after 2020.
North-of-Delta Off-stream Storage (Sites Reservoir)	Y	N	Y	Y		X	
In-Delta Storage	Y	Y	Y	Y		X	Although the private Delta Wetlands water project has completed environmental review, this project is being reevaluated by CALFED agencies. Because the final design and use of In-Delta storage has yet to be determined, this project is included in the qualitative assessment of cumulative effects.
Los Vaqueros Reservoir Expansion	Y	N	N	Y		X	It will take Reclamation approximately 15 years to complete a dam expansion process. The EIS/EIR will not be complete until 2007. The project will be not be completed and operating until after 2020.
Upper San Joaquin River Storage	Y	N	N	Y		X	Actions to expand dams or storage areas will most likely not take place until after 2020, so long as feasibility studies planned for completion in 2005 warrant further consideration of the project.
CALFED Conveyance Program							
10,300 cfs at Banks	Y	N	N	Y		X	
Tracy Fish Test Facility	Y	N	Y	Y		X	
Lower San Joaquin Flood Improvements	Y	N	Y	Y		X	It was intended that this project be implemented in 2005, but it has been indefinitely delayed. Delays should not last through 2020.
Old River and Rock Slough Water Quality Improvement Project	Y	N	Y	Y		X	

Project	Criterion 1: Is the action under active consideration?	Criterion 2: Does the action have recently completed environmental documentation or are environmental documents in some stage of active development?	Criterion 3: Would the action be completed or operational within the timeframe being considered for the SDIP (assumed to be 2020)?	Criterion 4: Does the action, in combination with the SDIP alternatives, have the potential to affect the same resources?	Role in Cumulative Assessment: Quantitative	Role in Cumulative Assessment: Qualitative	Notes
Delta Cross Channel Reoperation and Through-Delta Facility	Y	N	Y	Y		X	If this project is implemented, it will be before 2020.
North Delta Flood Control Project	Y	N	Y	Y		X	
Delta-Mendota Canal/ California Aqueduct Intertie	Y	Y	Y	Y	X		
CCF–Tracy Pumping Plant Intertie	Y	N	N	Y		X	The CALFED ROD did not set a schedule for completion of this project but initiation on work is expected on or after 2006.
CALFED Drinking Water Quality Program ***							
Bay Area Water Quality and Supply Reliability Program	Y	N	Y	Y		X	This program would involve construction of interconnects between existing and future Bay Area water supplies. The environmental review phase of program planning has not been initiated.
San Joaquin Valley/ Southern California Water Exchange	Y	N	Y	Y		X	Environmental review is expected to be complete, and implementation is expected to begin, by 2007.
North Bay Aqueduct Improvements	Y	N	Y	N			
San Luis Reservoir Low Point Improvement Project	Y	Y	Y	Y		X	
CALFED Ecosystem Restoration Program	Y	Y	Y	Y		X	Individual projects under this CALFED program complete their environmental documentation and permits as they are proposed. The CALFED PEIS/EIR provides a programmatic assessment of these programs.
CALFED Levees Program	Y	Y	Y	Y		X	Individual projects under this CALFED program complete their environmental documentation and permits as they are proposed. The CALFED PEIS/EIR provides a programmatic assessment of these programs.

Project	Criterion 1: Is the action under active consideration?	Criterion 2: Does the action have recently completed environmental documentation or are environmental documents in some stage of active development?	Criterion 3: Would the action be completed or operational within the timeframe being considered for the SDIP (assumed to be 2020)?	Criterion 4: Does the action, in combination with the SDIP alternatives, have the potential to affect the same resources?	Role in Cumulative Assessment		Notes
					Quantitative	Qualitative	
Other CVP/SWP-related Projects							
Freeport Regional Water Project	Y	Y	Y	Y	X		
Trinity River Mainstream Fishery Restoration Program	Y	Y	Y	Y	X		
Sacramento Valley Water Management Agreement (Phase 8)	Y	N	Y	Y		X	Most of the project components involve only the cooperation of northern California water users to increase water use efficiency. This will likely be accomplished by 2020.
Water Transfer and Acquisition Programs							
CALFED Environmental Water Account	Y	Y	Y	Y	X		It is quantitative because 190,000 acre-feet were purchased and an additional 190,000 acre-feet will be gained each year through modification of pumping procedures
CALFED Environmental Water Program	Y	N	Y	Y		X	The program has not been implemented because of funding constraints, but should be by year 2020.
Delta Improvements Package	Y	Y	Y	Y		X	The Delta Improvements Package will be implemented in phases and includes actions that have already been implemented.
Local Projects							
State Route 4 Bypass Project	Y	Y	Y	Y		X	The first phase of this project is complete and the next phases are scheduled for 2004–10, depending on available funding.
Mountain House	Y	Y	Y	Y		X	
River Islands	Y	Y	Y	Y		X	
East Altamont Energy Center	Y	Y	Y	Y		X	
City of Sacramento Water Facility Expansion Project	Y	Y	Y	N		X	Notice of Determination was filed on November 27, 2000. Construction began in October 2001.

SDIP cumulative impacts are analyzed both quantitatively and qualitatively. Cumulative effects related to water supply, Delta tidal hydraulics, water quality, and fisheries are evaluated quantitatively and qualitatively to capture those aspects of the SWP and CVP operations that can be captured using CALSIM II and those that cannot because of uncertainty about a project's effect on operations. Cumulative effects related to all other topics are evaluated qualitatively. The following sections describe each approach.

Quantitative Cumulative Impact Assessment

Hydrologic modeling can be used to evaluate cumulative effects of changes to the SWP and CVP operations on hydrology and aquatic resources (e.g., water supplies, tidal hydraulics, water quality, fisheries). However, to quantitatively evaluate changes in hydrologic conditions, projects must be well defined and "reasonably foreseeable." Although the CALFED ROD identifies many projects, few are far enough along in the planning stages to be well defined. Because many related programs would likely compete for water and for conveyance and pumping capacity, it would be speculative to determine how each project would operate and even which projects would be completed. Therefore, only those projects that have been adequately defined (e.g., in recent project-level environmental documents or CALSIM II modeling) and that have the potential to contribute to cumulative impacts are included in the quantitative assessment. All other projects that are under active consideration are included in the cumulative analysis using qualitative means (see below).

Future hydrologic cumulative conditions are quantitatively simulated using the CALSIM II modeling process. A summary of this approach is provided here but is further described in Sections 5.1, 5.2, and 5.3 of Chapter 5. Overall, four categories of model runs were conducted: (1) existing conditions without project, (2) existing conditions with project, (3) future no action condition, and (4) future with-project condition. Individual model runs were conducted for each SDIP project alternative under the with-project and future with-project conditions. Model runs were also completed for the OCAP BA that included future with-project conditions. The relationship of these model runs is illustrated in Figure 10-1 and described below.

The technical approach for conducting the cumulative impact assessment involved comparing CALSIM II hydrologic model output for the future with-project condition against the existing condition. The existing condition includes 2001 level of development per DWR's Bulletin 160-98, existing CVP and SWP operational rules and facilities, and current use of the EWA, a CALFED water transfer program described below. The future with-project model runs, which represents the cumulative condition under each SDIP alternative include two future with-project simulations: (1) the SDIP future with-project condition that includes implementation of SDIP Alternatives at 2020 level of development, increases in Sacramento River diversions as a result of the Freeport Regional Water Project (FRWP) (see below), EWA assumptions, other assumptions consistent with the 2003 OCAP Biological Assessment CALSIM II simulations, and SDIP Alternative 2A; and (2) future with-project assuming OCAP modeling assumptions for 2020 level of development. The OCAP CALSIM II model output was developed for the OCAP BA and is generally accepted as representing the most up-to-date assumptions for future operations of the CVP and SWP. CALSIM output for OCAP is summarized with the SDIP output to provide a summary comparison of CALSIM results (Table 10-2). Because of the importance of OCAP in describing the probable future cumulative changes to CVP/SWP operations, it is briefly described below.

To assess the incremental contribution of the SDIP alternatives to cumulative impacts, the future with-project conditions are compared to the future no action condition. By subtracting the SDIP alternative from the future no action condition, the incremental contributions of the SDIP can be defined.

The CALSIM II model outputs are used to help evaluate changes in water supply, water management, water quality, and fisheries resources. The tools used to determine the environmental effects of hydrologic changes under the cumulative scenario are the same as those used in the project impact analysis chapters. Please refer to Sections 5.1, Water Supply and Management, 5.2, Delta Tidal Hydraulics, 5.3, Water Quality, and 7.1, Fisheries and Aquatic Resources, for more information on impact assessment methods.

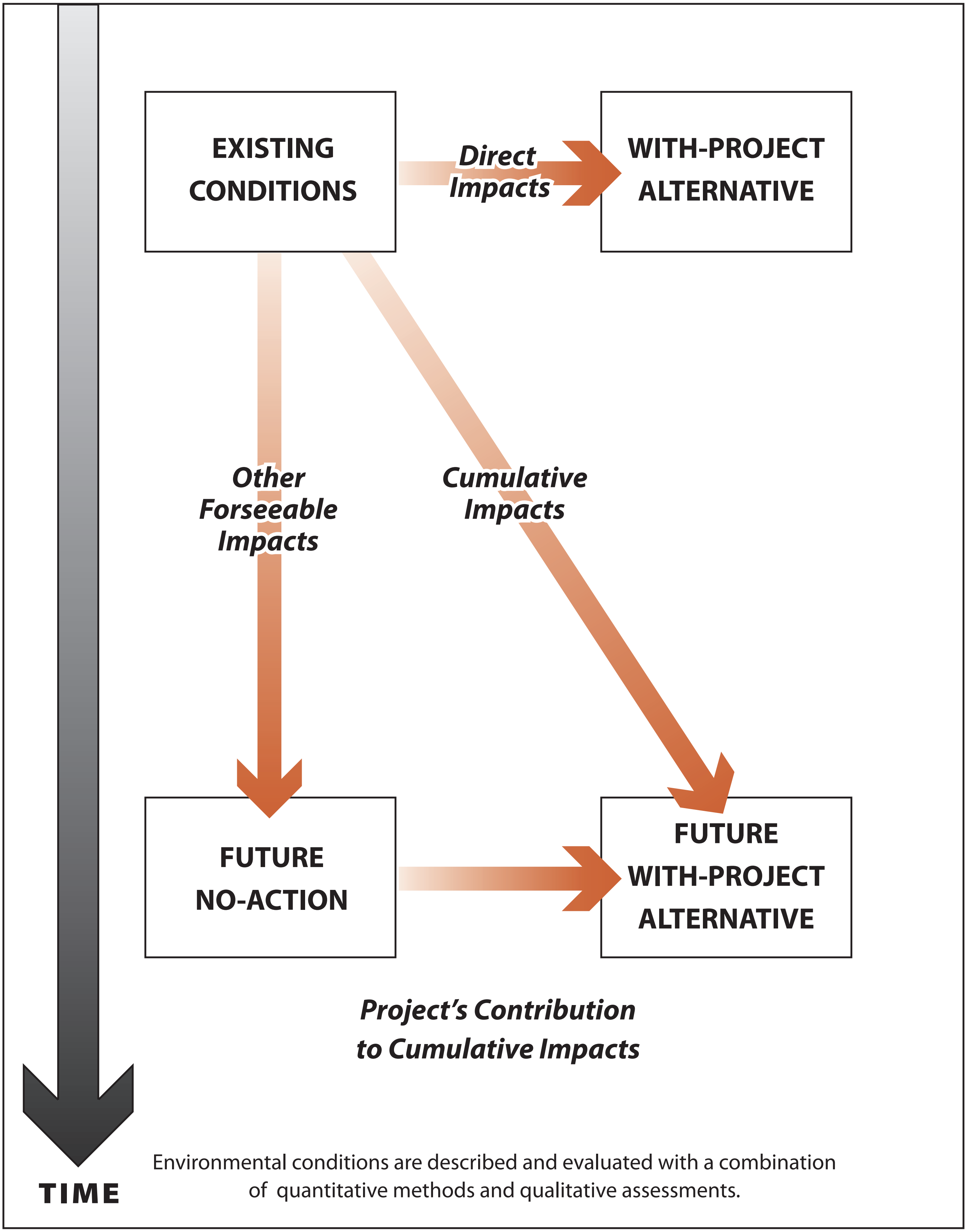
Operations Criteria and Plan

The Central Valley OCAP describes the regulatory and physical constraints and conditions under which the CVP and SWP currently operates. OCAP is the basis for the BOs that authorize take of endangered species and also explains the methods used in the determination of effects on endangered species for the current operating procedures. The documentation and analysis of operations contained in OCAP provided the basis for entering Section 7 ESA consultation with NOAA Fisheries and USFWS. Policymakers and technical specialists now also use OCAP to understand the operations of the CVP and SWP.

OCAP describes the benefits from and the objectives for each division in the Sacramento and San Joaquin River systems. These benefits/objectives cover such topics as recreation, water supply, power generation and supply, water storage, flood control, fishery enhancement, and water quality. Objectives assist Reclamation in determining the management strategies for each division of the CVP. OCAP also discusses operation of major facilities relied upon by SWP and CVP, such as CCF for joint operations at SWP Banks and San Luis Reservoir.

OCAP plays an important role in the operations of both the CVP and the SWP. Changes in pumping operations in either project must be consistent with OCAP to be covered by permits and BOs obtained based on operations described in OCAP. Important assumptions used for the CALSIM II modeling of OCAP include the following:

- Trinity River Mainstem ROD flows,



Jones & Stokes

Figure 10-1
Cumulative Impacts

Table 10-2. Summary Cumulative Frequency Results of CALSIM Hydrologic Modeling for South Delta Improvements Program Alternative 2A and OCAP at a 2020 Level of Development

Percentile	2001 Baseline	2001 Alternative 2A	2001 OCAP	2020 Baseline	2020 Alternative 2A	2020 OCAP
Shasta Reservoir Carryover Storage (taf)						
Min	550	550	550	550	550	561
10	956	974	975	884	895	927
20	2,133	2,134	2,134	1,901	1,924	1,924
30	2,373	2,270	2,282	2,227	2,149	2,218
40	2,608	2,527	2,580	2,518	2,393	2,410
50	2,840	2,734	2,752	2,691	2,621	2,730
60	2,949	2,918	2,933	2,847	2,800	2,754
70	3,178	3,081	3,089	3,041	3,024	3,083
80	3,400	3,400	3,393	3,377	3,357	3,400
90	3,400	3,400	3,400	3,400	3,400	3,400
Max	3,400	3,400	3,400	3,400	3,400	3,400
Avg	2,607	2,559	2,647	2,513	2,475	2,514
Oroville Reservoir Carryover Storage (taf)						
Min	216	185	173	387	388	391
10	1,183	1,197	1,188	1,193	1,199	1,297
20	1,442	1,466	1,456	1,459	1,444	1,490
30	1,629	1,662	1,648	1,651	1,650	1,641
40	1,812	1,792	1,793	1,734	1,732	1,759
50	1,939	2,008	1,987	1,931	1,913	1,923
60	2,213	2,105	2,105	2,184	2,113	2,064
70	2,504	2,382	2,459	2,407	2,443	2,410
80	2,943	2,874	2,851	2,730	2,800	2,727
90	3,145	3,150	3,157	3,096	2,992	2,995
Max	3,351	3,351	3,351	3,351	3,351	3,351
Avg	2,100	2,076	2,066	2,048	2,040	2,031
Folsom Reservoir Carryover Storage (taf)						
Min	90	90	90	90	90	90
10	222	209	202	196	189	253
20	367	365	366	357	340	368
30	410	399	399	393	379	387
40	455	464	467	425	428	462
50	521	493	508	487	465	556
60	586	557	562	548	508	591
70	607	600	600	593	590	637
80	650	650	650	650	645	650
90	650	650	650	650	650	650
Max	650	650	650	650	650	650
Avg	489	480	532	468	458	496
New Melones Reservoir Carryover Storage (taf)						
Min	132	129	129	130	120	199
10	701	700	700	699	699	737
20	890	890	890	888	889	972
30	1,057	1,056	1,056	1,056	1,055	1,163
40	1,235	1,233	1,234	1,235	1,234	1,312
50	1,332	1,331	1,331	1,332	1,332	1,374
60	1,408	1,404	1,405	1,410	1,406	1,461
70	1,565	1,564	1,564	1,568	1,564	1,626
80	1,750	1,746	1,747	1,752	1,748	1,802
90	2,011	2,006	2,008	2,014	2,008	2,052
Max	2,270	2,270	2,270	2,270	2,270	2,270
Avg	1,323	1,322	1,379	1,324	1,322	1,380

Table 10-2. Continued

Percentile	2001 Baseline	2001 Alternative 2A	2001 OCAP	2020 Baseline	2020 Alternative 2A	2020 OCAP
CVP Tracy Annual Export Pumping (taf)						
Min	872	848	1,022	915	922	953
10	1,593	1,599	1,640	1,644	1,543	1,623
20	1,929	1,909	1,919	1,918	1,893	1,907
30	2,230	2,231	2,140	2,091	2,115	2,099
40	2,398	2,366	2,444	2,364	2,330	2,337
50	2,481	2,448	2,480	2,435	2,413	2,442
60	2,543	2,551	2,564	2,543	2,518	2,570
70	2,594	2,621	2,637	2,646	2,622	2,634
80	2,678	2,708	2,682	2,690	2,698	2,756
90	2,749	2,754	2,759	2,747	2,754	2,820
Max	2,838	2,854	2,884	2,823	2,828	3,009
Avg	2,312	2,304	2,325	2,305	2,286	2,318
SWP Banks Annual Export Pumping (taf)						
Min	1,169	1,169	1,136	1,119	1,127	1,234
10	1,798	1,775	1,723	1,743	1,704	1,760
20	2,623	2,705	2,523	2,682	2,785	2,703
30	3,112	3,282	2,969	3,141	3,286	3,050
40	3,338	3,519	3,222	3,409	3,459	3,433
50	3,601	3,772	3,455	3,626	3,870	3,727
60	3,726	3,942	3,662	3,795	4,023	3,843
70	3,871	4,086	3,836	3,957	4,119	3,968
80	4,017	4,330	3,930	4,119	4,362	4,098
90	4,197	4,578	4,342	4,310	4,668	4,520
Max	4,646	5,056	4,594	4,532	5,092	5,209
Avg	3,312	3,514	3,262	3,357	3,559	3,444
CVP San Luis Reservoir Carryover Storage (taf)						
Min	51	45	45	65	45	45
10	90	90	95	85	90	74
20	130	124	133	135	135	121
30	148	135	148	156	143	134
40	171	159	166	168	167	141
50	198	181	193	194	186	165
60	228	223	226	226	220	194
70	261	268	263	278	259	225
80	303	323	337	348	357	377
90	439	428	399	414	509	573
Max	966	972	972	912	901	801
Avg	242	240	229	242	248	242
SWP San Luis Reservoir Carryover Storage (taf)						
Min	55	100	110	55	109	55
10	110	110	110	110	110	55
20	133	131	132	120	134	61
30	147	152	146	144	151	110
40	215	216	195	174	171	129
50	269	292	289	290	267	170
60	368	360	353	327	350	289
70	452	501	473	409	406	360
80	581	624	646	559	519	553
90	740	798	807	719	706	771
Max	1,067	1,067	1,067	1,067	1,067	1,067
Avg	358	381	351	332	342	300

- increased water demands on the American River,
- delivery of CVP water to the proposed FRWP,
- operation of SDIP at 8,500 cfs
- use of water transfers,
- implementation of the long-term EWA,
- operation of the Tracy Fish Facility,
- operation of the SWP-CVP Intertie,
- modifications to the North Bay Aqueduct,
- operation of Suisun Marsh salinity control gates, and
- operation of the Skinner Fish Facility.

Future changes in CVP and SWP operations must be consistent with the OCAP descriptions and resulting Biological Opinions and permits.

Qualitative Cumulative Impact Assessment

The qualitative analysis of cumulative effects considers projects and activities that are in the planning stage or are being discussed by various entities (such as various CALFED actions) but that have not been sufficiently defined to be considered “reasonably foreseeable” and quantifiable. Projects that are not yet quantifiable using CALSIM simulations, but that could have an effect on Delta resources, are addressed qualitatively to provide as much information on potential cumulative effects as possible. For water supply, tidal hydraulics, water quality, and fisheries resources, this qualitative analysis follows a discussion that is based on a quantitative evaluation and provides additional context for potential future effects and benefits. All other topics that are not dependent on hydrology, water level, or water quality or that are not effectively evaluated using hydrologic modeling are assessed in a qualitative manner.

10.3 List of Related and Reasonably Foreseeable Projects and Actions

This analysis incorporates all reasonably foreseeable, relevant projects and focuses on those water management actions or projects that, when combined with the SDIP, could contribute to cumulative effects. Scoping for the SDIP EIS/EIR, the CALFED ROD, and other recent documents was used to identify projects considered in the cumulative effect analysis. The following criteria, taken from the CALFED Programmatic EIS/EIR, were used to narrow the list of projects considered in the analysis:

1. The action is under active consideration.

2. The action has recently completed project-level environmental documentation or environmental documents in some stage of active completion (e.g., public draft EIS/EIR).
3. The action would be completed or operational within the timeframe being considered for the SDIP (assumed to be 2020).
4. The action, in combination with the SDIP alternatives, has the potential to affect the same resources.

Projects that meet all four criteria and would affect water operations are included in the quantitative analysis. The qualitative analysis considers projects that are not described in detail in an existing project-level environmental document (criterion 2) but could affect the same resources in the same timeframe as the SDIP.

Table 10-1 lists projects considered for the cumulative effects section, whether they meet the above criteria, and how they are incorporated into this analysis (i.e., quantitatively or qualitatively). Descriptions of each project and their relationship to the SDIP are provided below.

CALFED Storage Program

Shasta Reservoir Enlargement

The CALFED ROD includes enlargement of Shasta Reservoir as an option to increase storage north of the Delta. One alternative to expand Shasta Reservoir is to raise the height of the dam by 6.5 feet, which would inundate a segment of McCloud River, protected under the California Wild and Scenic Rivers Act, as well as portions of the Pit River and Upper Sacramento River. Other alternatives include modifications to the dam and reservoir re-operations. This project is currently in the planning stages, with an "Initial Alternatives Information Report" prepared in 2004. At the time of this writing, an environmental document has not been issued for the project but is anticipated to be released in 2008.

The Shasta Enlargement Project could contribute to cumulative effects on water supplies and associated resources. The project could increase water supplies available for export in those years when Shasta Reservoir otherwise would have spilled. This project could also modify the timing and magnitude of upstream reservoir releases in wet years. This project is included in the qualitative cumulative analysis.

North-of-Delta Off-Stream Storage (Sites Reservoir)

The CALFED Agencies are currently studying several off-stream storage locations including Sites Reservoir, located 70 miles northwest of Sacramento, as possible options for additional storage. With a potential maximum capacity of

1.8 maf, Sites Reservoir could increase the reliability of water supplies for a large portion of the Sacramento Valley and could improve fish migration by reducing water diversions on the Sacramento River.

The Sites Reservoir Project could contribute to cumulative effects on water supplies and associated resources. The project could increase water supplies available for export in those years when water otherwise would have been unavailable for storage and export. This project could also modify the timing and magnitude of upstream reservoir releases in wet years.

A Notice of Preparation/Notice of Intent (NOP/NOI) for this project was issued in November 2001 and public scoping for the environmental document occurred in January 2002. The project environmental document and engineering feasibility study are in progress and are scheduled for completion in fall 2006. This project is included in the qualitative cumulative analysis.

In-Delta Storage

The CALFED agencies are exploring options for storing water in the Delta. In-Delta Storage would increase the reliability, operational flexibility, and water availability for south-of-Delta water users. An in-Delta storage location can capture peak flows through the Delta in the winter when the CVP and SWP systems do not have the capacity or ability to capture those flows. Water can then be released from the in-Delta reservoirs during periods of export demands, typically summer months. Storing water in the Delta provides the opportunity to change the timing of Delta exports and the ability to capture flows during periods of low impacts on fish. One option is to lease or purchase the Delta Wetlands Project, a private water development project that would divert and store up to 217,000 acre-feet on two islands in the Delta and dedicate two other islands for habitat improvements. The Delta Wetlands Project was analyzed in environmental documents and permits were issued for the private project in 2001. As part of the Delta Wetlands Project, Webb Tract and Bacon Island would be converted to reservoirs, and Bouldin Island and Holland Tract would be used as wetland and wildlife habitat.

DWR released the In-Delta Storage Draft State Feasibility Reports in January 2004. Because the decisions needed to implement this type of project have not been made, it is included in the qualitative cumulative analysis.

Los Vaqueros Reservoir Expansion

Reclamation, DWR, and the CCWD are conducting a feasibility study examining alternatives to improve water quality and water supply reliability for Bay Area water users while enhancing the Delta environment, which will include expanding the existing Los Vaqueros Reservoir as well as a variety of other alternatives. Current work has focused on planning-level evaluations of expanding Los Vaqueros reservoir from 100,000 acre-feet up to 500,000 acre-feet in order to improve Bay Area water quality and water supply reliability. An expanded reservoir would require a new or expanded Delta intake, with a capacity of up to 1,750 cfs for the maximum reservoir size. Locations being considered for the new Delta intake include Old River and adjacent channels. Water from an expanded reservoir could be delivered to Bay Area water users through a connection to the South Bay Aqueduct.

The Los Vaqueros Reservoir expansion study is in the early planning stage. A Draft Planning Report, including an evaluation of the environmental impacts of an expanded Los Vaqueros Expansion alternative on the Delta, was released in May 2003 (California Bay-Delta Authority 2004). Studies conducted for the Draft Planning Report show that there would be no significant effect on water levels for current Delta water users, or on river velocities. An expanded Los Vaqueros could change the timing of diversions from the Delta. Passage of Measure N in March 2004 allows further environmental and engineering studies to continue, with planned environmental review public scoping meetings to be held in early 2005 and a tentative EIR/EIS schedule of 2007. Effects of a Los Vaqueros expansion are considered in the qualitative cumulative impact assessment below.

The Los Vaqueros Reservoir Expansion could contribute to cumulative effects on water supplies and associated resources. The project could increase water supplies available for export in those years when Los Vaqueros Reservoir otherwise would have spilled. This project could also modify the timing and magnitude of upstream reservoir releases in wet years. Because this project is in its early environmental documentation stages, the cumulative analysis will be qualitative.

Upper San Joaquin River Basin Storage Investigation

The Upper San Joaquin River Basin Storage Investigation is considering a range of approaches to increase water supplies through possible enlargement of Millerton Lake at Friant Dam. Reclamation and DWR are conducting the Upper San Joaquin River Basin Storage Investigation to consider a 700,000-acre-foot Millerton Lake expansion and other alternatives to providing surface storage in the upper San Joaquin River Basin. As stated in the CALFED ROD, the goal of the project is to “contribute to restoration of and improve water quality for the San Joaquin River and facilitate conjunctive water management and water exchanges that improve the quality of water deliveries to urban communities.” The investigations are ongoing. The first of a series of reports analyzing alternatives was completed in 2003, with a second report, an “Initial Alternatives Information Report,” due for completion in spring 2005. A final feasibility report and environmental review would be prepared at a later unscheduled date.

This project has the potential to improve fish conditions in the San Joaquin River and could increase flows into the Delta, depending on operation of Friant Dam and Delta Mendota Pool. This project is included in the qualitative cumulative analysis.

CALFED Conveyance Program

10,300 cfs at Banks Pumping Plant

- The CALFED ROD envisioned two steps for conveyance improvements in the south Delta: Banks at 8,500 cfs and other improvements for fish and local impacts, and
- Banks at 10,300 cfs with construction of operable barriers and a new intake and fish screening facility at CCF to support the maximum pumping rate.

This EIS/EIR incorporates components of both projects above: the increased diversions up to 8,500 cfs and the installation of permanent operable gates. The ROD states that pumping and diversions may not increase to 10,300 cfs until the gates and fish screen are installed.

SWP Banks has a physical export pumping capacity of 10,300 cfs; however, current permit terms limit the diversion of water to CCF to 6,680 cfs. Implementation of the SDIP, as described and evaluated in this document, would increase allowable diversions at CCF from 6,680 cfs to 8,500 cfs. To take advantage of the full pump capacity of 10,300 cfs, DWR would need to construct fish screens and increase the capability of the Clifton Court Fish Facility to handle fish entering CCF. Also, the existing intake to CCF may physically limit flows needed to support 10,300 cfs and would need substantial modifications to accommodate the new fish screens. Therefore, a new CCF intake would be constructed as part of the 10,300 cfs project.

The 10,300 cfs at Banks Project has not yet been defined in detail; there are two major issues yet to be resolved. First, DWR has not yet determined either how operation of the SWP pumps would change with 10,300 cfs or what would be the priority for the increased pump capacity. Second, the design and effectiveness of a new intake and fish screen facility is dependent on feasibility evaluation and testing (see “Tracy Fish Test Facility” below). Implementation of the Tracy Fish Test Facility has been put on hold. Until the effectiveness of a new fish facility is tested and proven, the feasibility of the 10,300 cfs project is unknown. This project is included in the qualitative cumulative analysis.

Tracy Fish Test Facility

The Tracy Fish Test Facility, to be constructed near Byron, California, will develop and implement new fish collection, holding, transport, and release technology to significantly improve fish protection at the major water diversions in the south Delta. DWR and Reclamation will use results of the Tracy Fish Test Facility to design the CCF Fish Facility, an element of the 10,300 cfs project described above, and improve fish protection at the CVP Tracy facility as required by the CVPIA. The test facility, unlike conventional fish screening facilities, will require fish screening, fish holding, and fish transport and stocking capabilities. The facility would be designed to screen about 500 cfs of water at an approach velocity of 0.2 ft/s and meet other appropriate fish agency criteria. The facility would have the structural and operational flexibility to optimize screening operations for multiple species in the south Delta. However, construction of the facility has been delayed by shortfalls in funding. The South Delta Fish Facilities Forum, a CALFED workgroup, is evaluating the cost effectiveness and cost sustainability of the fish facilities strategy.

If eventually constructed, the Tracy Fish Test Facility would not affect current CVP and SWP operations. This project is included in the qualitative cumulative analysis.

Lower San Joaquin Flood Improvements

The primary objective of this project is to "design and construct floodway improvements on the lower San Joaquin River and provide conveyance, flood control, and ecosystem benefits" (CALFED ROD). This project would construct setback levees in the South Delta Ecological Unit along the San Joaquin River between Mossdale and Stockton, and convert adjacent lands to overflow basins and nontidal wetlands or land designated for agricultural use. The levees are necessary for future urbanization and will be compatible with the Sacramento and San Joaquin River Basins comprehensive study. Progress has been indefinitely delayed with no scheduled date for completion. Nevertheless, if implemented, the project may also include the restoration of riparian and riverine aquatic habitat, increased riparian habitat, restrictions of/on dredging and sediment disposal, reduction of invasive plants, and protection and mitigation of effects on threatened or endangered species. This project could contribute to ecosystem improvements in the lower San Joaquin River and is considered qualitatively in the cumulative effects section.

Delta Cross Channel Re-operation and Through-Delta Facility

As part of the CALFED ROD, changes in the operation of the DCC and the potential for a Through-Delta Facility (TDF) are being evaluated. Studies are being conducted to determine how changing the operations of the DCC could benefit fish and water quality. This evaluation will help determine whether a screened through-Delta facility is needed to improve fisheries and avoid water quality disruptions. In conjunction with the DCC operations studies, feasibility studies are being conducted to determine the effectiveness of a TDF. The TDF would include a screened diversion on the Sacramento River of up to 4,000 cfs and conveyance of that water into the Delta.

Both a DCC re-operation and a TDF would change the flow patterns and water quality in the Delta, affecting fisheries, ecosystems, and water supply reliability. Further consideration of related actions will take place only after completion of several assessments, scheduled for completion in November 2005. This project is included in the qualitative cumulative analysis.

North Delta Flood Control and Ecosystem Restoration Project

The purpose of the North Delta Flood Control and Ecosystem Restoration Project is to implement flood control improvements in the northeast Delta in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. The North Delta project area includes the North and South Fork Mokelumne Rivers and adjacent channels downstream of Interstate-5 and upstream of the San Joaquin River. Solution components being considered for flood control include bridge replacement, setback levees, dredging, island bypass systems, and island detention systems. The project will include ecosystem restoration and science actions in this area, and improving and enhancing recreation opportunities. In support of the environmental review process, an NOP/NOI was prepared and public scoping was held in 2003. Modeling studies are under preparation with construction preliminarily scheduled for some time in 2008. This project is included in the qualitative cumulative analysis.

Delta-Mendota Canal/California Aqueduct Intertie

The DMC and California Aqueduct Intertie (Intertie) consists of construction and operation of a pumping plant and pipeline connections between the DMC and California Aqueduct. The Intertie alignment is proposed for DMC milepost 7.1, where the DMC and California Aqueduct are about 400 feet apart. The Intertie would provide operational flexibility between the DMC and California Aqueduct. It would not result in any changes to authorized pumping capacity at CVP Tracy or SWP Banks.

The average daily pumping capacity at CVP Tracy is limited to 4,600 cfs, which is the existing capacity of the upper DMC and its intake channel. However, because of conveyance limitations in the lower DMC and other factors, pumping at CVP Tracy is almost always less than 4,600 cfs. DMC conveyance capacity is affected by subsidence; canal siltation and deposition; the amount, timing and location of water deliveries from the DMC; the facility design; and other factors. By linking the upper DMC with the California Aqueduct, the Intertie would allow year-round CVP Tracy pumping up to 4,600 cfs, subject to all applicable export pumping restrictions for water quality and fishery protections. CVP Tracy capacity would remain limited to its existing authorized pumping capacity of 4,600 cfs.

A negative declaration and finding of no significant impact has been prepared and was circulated for public comment in December 2004. This project is considered in the quantitative analysis of cumulative impacts.

Clifton Court Forebay–Tracy Pumping Plant Intertie

This project would construct an intertie between the CVP and the CCF. It would require an increase in the capacity of the proposed CCF screened intake (see description of 10,300-cfs at Banks, above). This project would provide increased operational flexibility by modifying intake operations to improve the water quality of exports, improving water supply reliability, and minimizing impacts on fish entrainment. Because this project is not yet defined in detail, it is included in the qualitative cumulative analysis

CALFED Drinking Water Quality Program

Old River and Rock Slough Water Quality Improvement Project

CCWD is working with CALFED Agencies to design a project to minimize salinity and other constituents of concern in drinking water by relocating or reducing agricultural drainage in the south Delta. CCWD intake facilities are located on Rock Slough and Old River, which also receive agricultural drainage water discharged from adjacent agricultural lands. Agricultural drainage water can adversely affect water quality entering the CCWD system. Therefore, alternatives are being considered to improve water quality in these locations through reconfigurations of agricultural drains and other options. This project is expected to be completed in Fall 2005.

Bay Area Water Quality and Reliability Program

The Bay Area Water Quality and Reliability Program would encourage participating Bay Area partners, including Alameda County Water District, Alameda County Flood Control & Water Conservation District, Bay Area Water Users Association, Contra Costa Water District, East Bay Municipal Utility District (EBMUD), San Francisco, and the Santa Clara Valley Water District (SCVWD), to develop and coordinate regional exchange projects to improve water quality and supply reliability. This project would include the cooperation of these agencies in operating their water supplies for the benefit of the entire Bay Area region as well as the potential construction of interconnects between existing water supplies. This program is in the preliminary planning stages. No specific projects have been proposed and evaluated in detail. This project is included in the qualitative cumulative analysis.

San Joaquin Valley/Southern California Water Exchange

This program would facilitate a partnership between Metropolitan and San Joaquin interests to help improve the water quality in Southern California and the water conveyance infrastructure in Northern California by better managing the water supply. This would include resolving water supply and water quality problems of water quality sampling, reconnaissance and feasibility analyses, and environmental documentation. This project is included in the qualitative cumulative analysis.

North Bay Aqueduct Intake Project

The North Bay Aqueduct Project would construct a new intake for the North Bay Aqueduct to increase the flow in the aqueduct. It will involve the construction of pipeline corridors and connection points to the existing North Bay Aqueduct. Possible intake points are the Deep Water Ship Channel, Sutter/Elk Slough, Steamboat Slough, Miner Slough, and Main Stem Sacramento River. Because this project is not yet defined in detail, it is included in the qualitative cumulative analysis.

San Luis Reservoir Low Point Improvement Project

The San Luis Low Point Improvement Project would use one or a combination of alternatives, including treatment options, bypasses, and other storage options, to reduce the risk of “low point” water levels. When water levels in San Luis Reservoir are low, high water temperatures combined with wind-induced mixing result in algal blooms at the reservoir’s water surface. This condition degrades water quality, making the water difficult or impractical to treat, and can prevent deliveries of water from San Luis Reservoir to San Felipe Division contractors. In order to solve the low point problem, the Reclamation and DWR have operated the reservoir to maintain water levels above the critical low elevation—the low point—resulting in approximately 200,000 acre-feet of unallocated water to remain as “carryover” in the reservoir. The SCVWD, working with Reclamation, are exploring options to address the low point problem.

The alternatives being considered to avoid water quality problems for the SCVWD and to increase the effective storage capacity of the reservoir include, but are not limited to:

- a bypass to the San Felipe Unit around the San Luis Reservoir,
- treatment options such as dissolved air flotation,
- algae harvesting or application of algaecides,
- lowering the San Felipe Division intake facilities, and

- expansion of Pacheco Reservoir.

The Low Point Improvement Project is currently in the planning stages. A NOP/NOI to prepare an EIS/EIR was released in August 2002, and the EIS/EIR is expected to be released in 2006, with possible implementation sometime during or after 2007. Implementation of this project would restore operational flexibility of the San Luis Reservoir and improve reliability of water deliveries to CVP contractors. This project is included in the qualitative cumulative analysis.

CALFED Ecosystem Restoration Program

The goals of the CALFED ERP are to:

- recover 19 at-risk native species and contribute to the recovery of 25 additional species;
- rehabilitate natural processes related to hydrology, stream channels, sediment, floodplains and ecosystem water quality;
- maintain and enhance fish populations critical to commercial, sport and recreational fisheries;
- protect and restore functional habitats, including aquatic, upland and riparian, to allow species to thrive;
- reduce the negative impacts of invasive species and prevent additional introductions that compete with and destroy native species; and
- improve and maintain water and sediment quality to better support ecosystem health and allow species to flourish.

The ERP plan, which is divided into the Sacramento, San Joaquin, and Delta and Eastside Tributary regions, includes the following kinds of actions:

- develop and implement habitat management and restoration actions, including restoration of river corridors and floodplains, reconstruction of channel-floodplain interactions, and restoration of Delta aquatic habitats;
- restore habitat that would specifically benefit one or more at-risk species;
- implement fish passage programs and conduct passage studies;
- continue major fish screen projects and conduct studies to improve knowledge of their effects;
- restore geomorphic processes in stream and riparian corridors;
- implement actions to improve understanding of at-risk species;
- develop understanding and technologies to reduce the impacts of irrigation drainage on the San Joaquin River and reduce transport of contaminant (selenium) loads carried by the San Joaquin to the Delta and the Bay; and

- implement actions to prevent, control, and reduce impacts from nonnative invasive species.

ERP actions contribute to cumulative benefits on fish and wildlife species, habitats, and ecological processes and are considered in the qualitative analysis of cumulative effects.

CALFED Levees Program

The goal of the CALFED Levees Program is to uniformly improve Delta levees by modifying cross sections, raising levee height, widening levee crown, flattening levee slopes, or constructing stability berms. Estimates predict that there are 520 miles of levees in need of improvement and maintenance to meet the PL 84-99 standard for Delta levees. The levees program continues to implement levee improvements throughout the Delta, including the south Delta area. The program is included in the qualitative cumulative analysis.

Other CVP/SWP-Related Projects

Freeport Regional Water Project

FRWP is a regional water supply project being developed on the Sacramento River near the town of Freeport by the Sacramento County Water Agency (SCWA) and EBMUD, in close coordination with the City of Sacramento and Reclamation. The project is designed to help meet future drinking water needs in the central Sacramento County area and supplement aggressive water conservation and recycling programs in the East Bay to provide adequate water supply during future drought periods.

FRWP will provide up to 100 mgd of water for EBMUD to use during drought years and 85 mgd for SCWA for use in all years. The project would divert water from the Sacramento River and deliver it to a Sacramento County Treatment facility and the Folsom South Canal. From the Folsom South Canal, water will be delivered to the Mokelumne Aqueducts. This project would require the construction of fish screens and a pumping plant at the intake on the Sacramento River, a water treatment facility in Sacramento County, and pipeline facilities to transport the water from Freeport to the Mokelumne Aqueduct.

A final EIS/EIR was certified in April 2004, with the subsequent notice of determination and record of decision filed in April 2004 and January 2005, respectively. Completion and activation of the treatment plant and diversion are anticipated between 2008 and 2010. By diverting water on the Sacramento River, the FRWP could affect Delta inflows. This project is included in the quantitative cumulative analysis.

Sacramento Valley Water Management Agreement (Phase 8)

The State Water Board has held proceedings regarding the responsibility for meeting the flow-related water quality standards in the Delta established by the Delta WQCP (D-1641). The State Water Board hearings have focused on which users should provide this water, and Phase 8 focuses on the Sacramento Valley users. The Sacramento Valley Water Management Agreement (SVWMA) is an alternative to the State Water Board's Phase 8 proceedings. The SVWMA, entered into by DWR, Reclamation, Sacramento water users, and export water users, provides for a variety of local water management projects that will increase water supplies cumulatively. For example, the SVWMA includes a provision to have upstream users provide 185,000 acre-feet of water through conjunctive management projects in 2005. An environmental document is being prepared for the program. This action is included in the qualitative cumulative analysis.

Trinity River Mainstream Fishery Restoration Program

The Trinity River Mainstream Fishery Restoration Program Environmental Impact Statement (TRMFRP EIS) ROD issued December 19, 2000, allocates 369–815 taf annually for Trinity River flows. Although in litigation for several years, recent federal court decisions will allow implementation of the Trinity ROD flows. Prior to this most recent decision, a previous court order directed the CVP to release 368.6 taf in critically dry years and 452 taf in all other years. Temperature objectives for the Trinity River are set forth in State Water Board Water Rights Order 90-5 (WR 90-5). Operationally, for the purposes of establishing the Trinity River flows, the water year type will be forecasted by Reclamation based on a 50% forecast on April 1. To avoid warming and to function most efficiently for temperature control, water is exported for the Trinity River Basin through Whiskeytown Reservoir and into the Sacramento River Basin during the late spring.

Delta Improvements Package

The DIP is an outline for CALFED agencies to implement a series of projects, programs, and activities that will help meet the balanced implementation goal of the CALFED Program. Many of the activities identified in the DIP were also described in the CALFED ROD. However, some actions (listed below) were not, but are also reasonably foreseeable and are included in the cumulative impacts assessment:

- San Joaquin River Salinity Management Plan—DWR and Reclamation developed a plan to maintain compliance with all existing Delta water quality salinity objectives. The RWQCB adopted an amendment to the basin plan and forwarded it to the State Water Board for final action. The State Water Board has not set a hearing date.

- Vernalis Flow Objectives—The San Joaquin Water Quality Management Group, an interagency working group, is currently looking at the salinity problem in the lower San Joaquin River and the DO problem in the Stockton DWSC. A report of findings and recommendations is in process.
- San Joaquin River Dissolved Oxygen—CALFED agencies would develop a plan to help improve water quality in the Stockton DWSC.
- Franks Tract—State and federal agencies would evaluate and implement, if appropriate and authorized, a strategy to significantly reduce salinity levels in the south Delta and at the CCWD and SWP/CVP export facilities and improve water supply reliability by reconfiguring levees and/or Delta circulation patterns around Frank Tract while accommodating recreational interests.
- Relocation of M&I Intake—state and federal agencies will work with CCWD to relocate their intake to the lower part of Victoria Canal should the above actions not provide acceptable continuous improvements in Delta water quality.
- Delta Regional Ecosystem Restoration Implementation Plan (DRERIP)—This plan is intended to refine the existing planning foundation specific to the Delta, refine existing Delta-specific restoration actions, and provide guidance for Delta specific ERP tracking, performance evaluation, and adaptive management feedback.
- Science Actions and Commitments—several studies would be conducted, including a Focused Study on South Delta Hydrodynamics, Water Quality, and Fish; Focused Study on Delta Smelt and Fish Facilities; South Delta Fish Facilities; and Performance Evaluation and Monitoring Program.

Water Transfers and Acquisition Programs

CALFED Environmental Water Account

The EWA is designed to mitigate for water loss during times when CVP and SWP pumping is reduced in an effort to avoid harming fish as they migrate through the Delta. The EWA was created to address two problems: declining fish populations and unreliable water supplies. Its purpose is to better protect fish by making it possible to modify water project operations in the Bay-Delta and still meet the needs of water users. To do that, the EWA buys water from willing sellers or diverts surplus water when safe for fish, then banks, stores, transfers and releases it as needed to protect fish and compensate water users. The EWA has set a goal of acquiring up to 188,000 acre-feet of water each year through purchases. EWA expects to obtain some water through additional pumping at times safe for fish (CALFED ROD). The EWA was set up as a short-term program, and its use as a long-term management tool is being considered by EWA agencies. The final EIS/EIR evaluating an EWA program through 2007 was adopted in March 2004. Although the environmental review covered only implementation of the EWA up to 2007, it is assumed that the EWA would continue in future years at a level similar to its existing one. A draft EIS/EIR on a long-term EWA is expected to be released in December 2006. Implementation of the EWA beyond 2007 is included in the quantitative cumulative analysis.

CALFED Environmental Water Program

The Environmental Water Program (EWP) has been set up by CALFED Agencies to carry out flow-related goals of the ERP Plan. The EWP would purchase 100,000 acre-feet of water per year from willing sellers to increase the integrity of the instream and riparian ecosystems and provide spawning fish with adequate habitat. This water would remain in tributaries to the Sacramento and San Joaquin Rivers and could not be taken for non-environmental uses. At this time, only pilot water acquisitions are planned. After evaluation of the pilot program, an environmental document that covers full implementation of the program would be prepared. This project will be included in the qualitative analysis.

Current Capacity for Potential Water Transfers

Under the current level of diversion at SWP Banks, water may be transferred from North-of-Delta water users to South-of-Delta water users from July through September. The average water transfer capacity based on the 2001 CALSIM baseline was 250 taf/yr (see Figure 5.1-34). The water transfer capacity will be greatest in dry years with reduced SWP deliveries. However, substantial water transfers of more than 200 taf/yr are currently possible in a range of delivery years, not just in dry years. Current potential water transfers may be limited by available water supplies and demands, and may also be limited by water quality and fish protection requirements.

An average of 200 taf/yr out of the total of 250 taf/yr of potential water transfers (about 80%) might be allowed within the E/I ratio, without any relaxation of the E/I ratio or additional inflow.

Local Projects

State Route 4 Bypass Project

Caltrans is modifying SR 4 in an effort to ease traffic through the cities of Brentwood and Oakley and to provide access to the growing areas of southeast Antioch and western Brentwood. The project is being developed cooperatively by Caltrans, Contra Costa County, and the Cities of Antioch, Brentwood, and Oakley. The highway will be relocated east of Oakley and on the eastern edge of Brentwood. The project is expected to be complete, and the old highway relinquished, between 2006 and 2008.

Mountain House New Town

Trimark Communities has gained approval to develop a new community in the western portion of San Joaquin County along the Alameda–San Joaquin County line and north of Interstate 205. At full buildout a total of 16,105 residential units on 4,784 acres would be developed. Mountain House will be located directly south of Old River and west of Patterson Pass Road, and will include residential, commercial, and some industrial development. It has been designed to accommodate all the needs of the expected 43,522 residents, including housing, jobs, retail, commercial, open space, and public services, such as schools, emergency services, and roads. The EIR was completed in 1994. Construction began in 2003.

River Islands Development

The Cambay Group, Inc. is proposing to develop approximately 4,990 acres of agricultural land and open space known as the River Islands at Lathrop Project. The project applicant intends to build a mixed-use residential/commercial development on Stewart Tract and Paradise Cut. Stewart Tract is an inbound island bounded by Paradise Cut, the San Joaquin River, and Old River. Paradise Cut consists of a flood control bypass connecting the San Joaquin River and Old River in the Delta. This mixed-use development is expected to include a town center, employment center, dock facilities, residences, and golf courses. It is expected to generate 31,680 residents and 16,751 jobs at full buildout. The Draft Subsequent EIR was completed in October of 2002 and buildout of the development is planned for 2025.

East Altamont Energy Center

Western Area Power Authority plans to construct an energy center with the intent to market power from hydroelectric plants, such as Shasta and Folsom dams, to other entities, such as merchant power plants. The center would be located on a 174-acre parcel of land approximately 1 mile west of the San Joaquin County line and 1 mile southeast of the Contra Costa County line. The actual footprint of the plant would be approximately 55 acres, with the remainder of the parcel available for agricultural leases. Water for cooling and other power plant processes would be provided by Byron Bethany Irrigation District. The plant is expected to have a 30 to 50 year operating life. Environmental documentation equivalent to an EIS/EIR (Revised Presiding Member's Proposed Decision) was completed in January 2003 and approval from the Energy Commission was granted in August 2003.

Water Facilities Expansion Project

The City of Sacramento is in the process of expanding and replacing facilities at the E. A. Fairbairn Water Treatment Plant (WTP) and the Sacramento River WTP. The purpose of this project is to allow the City to reliably meet increasing water demands and to allow diversions to be shifted from the American River to the Sacramento River. The Fairbairn WTP is being expanded from approximately 90 mgd to 200 mgd. The Sacramento River WTP is being expanded from approximately 110 mgd to 160 mgd. Construction at both plants includes some new facilities as well as improvements to some of the existing facilities. It is expected that the Fairbairn WTP construction will be completed within approximately 32 months, while construction at the Sacramento River WTP is expected to be completed within approximately 34 months. Construction at both facilities may ultimately require up to 164,000 linear feet of transmission pipeline improvements. A final EIR was completed for this project in November of 2000, and construction of the project began in October of 2001.

10.4 Summary of Cumulative Effects by Resource

Quantitative Assessment

Quantitative assessment of cumulative water supply changes is summarized below. The discussion of the cumulative water supply changes that could be expected under future with-project conditions is intended to show the potential for improving future water supply reliability and to provide quantified hydrological information that is used to judge cumulative impacts on specific resources, including Delta water quality and fisheries conditions. Therefore, significance conclusions are not disclosed for cumulative water supply changes, but are disclosed for resource impacts that are influenced by water supply changes.

Water Supply

Cumulative water supply impacts are the changes in the environment that result from the incremental impact of the SDIP when added to other closely related past, present, and reasonably foreseeable probable future projects. The physical impacts in the environment resulting from changes in water supply would be the combination of effects in the reservoirs that store the water supply, in the rivers that convey the water supply, in the Delta where the water supply is diverted, and in the areas where the water supply is delivered and used.

Export Pumping

Because the long-term CVP-OCAP CALSIM simulations include all reasonably foreseeable future operations of CVP and SWP facilities, including the CVP-Intertie (connecting the DMC to the California Aqueduct to allow year-round 4,600 cfs CVP pumping capacity) and the SWP 8,500 cfs pumping capacity, the OCAP results can be used for quantitative evaluation of the cumulative water supply impacts.

The SDIP 2020 and OCAP CALSIM results suggest that, without a new source of water (i.e., new reservoirs), there would be very little change in the future CVP and SWP pumping with SDIP compared to the CVP and SWP pumping that would be allowed under current conditions. The OCAP 2020 CALSIM simulations suggest that cumulative impacts from increased CVP and SWP pumping, beyond those already identified as incremental SDIP project changes, are expected to be limited.

Table 10-2 shows summary statistics for CALSIM results that reflect future with-project conditions (2020 level of demand) as modeled for SDIP and OCAP. Cumulative hydrologic effects are represented by the difference between 2020 conditions with the Proposed Action and 2001 no action conditions. The incremental changes potentially attributable to the Proposed Action are represented by the difference between the simulated 2020 conditions with the Proposed Action and the 2020 no action conditions. The results indicate that under 2020 no action conditions, combined SWP and CVP average annual export pumping would increase slightly compared to no action conditions under a 2001 level of development. This result indicates that, under future operational conditions without increased SDIP export pumping (e.g., increased CCF diversions), combined CVP and SWP export pumping would not be expected to change substantially compared to total average annual export pumping because the CVP and SWP are already capable of delivering full water supplies during above-normal and wet years (approximately 50% of the years simulated in CALSIM) and unable to deliver water supplies that meet demands during drier periods. This basic water supply condition would not change substantially at a 2020 level of demand because existing CVP and SWP storage reservoirs are unable to deliver additional water.

Table 10-2 provides CALSIM statistics that allow an approximation of the probable cumulative CVP and SWP export pumping changes that are simulated using the SDIP 2020 level of demand condition and the OCAP 2020 level of demand condition. Table 10-2 indicates that cumulative export pumping under the SDIP and OCAP simulations would increase by approximately 190–221 taf and that the SDIP and OCAP cumulative results are similar. The increased SDIP pumping limit would account for most of the increased pumping, and its effect on SWP and CVP operations would be relatively small (less than 4%) compared to the combined average annual export pumping of these two projects. This cumulative result indicates that without a new source of water (i.e., new reservoir storage), relatively minor changes in future CVP and SWP export pumping would occur with SDIP compared to the export pumping that is currently allowed without SDIP under existing conditions. The contribution of SDIP to the cumulative export conditions would account for most of the change. The cumulative impacts of this export pumping are discussed below for Delta tidal hydraulics, water quality, and fisheries resources.

Water Deliveries

Cumulative south-of-Delta average annual water deliveries for CVP and SWP would increase slightly compared to existing conditions at a 2001 level of demand. Cumulative water supply conditions would result in average annual CVP water deliveries of approximately 100 taf, and SWP Table A and Article 21 deliveries would account for up to an additional 90 taf. Increased south-of-Delta deliveries would occur through additional Delta exports and additional reliance on San Luis Reservoir storage reserves (See Tables 5.1-12 and 5.1-13).

Reservoir Carryover Storage

Table 10-2 indicates that at a cumulative 2020 level of demand with SDIP, average annual reservoir carryover storage in Shasta Reservoir and Oroville Reservoir would be expected to decline slightly because of increased water demands and deliveries. Cumulative average annual carryover storage for Folsom Reservoir and New Melones Reservoir would be similar to the 2001 baseline conditions as would the CVP portion of San Luis Reservoir. The SWP portion of San Luis Reservoir carryover storage would be less than under existing conditions, reflecting increased SWP water demand and deliveries under cumulative conditions.

Water Transfers

Implementing SDIP as assumed in the long-term OCAP, could result in a cumulative increase in export pumping from possible water transfers during summer months. Under current (2001) and 2020 baseline (future with-project) conditions in many years, there will be unused SWP pumping capacity during the July-September period. While uncertainty exists regarding when or if this pumping capacity would be used for moving water transfers through the Delta in any particular future year, the availability of excess pumping capacity, projected increases in future water demands, and recent water transfer history suggest this potential is a possibility that could increase cumulative water deliveries south of the Delta.

Generally, the 2020 cumulative (with project) results indicate that the average summer (July–September) transfer capacity could be approximately 350 taf/yr with the assumed maximum transfer capacity of 200 taf/month (600 taf/yr). This potential cumulative water supply effect from water transfers is one of the major water supply change that could result from implementing SDIP and other past, present, and reasonably foreseeable water storage and conveyance projects. As described in Section 5.1, approximately 100 taf/yr of these potential water transfers are indirect effects from the SDIP project; the remaining 250 taf/yr are cumulative future effects that could occur without the SDIP project.

Other Water Storage and Conveyance Projects

As indicated in the discussion of probable storage and conveyance projects above, a substantial number of actions are currently being considered that, if implemented, could result in improved water supply reliability for north-of-Delta and south-of-Delta service areas. This qualitative cumulative analysis assumes that a number of water supply storage and conveyance projects could be implemented by 2020 with no judgment about which projects are likely to be implemented. These are the likely sources for water transfers that are discussed above and in Section 5.1.

Combining the cumulative projects that were modeled in SDIP and OCAP CALSIM analyses with other possible storage projects, including Shasta Reservoir Enlargement, North-of-Delta Off-Stream Storage, Los Vaqueros Reservoir Expansion, In-Delta Storage, and Upper San Joaquin River Basin Storage Investigation, could result in increased water supplies available for export in those years when water otherwise would have been unavailable for storage and export. Operating one or more of these projects could also result in modification of the timing and magnitude of upstream reservoir releases in wet years. Although it is speculative to identify the specific cumulative water supply and management effects that new or expanded storage projects would have on south Delta water supplies, it is reasonable to assume that current Delta protections for Delta outflow, D-1641 flow-related water quality requirements and current in-Delta uses would continue to be required. It is assumed that these types of storage projects could have positive effects on Delta water supply and resources by improving the amount and timing of flow to the Delta, providing flexibility in timing of storage and release of water for exports, and increasing the amount and timing of water used to protect sensitive aquatic species in upstream tributaries and Delta channels.

Constructing additional upstream and off-stream storage reservoirs would result in direct effects associated with changes in resources and land uses in a new or expanded reservoir. Enlarging Shasta Reservoir and constructing a new Sites Reservoir would not have a direct physical effect on Delta water supply resources because of their location upstream of the Delta; constructing these facilities would not result in construction-related cumulative impacts on Delta resources, including those in the south Delta. Constructing an In-Delta storage facility such as the Delta Wetlands Project and constructing a new Los Vaqueros intake facility would result in direct physical impacts on some Delta resources that are similar to those affected by constructing the Proposed Action. The potential cumulative effects of these project features are discussed below under Water Quality, Fish Resources, and Land Use. Potential cumulative water supply effects of constructing water supply infrastructure (storage and conveyance facilities or local development infrastructure) in the Delta include the potential for temporary disruption of local water supply attributable to increased turbidity during project construction. The potential for this cumulative water supply impact is considered less –than significant because the construction activities associated with these projects would be localized, agricultural diversions would not be affected, and they would be temporary. Each of these projects also would be required to implement standard construction-practice measures similar to those identified for SDIP Alternative 2A and mitigation measures identified in the CALFED Programmatic ROD for construction effects.

Water supply conveyance projects that are currently being considered that potentially could add to the cumulative effect on south Delta water supply and SWP/CVP operations include future plans to expand the Banks permitted pumping limit to 10,300 cfs, Delta Cross Channel Re-operation and Through-Delta Facility, and the Intertie (included in OCAP CALSIM modeling). It is the intent of these water supply conveyance improvements when considered with future water supply storage projects that conveying water supply for export purposes would be improved substantially by expanding SWP export pumping capacity, improving the operational flexibility of the DMC and California Aqueduct, and conveying water supplies through the Delta in the most ecologically beneficial way.

Other CALFED Programs

Other CALFED Program actions, including the Drinking Water and Reliability Program and the Levee Program actions, could result in some localized effects on Delta waterways (i.e., intake and levee improvements). These types of actions would generally be considered cumulatively beneficial from a water supply perspective because they are intended to improve the quality and reliability of water supplies for jurisdictions that depend on Delta water and because improving the stability of Delta levees is needed to ensure that Delta waterways are a reliable means for conveying water for in-Delta and export purposes.

The CALFED ERP actions when considered with other cumulative Delta projects and actions are intended to improve, in part, Delta habitat and conditions for fish and wildlife. Although implementing ERP actions in the Delta may result in some temporary disturbance of Delta waterways and habitat, it is unlikely that these effects would substantially affect local or export water supplies. Improvements to Delta aquatic and terrestrial habitats could result in improved water quality and habitat conditions that ultimately would be beneficial to improving local and export water supply reliability.

In addition to CALFED programs identified in the Programmatic ROD, CALFED agencies have formulated the DIP as a series of projects and programs, as described above, to help meet the balanced implementation goal of the CALFED program. Implementing a combination of these programs may have some influence on improving water supply and water quality conditions in the Delta. Implementing a number of these programs, such as Franks Tract improvements, also could contribute to short-term construction-related cumulative impacts in localized areas near the improvements.

Other Local Development Projects

Other local transportation and development projects in the vicinity of SDIP improvements (i.e., SR 4 Bypass, Mountain House and River Islands developments) are not expected to substantially affect local or export water supply conditions, because these projects are required to construct wastewater and drainage discharge facilities that would protect Delta water supply sources. These projects would not affect the amount or quality of water supply available for in-Delta uses and would not directly or indirectly affect operation of the SWP or CVP. This potential cumulative impact is less than significant.

Delta Tidal Hydraulics

The cumulative effects of SDIP and other reasonably foreseeable projects on Delta tidal hydraulics are expected to be similar to the simulated project impacts that were shown in the previous assessment sections. Besides the transfers that could occur under existing conditions as described above, no other projects (that can be evaluated using hydrologic modeling) are proposed in the vicinity of the SDIP that could substantially affect level and flow at the locations evaluated in this section. The operational effects of the four tidal gates have been shown to be nearly identical for all of the operational cases (2A, 2B, and 2C) for the 2001 LOD and 2020 LOD simulations. Some differences in tidal level and tidal flow conditions were simulated for Alternatives 3B (no Grant Line Canal tidal gate) and 4B (fish control gate only).

The cumulative effects on tidal hydraulics are considered to be less than significant because the minimum tide elevations are similar to the minimum tides experienced at many south Delta channel locations that are not directly influenced by pumping (e.g., Old River at Bacon Island). The SDIP alternatives have assumed that tidal gates will be operated to maintain a minimum tide elevation of 0 feet msl. Although this target elevation is not considered to be necessary for mitigation of tidal hydraulic effects, it is selected to improve the general conditions in the south Delta channels and possibly reduce the necessary pump and siphon extensions and the dredging required to maintain the local water supply pumps and siphons. These objectives have been specified as part of the project description and are not required for environmental mitigation. The cumulative effects of other possible projects that may influence SWP and CVP operations, including future water transfers during the summer months, are not expected to significantly affect the tidal hydraulic conditions in the south Delta beyond those impacts already simulated and evaluated for the SDIP alternatives. Water transfers will not result in diversion levels above 8,500 cfs, which is what was simulated in many months for the SDIP direct project effects. DWR and Reclamation will also jointly develop criteria to address any stage deficiencies at the Tracy Pumping Plant due to transfers through the SWP Banks Pumping Plant prior to the transfers occurring.

Other Water Storage and Conveyance Projects

Other water storage and conveyance projects outlined above are not expected to significantly affect cumulative tidal hydraulic conditions in the south Delta beyond those discussed for SDIP because level and flow conditions in south Delta channels would largely be controlled by SDIP permanent gate operation, and typical operation of storage reservoirs would not be expected to adversely affect level and flow conditions in the SDIP project area. Operating SWP Banks at a future permitted pumping capacity of 10,300 cfs is not expected to significantly affect south Delta channel level and flow because operation at this permitted capacity would be similar to the operations analyzed for 8,500 cfs permitted pumping capacity, and maintaining the level and flow improvements provided under SDIP alternatives would be required at an increased pumping level. Future storage reservoirs or expansion of existing reservoirs would not result in substantial reductions in level and flow in Delta channels because operating storage reservoirs typically involves storing river flows during high-flow periods (when level and flow conditions are not a water management concern in the Delta) and releasing flows during high demand summer periods. All of the existing flow-related water quality requirements of D-1641 and other Delta protections would continue in effect, and these future projects would be required to show how they are being met. Potential cumulative effects of storage and conveyance projects on south Delta level and flow conditions are considered less than significant.

Other CALFED Programs

Other CALFED Program actions, including the Drinking Water and Reliability Program and the Levee Program actions, could result in some localized effects on Delta waterways (i.e., intake and levee improvements), but none would be expected to significantly affect south Delta tidal hydraulic conditions because they would not affect water level and flow conditions. The CALFED ERP actions would not substantially affect cumulative Delta tidal level and flow conditions.

In addition to CALFED programs identified in the Programmatic ROD, a number of programs in the DIP, including Franks Tract improvements, Delta Cross Channel operations, and the Through-Delta Facility, could have generalized cumulative affects on water level and flow conditions in the Delta. The potential for cumulative, localized tidal hydraulic effects in the south Delta is believed to be unlikely because of the distance of these projects from SDIP improvements. Specific projects related to improving San Joaquin River salinity and DO conditions would have a positive effect on flow conditions.

Other Local Development Projects

Other local transportation and development projects in the vicinity of SDIP improvements (i.e., SR 4 Bypass, Mountain House and River Islands developments) are not expected to adversely affect Delta tidal hydraulic conditions because these projects would not modify level or flow conditions in Delta channels and would not affect operation of the CVP or SWP. The River Islands development project proposes to widen the Paradise Cut channel south of Stewart Tract to improve flood conveyance capacity and provide habitat for fish and wildlife. This project would also result in creation of back-bays on Old River adjacent to Stewart Tract. These changes are not expected to significantly affect level or flows on Old River or Paradise Cut and are not currently known to have adverse effects on other south Delta channels in the vicinity of Stewart Tract.

Water Quality

Cumulative future water quality impacts in the Delta can result from future changes in river inflow water quality, as well as future conditions of reduced Delta outflow. No other projects that are assumed in SDIP or OCAP CALSIM analyses are proposed in the vicinity of the SDIP permanent gates or CCF gates that could have a substantial effect on south Delta water quality. The quantifiable cumulative changes in south Delta water quality would be associated primarily with SDIP permanent gate operations and operation of the CCF gates.

There is a limit to the magnitude of the future salinity changes expected in the Delta channels. The D-1641 objectives for maximum EC are generally satisfied by CVP and SWP operations in the Delta. Delta outflow is therefore already regulated, and these minimum Delta outflows are included in the CALSIM simulations that are used for the DSM2 inputs. Water quality objectives for salinity at Vernalis are expected to maintain the future San Joaquin River EC values at about what they are simulated to be in the 2001 baseline and 2020 baseline conditions. Other potential future changes in inflow water quality, or increased discharges of treated wastewater, in the Delta are expected to be independent of the increased SWP Banks pumping anticipated with SDIP alternatives. These potential water quality changes are considered to be independent of the SDIP and will not be increased with the SDIP alternatives. These future changes in Delta water quality are expected to occur with or without the SDIP alternatives, and can be evaluated only generally.

Some future water transfers during the July–September period will be possible without the SDIP. As described above, the water quality effects from these additional exports are assumed to be compensated for by “carriage water” that will slightly increase Delta outflow during the transfer. No cumulative water quality impacts from any additional water transfers with SDIP are anticipated.

Some of the additional water quality actions and projects that are being considered and investigated by the CBDA Drinking Water Quality and CALFED

Science Programs, such as described in the Delta Improvement Program, may provide improvements in the south Delta salinity and DOC concentrations. These potential improvements would reduce the future baseline conditions, but would not likely reduce the SDIP water quality effects. However, the adaptive operations of the tidal gates will provide a substantial new tool for management of south Delta water quality. Incremental improvements, from whatever future baseline conditions develop, will be possible by careful monitoring of water quality and appropriate operations of the south Delta tidal gates.

No significant cumulative water quality impacts beyond those impacts identified for the SDIP alternatives would result from combining other past, present, or reasonably foreseeable projects.

Cumulative changes in DWSC DO concentrations would be considered less than significant during summer months because when the south Delta water level and quality objectives have been met, the head of Old River gate would be operated to improve San Joaquin River DO conditions.

Other Water Storage and Conveyance Projects

Other water storage and conveyance projects outlined above are not expected to significantly affect cumulative water quality conditions in the south Delta beyond those discussed for SDIP because operating these projects would require compliance with current Delta flow and water quality requirements. Operating SWP Banks facility at a future permitted pumping capacity of 10,300 cfs is not expected to significantly affect south Delta salinity, DOC and DO conditions because operations at this pumping capacity would be similar to operations described for SDIP at 8,500 cfs, and current Delta outflow and water quality criteria would be required at an increased level of SWP pumping. Future storage reservoirs or expansion of existing reservoirs would not result in substantial changes in south Delta water quality because operating storage reservoirs typically involves storing river flows during high flow periods when water quality conditions are not a concern in the Delta and releasing flows during high demand summer periods, when south Delta salinity and DO conditions are less desirable. All of the existing flow-related water quality requirements of D-1641 and other Delta protections would continue in effect, and these future projects would be required to show how they are being met. Potential cumulative effects of storage and conveyance projects on Delta water quality conditions are considered less than significant.

Other CALFED Programs

Other CALFED Program actions, including the Drinking Water and Reliability Program and the Levee Program actions, could result in some localized effects on Delta waterways (i.e., intake and levee improvements), but none would be expected to significantly affect south Delta water quality because current water quality protections would remain in place and these projects would not substantially affect Delta flow or water quality conditions. The CALFED ERP actions would not substantially affect cumulative Delta water quality conditions.

In addition to CALFED programs identified in the Programmatic ROD, a number of programs in the DIP, including Franks Tract improvements, San Joaquin River Salinity Management Plan, and Vernalis Flow Objectives, are proposed to improve salinity and DO conditions in the San Joaquin River and Delta. Overall, it is expected that these programs will have a beneficial effect on cumulative water quality conditions in the south Delta.

Other Local Development Projects

Other local transportation and development projects in the vicinity of SDIP improvements (i.e., SR 4 Bypass, Mountain House and River Islands developments) are not expected to adversely affect Delta water quality conditions because these projects would result in only minor localized effects on Delta waterways and would employ standard construction methods to minimize erosion and turbidity effects. Cumulative construction-related water quality effects would be similar to the types identified for SDIP Alternative 2A and could be additive, but are considered less-than-significant impacts because impacts on water quality would be minor and temporary. No additional mitigation is required.

Fish

The cumulative fisheries resource impacts of the SDIP and other reasonably foreseeable projects have been addressed quantitatively during ESA consultation for the coordinated operations of the CVP and SWP and the OCAP (National Marine Fisheries Service 2004; U.S. Fish and Wildlife Service 2004a). The BOs provide a project description for formal and early consultation elements, including a description of conservation measures (e.g., Water Rights Decision 1641, VAMP, EWA, CVPIA b(2), and an adaptive management process that is primarily centered on use of the Delta Smelt Risk Assessment Matrix (DSRAM) (National Marine Fisheries Service 2004; U.S. Fish and Wildlife Service 2004a). Formal consultation covers the effects of proposed 2020 operations of the CVP and SWP, including:

- long-term EWA to provide targeted pumping reductions,
- continued (improved) operation of the Tracy Fish Collection Facility,
- operation of the DMC/California Aqueduct Intertie,
- continued (improved) operation of the Skinner Fish Facility,
- water transfers in the July-September period,
- increased demands for the 2020 LOD,

- implementation of the Trinity River Mainstem ROD,
- delivery of CVP water to the proposed FRWP,
- continued operation of North Bay Aqueduct,
- continued operation of Suisun Marsh salinity control gates, and
- continued operation of Skinner Fish Facility.

Early consultation covers the effects of the SDIP and includes pumping of 8,500 cfs at SWP Banks, permanent gate operations in the south Delta, long-term EWA, water transfers, and CVP and SWP operational integration. The environmental evaluation of fish effects contained in the OCAP documents therefore provides an important basis for cumulative fish impact assessment.

NOAA Fisheries anticipates effects on Sacramento winter-run Chinook salmon, spring-run Chinook salmon, and Central Valley steelhead from implementation of OCAP in the Delta, including altered fish behavior, modification of habitat value, and increased entrainment of salmonid juveniles and adults. The Delta effects are reduced by the real-time adjustments made in operations of the DCC gates, use of CVPIA (b)(2) water and the protective actions taken by the EWA. Overall cumulative impacts on Chinook salmon and Central Valley steelhead from changes in operations under OCAP are considered significant. To reduce these impacts to a less-than-significant level, NOAA Fisheries has required implementation of several mitigation measures to reduce impacts of water supply operations to reduce the cumulative take to not exceed 2% of the juveniles for steelhead or Chinook salmon runs. DWR was also directed to study methods to reduce predation and loss of steelhead associated with the CCF and salvage facilities and procedures.

USFWS anticipates that incidental take of delta smelt will occur from operation of the SWP and CVP pumps according to the OCAP. Although USFWS indicates that take of delta smelt at the Skinner and Tracy fish facilities will be difficult to quantify, they have established monthly take limits and required continued monitoring of delta smelt abundance and distribution. These take limits are established from historical measurements and correspond to maximum pumping allowed with the 8,500-cfs SWP limit. Because SDIP includes this same maximum pumping limit, there are presumably no additional cumulative impacts possible for entrainment of delta smelt.

The 2004 OCAP BOs do not include considerations of impacts on splittail or striped bass. Nevertheless, because OCAP included SDIP 8,500-cfs limits, with a discussion of additional water transfers anticipated in the July–September window, there are no additional cumulative impacts possible for entrainment of splittail or striped bass, or any other fish species.

The only additional project that might further increase entrainment impacts would be increased SWP Banks pumping limits of 10,300 cfs. As described in the CALFED ROD, this final increment of allowable SWP pumping is conditioned on additional fish protection measures. It can be assumed that these additional fish measures would be effective and more than compensate for any additional entrainment impacts on special-status species.

Chinook Salmon and Central Valley Steelhead

NOAA Fisheries anticipates effects on Sacramento winter-run Chinook salmon, spring-run Chinook salmon, and Central Valley steelhead from implementation of OCAP actions in upstream areas and in the Delta. The upstream areas include the upper Sacramento River, Clear Creek, the Feather River, the American River, and the Stanislaus River. The effects on upstream areas include elevated water temperatures, reduced availability and suitability of spawning and rearing habitat, redd desiccation, and juvenile stranding. In the Delta, anticipated effects include altered fish behavior, modification of habitat value, and increased entrainment of salmonid juveniles and adults. The expected increase in entrainment rates is assumed to be related to potential increases in salmonid entrainment into the central Delta through the DCC, altered Delta hydrology, and direct loss of juvenile salmon and juvenile and adult salmon and steelhead at the CVP and SWP pumping facilities and the Rock Slough Intake. The Delta effects are reduced by the real-time adjustments made in operations of temperature control strategies, minimum flow requirements, closures of the DCC gates, use of b(2) water and the EWA. Overall cumulative impacts on Chinook salmon and central valley steelhead from changes in operations under OCAP are considered significant. To reduce these impacts to a less-than-significant level, NOAA Fisheries has required implementation of mitigation measures to reduce impacts of water supply operations.

The implementation of reasonable and prudent measures on water operations carried out by the Joint CVP and SWP Measures (Reclamation and DWR), CVP Measures (Reclamation) and SWP Measures (DWR) are outlined by NOAA Fisheries in their BO on the long-term CVP and SWP OCAP, dated October 2004. These measures are deemed necessary and appropriate to minimize take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead. These reasonable and prudent measures from the formal consultation are outlined in detail in the NOAA Fisheries BO on pages 212–216. In addition, Reclamation and DWR must comply with terms and conditions under formal consultation (pgs. 216–231) under all of the Central Valley and state water projects.

Preliminary reasonable and prudent measures require that Reclamation and DWR monitor the extent of incidental take of Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, and Central Valley steelhead associated with the operation of CVP Tracy and SWP Banks. If loss of juvenile Sacramento River winter-run salmon or Central Valley spring-run Chinook salmon exceeds 1%, Reclamation and DWR will convene the WOMT to explore additional measures that can be implemented to reduce the take and ensure the 2% level of take is not exceeded. If either agency or NOAA Fisheries determines the rate of loss will likely exceed the 2% level, consultation will be reinitiated immediately. For Central Valley steelhead, the loss at CVP and SWP Delta pumping facilities will be monitored and that information used to determine whether the cumulative estimated level of loss is expected to exceed 2% of the JPE for steelhead entering the Delta. Until suitable steelhead JPE has been developed, the cumulative take for Central Valley steelhead shall not exceed 4,500 juvenile and adult steelhead. If the take level exceeds the limit, Reclamation and DWR will convene the WOMT to explore additional measures that can be implemented to reduce the take. If suitable measures to reduce the rate of take cannot be implemented, consultation will be reinitiated immediately.

DWR will reduce predation and loss of Central Valley steelhead attributable to increased pumping to 8,500 cfs at SWP Banks at CCF, the John Skinner Fish Collection Facility, and the associated collection, trucking, and release program. DWR will design, implement, and complete studies to document the rate of predation on steelhead while in the CCF and prior to salvage at the John Skinner Fish Collection Facility. Initial studies will be completed prior to permanent gates being constructed and increased pumping at SWP Banks to 8,500 cfs. After completion of the initial studies, DWR will take appropriate action to reduce the predation rate on Central Valley steelhead when present in the CCF.

Delta Smelt

The re-operation of the Trinity River, increased level of development on the American River, the Freeport diversion, Suisun Marsh salinity control gates, Barker Slough Diversion, and changes to X2 are not expected to result in adverse effects on delta smelt. The implementation of conservation measures would avoid or minimize adverse effects on delta smelt.

However, USFWS anticipates that incidental take of delta smelt will occur from operation of the SWP and CVP pumps according to the OCAP. This cumulative impact on delta smelt is considered significant. To reduce this impact to a less-than-significant level, DWR and Reclamation will implement the following measures and process to ensure take of delta smelt is within the limits of the incidental take authorization.

Implement Salvage Triggers for Delta Smelt

USFWS indicates that any take of delta smelt at the Skinner and Tracy Fish Facilities will be difficult to detect and quantify. Consequently, precise numbers of take cannot be provided for delta smelt.

To ensure that the Delta Smelt Working Group closely monitors the effects of entrainment on the delta smelt population, USFWS identifies monthly triggers for wet and above-normal year types and for below-normal, dry, and critical year types. Slightly different triggers were identified for formal (Table 10-3) and early consultation (Table 10-4). The triggers are based on the salvage estimated from historical salvage numbers applied to simulated CVP and SWP pumping (CALSIM II). When actual incidental take exceeds the salvage triggers, the working group will convene a meeting to determine and recommend:

1. the actions, if any, that should be taken to reduce salvage, and
2. whether the USFWS should consider reinitiation of consultation.

If reinitiation of consultation is recommended, the USFWS will determine whether reinitiation is warranted.

Table 10-3. Incidental Take by Water Year Type (Formal Consultation)

	Water Year Type	
Month	Wet or Above Normal	Below, Normal, Dry, or Critical
October	100	100
November	100	100
December	700	400
January	3,000	1,900
February	2,300	1,700
March	1,300	1,300
April	1,000	1,100
May	37,800	30,500
June	45,300	31,700
July	3,500	2,500
August	100	100
September	100	100

Table 10-4. Incidental Take by Water Year Type (Early Consultation)

	Water Year Type	
Month	Wet or Above Normal	Below, Normal, Dry, or Critical
October	100	100
November	100	100
December	900	400
January	3,400	1,900
February	2,400	1,700
March	1,300	1,300
April	1,000	1,100
May	28,700	30,500
June	44,800	33,200
July	3,900	2,500
August	100	100
September	100	100

Implement Reasonable and Prudent Measures

Effects will be further minimized through implementation of reasonable and prudent measures and associated terms and conditions as follows:

- **RPM1.** Minimize the potential for harassment, harm, injury and mortality to the smelt.

  TC 1A. The Project shall be implemented as described, which includes the implementation of an adaptive management plan.

  TC 1B. All cultured delta smelt that are used for experiments or studies at the fish facilities will not be allowed to be released into the wild. These fish will be retained in captivity after these studies conclude.

- **RPM2.** Continue to monitor delta smelt throughout their life history.

  TC 2A. The following surveys will continue to be conducted to determine abundance and distribution of delta smelt: spring Kodiak trawl, 20 mm survey, summer townet survey, and fall midwater trawl survey. Any changes to these surveys would be subject to USFWS (as part of WOMT) approval.

The project, as indicated in term and condition 1A, includes the adaptive management process. The central component of the adaptive management process is the DSRAM. The Delta Smelt Working Group uses the DSRAM to determine whether the level of concern is sufficient to recommend an action to be taken to protect smelt. Recommendations will be made to the WOMT. The WOMT will respond to the Delta Smelt Working Group's recommendations. The WOMT will take actions that may include implementation of conservation measures and compliance with Water Rights Decision 1641, continued implementation of the VAMP, the EWA, and use of water that is part of CVPIA b(2). The salvage number triggers would essentially become part of the Delta Smelt Working Group process and the DSRAM.

Splittail and Striped Bass

Entrainment of splittail and striped bass may increase under the OCAP as a result of increased SWP pumping. Splittail salvage generally increases under the project, approaching a 40% increase in one year and 10–20% increases in other years (Figure 6.1-22). Striped bass salvage generally increases, approaching a 10–20% increase or more in some years (Figure 6.1-26). This cumulative impact is considered significant. The Delta Pumps Fish Effects Program identified in Mitigation Measures Fish-MM-1, Fish-MM-2, Fish-MM-3, Fish-MM-4, and Fish-MM-5 (Chapter 6) would reduce entrainment numbers for splittail and striped bass to a less-than-significant level.

Other Water Storage and Conveyance Projects

Combining the cumulative operations that were analyzed in the OCAP BOs with other possible storage and conveyance projects could result in cumulative operations changes of the SWP, CVP, and local water supply systems and new diversions from upstream or Delta sources. The specific operations changes that would result from the range of storage and conveyance projects currently contemplated are currently uncertain. The general changes that may occur and that could affect special-status and other fish species include:

- increased surface water diversion and storage of at least 950 taf;
- improved water supply reliability and water management flexibility;
- requirements for compatibility with objectives for continued improvement of Delta water quality;
- improvements in the pool of cold water in reservoirs to maintain lower Sacramento River water temperatures;
- reduced water diversions on the Sacramento River during critical fish migration periods;
- expanded pumping capacity at SWP Banks to 10,300 cfs with fish screens;
- improvements in flood conveyance in the north Delta and lower San Joaquin River; and
- modified DCC operation and screens.

The CALFED Programmatic ROD indicates that in addition to the construction-related effects of the contemplated program actions, the potential exists for reduced streamflow, Delta outflow, changed seasonal flow, water temperature variability, and changes in Delta salinity conditions that could result in effects on fish species. The important cumulative effects include a potential for reduced habitat abundance, impaired species movement, increased loss of fish from diversions, and increased entrainment loss of Chinook salmon and other species. Conveyance program actions could result in reduced frequency and magnitude of net natural flow conditions in the south and central Delta, resulting in reduced system productivity, impaired species movement, and increased loss from diversions. The potential for these types of cumulative impacts to result from cumulative storage and conveyance projects is considered significant, and the SDIP contribution to these impacts is considered significant. To reduce these cumulative impacts, recommended mitigation measures identified for SDIP Alternative 2A would be implemented and mitigation measures consistent with those identified in the CALFED Programmatic ROD and OCAP BOs would be implemented for each individual project. Further, because the contemplated storage and conveyance projects are CALFED recommended actions, implementation of these projects would be subject to fulfilling the objectives of CALFED.

Other CALFED Programs

Other CALFED Program actions, including the Drinking Water and Reliability Program and the Levee Program actions, could result in some localized effects on Delta waterways (i.e., intake and levee improvements). The cumulative construction-related impacts of these activities are considered to be significant because construction activities in Delta sloughs can result in direct mortality or a temporary disruption of fish habitat. This cumulative impact would be reduced to a less-than- significant level by implementing construction measures similar to those identified for SDIP as environmental commitments and by implementing measures consistent with those recommended in the CALFED Programmatic ROD for reducing construction effects on special-status fish species.

The CALFED ERP actions, when considered with other cumulative Delta projects and actions, are intended to improve, in part, Delta habitat and conditions for fish and wildlife. Although implementing ERP actions in the Delta may result in some temporary disturbance of Delta waterways and habitat, these potential short-term cumulative effects are considered less than significant, and long-term ERP actions are considered beneficial for fish species and the aquatic ecosystem.

A number of programs in the DIP, including the Delta Regional Ecosystem Restoration Implementation Plan, various science actions, Franks Tract improvements, Delta Cross Channel operations, and the Through-Delta Facility, could result in cumulative and as-yet-unknown Delta fish resource effects that could be both beneficial and adverse depending on the fish species considered. Because of the speculative nature of the short-term and long-term cumulative effects of these programs, no significance has been determined for fish.

Other Local Development Projects

Other local transportation and development projects in the vicinity of SDIP improvements (i.e., SR 4 Bypass, Mountain House and River Islands developments) would likely contribute to cumulative impacts on fish species from construction activities that involve work in Delta channels. The cumulative construction-related impacts are considered to be significant because construction activities in Delta sloughs can result in direct mortality or a temporary disruption of fish habitat. This cumulative impact would be reduced to a less-than-significant level by implementing construction measures similar to those identified for SDIP as environmental commitments and by implementing measures consistent with those recommended in the CALFED Programmatic ROD for reducing construction effects on special-status fish species.

Qualitative Assessment

Geology, Seismicity, and Soils

Implementation of the SDIP in combination with other CALFED Actions (as presented above) and other local and regional projects could contribute to regional impacts and hazards associated with geology, seismicity, and soils. As described in Section 5.4 the effect of SDIP alternatives is primarily related to localized project impacts or seismic hazards in the vicinity of proposed permanent gates on Old River, Middle River, and Grant Line Canal. These impacts include the potential for structural damage as a result of liquefaction, ground shaking, development on expansive soils and fault rupture; accelerated runoff, erosion, and sedimentation from levee construction activities; and decreased levee stability from construction activities. All of the impacts are mitigated by incorporating standard construction and structural measures into project design and construction. No impacts related to operation of permanent gates or changes in SDIP pumping were identified for this resource area.

Other CALFED Actions such as the Storage and Conveyance Program Actions located in the same area as the proposed action, and other local projects, have the potential to contribute to similar types of geology, seismicity, and soils effects. Projects that could contribute most directly to these cumulative impacts include the Banks Pumping Expansion to 10,300 cfs, In-Delta Storage Project, Mountain House New Town, and River Islands Development. These cumulative impacts would result from construction activities and development of additional structures that may be subject to geologic, seismic, or soil erosion damage and could be reduced by implementing measures similar to those described for SDIP. Although these combined impacts could be cumulatively considerable, implementing the measures identified for the SDIP in Section 5.4 would reduce the SDIP's contribution to these cumulative impacts to a level below the "cumulatively considerable" threshold. Therefore, the SDIP's contribution to these impacts is considered less than significant. No mitigation is required.

Flood Control and Levee Stability

Other CALFED Storage and Levee Program Actions and local and regional projects exist in the vicinity of the SDIP Alternatives that could cumulatively contribute to flood control and levee stability effects. However, the SDIP would not contribute to these potential cumulative impacts because flood control and levee stability measures would be built into project design and no significant flood control and levee stability impacts are identified for project alternatives. Cumulative impacts on flood control and levee stability in the vicinity of SDIP alternatives are considered less than significant, and the contribution of SDIP to this cumulative effect is less than significant. No mitigation is required.

Sediment Transport

Implementation of the SDIP in combination with the SWP Banks Pumping Plant Expansion project to 10,300 cfs and Mountain House and River Islands development projects could contribute to sediment transport effects in south Delta channels, particularly Old River. As described in Section 5.6, the effect of SDIP alternatives is primarily related to sedimentation and scouring in the south Delta from accumulation of sediments and debris during construction of the gates and scouring as a result of increased velocities. Other projects in the immediate vicinity, including Mountain House and River Islands development projects, could contribute to these effects in Old River. No other reasonably foreseeable future projects occurring in the vicinity of the SDIP alternatives increase the velocity of, or scouring within, channels of the south Delta. Accumulation of sediments and debris as a result of the operation of the gates would be minimal under SDIP alternatives. Debris racks, as well as maintenance dredging around the gates, are components of the project and would effectively minimize the accumulation of debris and sediment behind the gates.

Although these combined impacts could be cumulatively considerable in Old River, implementing measures identified in Section 5.6 would reduce the SDIP's contribution to these impacts to a level below the "cumulatively considerable" threshold. Because the cumulative impacts of other projects near Old River would be minimized through the implementation of BMPs and water quality and erosion control regulations, the cumulative impact resulting from these projects combined, is less than significant. No further mitigation is required.

Groundwater Resources

Implementation of the SDIP in combination with other CALFED Storage and Conveyance Program Actions and other local and regional projects could contribute to regional groundwater effects. As described in Section 5.7 the groundwater effect of SDIP alternatives is related to the potential for groundwater contamination from construction vehicles and equipment spills, and from disposal of dredged materials; and increased seepage losses from sloughs, canals, and streams from dredging activities in and near south Delta channels. No impacts related to operation of permanent gates or changes in SDIP pumping were identified for this resource area.

Other CALFED Actions such as the Storage and Conveyance Program Actions located in the same area as the proposed action, and other local projects, have the potential to contribute to similar types of groundwater impacts as identified for the SDIP. Projects that could contribute most directly to these cumulative impacts include the Banks Pumping Expansion to 10,300 cfs, In-Delta Storage Project, Mountain House New Town, and River Islands Development. These cumulative impacts would result from construction activities that may affect groundwater quality and movement of groundwater. Although these combined impacts could be cumulatively considerable, implementing the measures identified for the SDIP in Section 5.7 would reduce the SDIP's contribution to these cumulative impacts to a level below the "cumulatively considerable" threshold. Therefore, the SDIP's contribution to these impacts are considered less than significant. No mitigation is required.

Transportation, Air Quality, and Noise

Implementation of SDIP alternatives, with other projects occurring at the same time in the same vicinity, have the potential to create short-term cumulative impacts on transportation, air quality, and noise caused by increased movement and use of construction vehicles and equipment, especially in the area west of Old River. Mountain House and River Islands developments, as well as the East Altamont Power Facility, may be under construction during the time SDIP is implemented, resulting in significant cumulative impacts associated with temporary and permanent reductions in levels of service on existing roads and exceedance of air and noise thresholds from these major developments. Operation of the SDIP permanent gates would require a permanent employee at each gate and a rover four times weekly for maintenance. Other projects in the area would add approximately 70,000 people to the area, requiring the use of existing and planned roads.

Although these combined impacts could be cumulatively considerable, implementing the measures identified for the SDIP in Sections 5.8–5.10 would reduce the SDIP's contribution to these cumulative impacts to a level below the "cumulatively considerable" threshold. Therefore, the SDIP's contribution to these impacts is considered less than significant. No mitigation is required.

Vegetation and Wildlife

Many of the CALFED Actions listed above would result in impacts on vegetation and wildlife resources. For example, Sites Reservoir (which has been under consideration for at least 50 years) would inundate hundreds of acres of habitats including annual grasslands, some of which support vernal pools, riparian woodlands, chaparral, and oak woodland. However, most of the projects are not located near the SDIP alternatives and habitats are not contiguous. Therefore the SDIP does not contribute to cumulative impacts on habitats and related resources except with those projects that are within reasonable proximity.

Implementation of the SDIP alternatives in combination with other local and regional projects (In-Delta Storage Project, Banks Pumping Plant Expansion to 10,300 cfs, Mountain House Development Project, River Islands Development Project, and a power facility development project) would contribute to the cumulative loss of identified sensitive resources, including wetlands, riparian woodlands, and habitats for sensitive wildlife species from construction activities. Although these combined impacts could be cumulatively considerable, implementing the measures identified for the SDIP in Sections 6.2 and 6.3 would reduce the SDIP's contribution to these cumulative impacts to a level below the "cumulatively considerable" threshold. Therefore, the SDIP's contribution to these impacts is considered less than significant. No mitigation is required.

Land Use

A number of CALFED actions and regional and local projects would contribute to cumulative changes in land uses in the vicinity of SDIP alternatives (In-Delta Storage Project, Banks Pumping Plant Expansion to 10,300 cfs, Mountain House Development Project, River Islands Development Project, and a power facility development project). Other, more localized activities could also contribute to cumulative land use impacts, but those listed above capture the magnitude of changes. Overall, cumulative land use changes would involve temporary and permanent conversion of agricultural land to non-agricultural uses. Considering the two major projects in the vicinity of the SDIP Alternatives, cumulative loss of agricultural land in the vicinity of SDIP activities, Mountain House, and River Islands development would be approximately 7,241 acres. Overall, this cumulative loss of farmland is considered significant and the SDIP contribution to this loss is considered less than significant. Construction of permanent gates at head of Old River, Old River, Grant Line Canal, and Middle River would result in the permanent loss of approximately 21 acres of prime and unique farmland. This amount is approximately .0029% of the total of these three projects and is not considered to be cumulatively considerable. In addition, the drying areas for dredge spoils would require the temporary use of up to 205 acres for up to 5 years. Although this is .0029% of the overall expected land use change, it is temporary, and these lands would be returned to preproject conditions after their use.

Operation of cumulative water conveyance and storage projects could contribute to the potential for increased water transfers related to improved CVP and SWP storage and conveyance capabilities. Discussion of the potential for increased water transfers associated with improved SDIP pumping capacity is summarized above under the Water Supply discussion and analyzed in Section 5.1, Water Supply and Management. Although uncertainty exists regarding whether water transfers would occur in any particular year, the cumulative water storage and conveyance projects could have some influence over the amount of agricultural land in production during years when water transfers occur from north-of-Delta sources to south-of-Delta service areas. Although the effect of converting or temporarily fallowing agricultural land could be cumulatively considerable, implementing the SDIP alternatives would not significantly contribute to this cumulative impact.

Utilities, Public Services, and Energy

Implementation of SDIP alternatives in combination with other CALFED actions and other local projects in the same area as the proposed action have the potential to conflict with underground utility lines. However, SDIP impacts on power production and energy are considered less than significant without mitigation and are not discussed further as cumulative impacts even though other development projects would increase the demand for power production and energy. Cumulative impacts associated with conflicts with utilities lines is considered less than significant because standard construction practices would be required to identify and relocate utility lines for all local projects and the SDIP's contribution to this impact is not cumulatively considerable. Construction and operation of SDIP alternatives would also not contribute to cumulative impacts on local public services because of the localized nature of project construction in the south Delta.

Recreation and Visual Resources

Implementation of the SDIP alternatives in combination with other local and regional projects (In-Delta Storage Project, Banks Pumping Plant Expansion to 10,300 cfs, Mountain House Development Project, River Islands Development Project, and a power facility development project) would contribute to cumulative impacts on recreation resources and aesthetics near south Delta channels including temporary disruption of boating opportunities from construction of the permanent gates and during dredging operations and changes in visual resources in south Delta channels, especially Old River. Cumulative recreation and visual resources impacts on Old River, in particular would involve permanent changes from undeveloped river channels and Delta islands to built environments associated with suburban housing development. The cumulative impact on these resources is considered significant and no mitigation measures are available to reduce this impact to a less-than-significant level. Although these combined impacts could be cumulatively considerable, the SDIP's contribution to these cumulative impacts is not "cumulatively considerable" because of the small-scale nature of the SDIP improvements compared to regional housing and energy development projects. Therefore, the SDIP's contribution to these impacts is considered less than significant. No mitigation is required.

Cultural Resources

Three prehistoric archaeological sites (CA-SJo-133, CA-SJo-134, and CA-SJo-135) are located immediately adjacent to the area of potential effects defined for the SDIP alternatives by Reclamation and the State Historic Preservation Officer of California. SDIP project elements would not directly or indirectly affect these known archaeological sites. Proposed locations for dredge disposal sites would not affect known archaeological sites, and no new sites have been identified at these locations. Access to one of the dredge areas was unavailable and would require preconstruction surveys prior to use of this site for dredge disposal. CALFED and local projects in the same area as the proposed action have the potential to result in significant impacts or effects to CA-SJo-133, CA-SJo-134, and CA-SJo-135, as well as other prehistoric and historic cultural resources. The classes of project most likely to affect cultural resources are levee improvement projects and housing developments. Effects would result from the placement of new levee structural material, addition of habitat-conducive elements, and grading and contouring. The result of these effects would be damage to or destruction of cultural resources, as well as limiting access (through burial) to the sites for future research. Physical damage, destruction, and limited access by burying the site under levee material without prior archaeological study are all significant impacts or effects under Section 106 of the NHPA, NEPA, and CEQA.

As presently designed, the SDIP would not contribute to cumulative effects on cultural resources. If the project design were altered such that archaeological sites CA-SJo-133, CA-SJo-134, and CA-SJo-135 will be affected by the proposed action, the SDIP would contribute to cumulative effects on cultural resources. Implementation of the mitigation measures described in Section 7.7 would reduce the SDIP's contribution to these cumulative impacts to a level below the "cumulatively considerable" threshold. Therefore, the SDIP's contribution to this cumulative impact is considered less than significant. No additional mitigation is required.

Public Health and Environmental Hazards

Implementation of the SDIP in combination with other CALFED Actions (as presented above) and other local and regional projects could contribute to potential public health impacts and environmental hazards. As described in Section 7.9, the effect of SDIP alternatives is related to a temporary increase in risk to people from pesticides, hazardous materials, disease-carrying mosquitoes, and construction vehicles. SDIP alternatives could also temporarily impede rescue and patrol boats in the south Delta during construction and dredging activities. The potential cumulative impacts associated with potential changes in public health and environmental hazards is considered less than significant because construction-related hazards would be temporary and public health affects from exposure to pesticides, hazardous materials, or mosquitoes would be reduced by standard construction and public health measures during the construction period. SDIP's contribution to this cumulative impact is not "cumulatively considerable" and is considered a less-than-significant impact. No mitigation is required.

Chapter 11
Public and Agency Involvement

Summary

This chapter provides a summary of the public and agency involvement activities undertaken by SDIP project sponsors, DWR and Reclamation. As a component of the larger CALFED Program, the SDIP was developed and refined over the past 8 years according to input received during many CALFED public and agency scoping meetings and workshops, and from working groups and technical panels.

In addition, Reclamation and DWR have conducted public and agency outreach and involvement efforts specifically related to development of the project, including project alternatives, components, and objectives. This involvement has consisted of public scoping meetings, the 8,500 Stakeholder Process, and numerous meetings with stakeholders to obtain their input and comments. A discussion of all of these efforts is presented below.

CALFED Bay-Delta Program Involvement

Public Involvement

Between August 1995 and September 1996, CALFED held scoping meetings, technical workshops, public informational meetings, and public BDAC work group meetings. This public involvement continued from 1997 to1998 with additional public meetings, focused group presentations, media outreach, mailings, website, and an information telephone line.

Workshops

Beginning in August 1995, 12 day-long workshops were conducted in Sacramento over a 3-year period—four workshops in 1995, five in 1996, and three in 1997. Open to the general public, the intensive working sessions focused on providing a solid framework for the solution-finding process. Using brainstorming techniques, informal debate, and analysis, an average of

100 participants at each workshop worked together to help identify the problems facing the Bay-Delta system, establish objectives for problem solving, and develop the actions necessary to achieve the objectives. These workshops provided an opportunity for the many different interests in the Bay-Delta system to share perspectives, reach common understandings, and develop cooperative solution alternatives.

Meetings

In addition to public workshops, 28 open-house public meetings were conducted to provide the general public who did not attend public workshops or other meetings the opportunity to learn about the CALFED Program and to express their views and concerns. Each public meeting featured an informal, open-house session with displays and informational materials, followed by a prepared general presentation about the CALFED Program.

Between 1995 and 1996, more than 2,000 people attended a total of 14 public meetings in 13 communities throughout California. These meetings took place in Redding, Red Bluff, Sacramento, Walnut Grove, Stockton, Oakland, Los Banos, Fresno, Bakersfield, Pasadena, Long Beach, Costa Mesa, and San Diego. Between September 1995 and May 1996, another six public meetings were held to solicit early public comment and gage local public reaction to the 10 draft alternatives.

Eight more public meetings were held in communities from Chico to San Diego in 1997, to inform stakeholders and the public about the CALFED Program's progress and the process to identify a preferred alternative, as well as to solicit input on the alternatives. Two additional public meetings were held following the end of March 1998 Draft Programmatic EIS/EIR comment period in Delta communities: on Roberts Island on July 27, 1998, and in Stockton on September 9, 1998. These additional meetings were held in conjunction with a BDAC meeting.

Programmatic Environmental Impact Statement/ Environmental Impact Report Scoping

Eight scoping meetings were held around the state to solicit input into the scope of the environmental review process. All scoping meetings were held in April 1996 and took place in Oakland, Walnut Grove, Red Bluff, Long Beach, San Diego, Pasadena, Bakersfield, and Sacramento.

Seventeen public hearings were held across the state to gain input into the March 1998 Draft Programmatic EIS/EIR. More than 400 people spoke at these hearings, which were held in Ontario, Fresno, Oakland, Burbank, Bakersfield, Santa Cruz, Irvine, Walnut Grove, Chico, San Diego, Pittsburg, Redding, San Jose, Vacaville, Yuba City, Stockton, and Santa Rosa. A similar public hearing effort was scheduled to receive public comments on the June 1999 Draft Programmatic EIS/EIR. Sixteen public hearings were held across the state, at which more than 800 people spoke. The meetings were held in Stockton, San Bernardino, Huntington Park, Salinas, Oakland, Pasadena, San Diego, Costa Mesa, San Jose, Antioch, Santa Rosa, Los Banos, Visalia, Chico, Redding, and Sacramento.

Multi-Cultural Public Outreach

Notices about the March 1998 Draft Programmatic EIS/EIR release and the public meetings were placed in several ethnic media outlets, such as Asian week, Los Angeles Sentinel, Oakland Post, La Opinion, El Sol, and La Voz De La Frantera. These efforts were duplicated with the release of the December 1998 Phase II Report and the June 1999 Draft Programmatic EIS/EIR.

Throughout the development of the CALFED Program, program staff met with a number of stakeholders, representing minority and multicultural business, government, agriculture, social services, and industry, to discuss their interests relating to the CALFED Program. The program overview fact sheet was translated into Spanish, Chinese, Japanese, Korean, and Vietnamese. Notices regarding the availability of these translated documents and public meeting notices were sent to statewide media outlets that target multi-cultural communities for distribution.

There have been a series of efforts to provide information to Native Americans about the CALFED process. As the CALFED process evolved and the concept of a solution area developed, additional efforts were made to communicate with tribal groups. These efforts initially took the form of letters notifying tribal groups of the availability of the June 1999 Draft Programmatic EIS/EIR and of meetings in which they were invited to participate. All California tribes were contacted before the June 1999 Draft Programmatic EIS/EIR was distributed.

In June 1996, Reclamation sent letters to the 12 individuals identified by the NAHC. (There are no federally recognized tribes in the Delta.) One person responded and asked Reclamation to provide notice to two additional Native Americans. No other responses were received from this inquiry. As the CALFED process evolved, the following briefings and communication with tribal groups were conducted:

- two briefings at regional tribal meetings in April and May 1999;
- multi-agency and multi-tribal informational meeting in September 1999 attended by 10 tribal representatives;
- presentation at the Seventh Annual Tribal Environmental Conference, sponsored by the EPA's Regional Tribal Operations Committee (RTOC) in October 1999;
- presentation at the Bureau of Indian Affairs (BIA) Regional Tribal council in December 1999;

- a presentation at a tribal governments' meeting in February 2000; and
- panel discussions conducted at the CBDA Tribal Forum planning meeting in February 2004.

Agency Involvement and Coordination

There has been constant dialogue among members of the U.S. Congress, California State Legislature, and appropriate subcommittees and local governments throughout the state. CALFED Program staff briefed key legislators and testified before several legislative committees.

The BDAC was formed under the Federal Advisory Committee Act to assist CALFED Program leaders. The council consists of 31 stakeholder representatives appointed by then-Governor Wilson and then-President Clinton. Members come from diverse backgrounds and represent water districts and utilities, environmental organizations, the California Farm Bureau, Indian tribes, environmental justice interests, business, local governments, energy, and sport fishing organizations from throughout the state. The BDAC met regularly through 1999 and early 2000 and made recommendations to CALFED on May 24, 2000.

Scientific Review of the Program

A scientific review panel of eight scientists with broad expertise in landscape ecology, fisheries and aquatic biology, physical processes, and terrestrial and wetlands ecology met during a 4-day workshop held from October 6 through 9, 1997, which resulted in written recommendations to the CALFED Program for refining the ERP. Members of the public were invited to attend and to provide verbal and written comments on the process. After their workshop, the Scientific Review Panel submitted recommendations to the program about the ERP.

A Bromide Panel consisting of independent, nationally recognized scientific experts was formed to evaluate the potential effects on bromide concentrations in the Delta as a result of the CALFED Program. Panel members were collaboratively chosen by members of the Water Quality Technical Group. The panel met on September 8 and 9, 1998, and published its report in November 1998.

The Diversion Effects on Fisheries Team (DEFT), consisting of stakeholders and representatives from member agencies, was formed in February 1998 to evaluate the technical issues related to diversion impacts on fisheries. DEFT identified seven entrainment losses or other effects that needed to be reduced, as well as eight programmatic actions (one of which is the SDIP) to maximize the chances of implementing a through-Delta conveyance alternative meeting the CALFED Program purpose. The agencies continue to meet regularly to discuss and analyze the potential effects on fisheries from water project operations.

South Delta Improvements Program

Public Involvement

8500 Stakeholder Process

In January 2002, DWR convened a group of stakeholders for the purpose of seeking input about key interests that should be addressed in an 8,500 operations plan (8500 Stakeholder Process). The group included representatives from resource agencies, water agencies and districts, and environmental groups. Table 11-1 below shows those who participated in the process.

Table 11-1. Participants in 8500 Stakeholder Process

U.S. Fish and Wildlife Service
U.S. Department of the Interior, Bureau of Reclamation
U.S. National Marine Fisheries Service
California Department of Fish and Game
California Department of Water Resources
Kern County Water Agency
Westlands Water District
San Luis and Delta-Mendota Water Authority
Tulare Lake Basin Water Storage District
Santa Clara Valley Water District
State Water Contractors
The Metropolitan Water District of Southern California
Contra Costa Water District
South Delta Water Agency
The Bay Institute
Environmental Defense
Natural Resources Defense Council
CALFED Bay-Delta Program

Source: CDR Associates 2002.

The 8500 Stakeholders devoted a significant amount of time to exploring a variety of operational proposals that addressed water quality, water supply reliability, operable barriers, and ecosystem restoration in the south Delta. The 8500 Stakeholder Process served to promote creative thinking and constructive discussions in multiple forums about how to balance key interests of Delta water users associated with increased pumping in CCF to a maximum of 8,500 cfs.

In April 2002, the stakeholders participated in an exercise to identify the key interests that should be addressed in an 8500 operations package. The interests identified included those that benefit all users of south Delta water and were focused on agricultural, recreational, and M&I users as well as concerns for success of the CALFED Program (including its approach to science-based decisions), fisheries, and the environment.

The stakeholders (excluding DWR and Reclamation) combined the sets of interests to develop three operational packages that were presented to the group on April 15, 2002. The three non-binding proposals, identified as Environmental Interest, Exporter, and Fishery Agency, were run through CALSIM II, and the results were presented to the stakeholder groups.

The constraints of each proposal became obvious to the group through this modeling and allowed the stakeholders to understand the potential effects of different operational scenarios on their previously identified interests. The Fishery Agency proposal was chosen as the discussion document because of its ability to address the greatest number of stakeholder interests.

The stakeholders identified the effects of the proposal on the specific interests in an attempt to identify interests that would not be satisfied and to what extent. The document represents a combination of possibilities for increased pumping to 8,500 cfs. It is too broad to develop a consensus but can be used as a tool to develop points of agreement among stakeholders and further develop proposals that fulfill the needs of several interests.

EIS/EIR Scoping

Reclamation published the NOI to prepare an EIS and Notice of Public Scoping Meeting pursuant to NEPA in the *Federal Register* on August 30, 2002. This notice was accompanied by a press release issued by CALFED announcing the public scoping meetings, which was mailed to interested individuals, stakeholders, and organizations. In addition, DWR issued an NOP of an EIR pursuant to CEQA to resource agencies and interested members of the public on September 20, 2002.

Public scoping meetings were held in five locations throughout the State of California to provide the public with an update on the status of the project and to solicit and receive input on alternatives, concerns, and issues to be addressed in the EIS/EIR (Table 11-2).

Table 11-2. Location and Dates of Public Scoping Meetings

Location	Date
Resources Building Auditorium, Sacramento	October 7, 2002
Community Center Multipurpose Room, Brentwood	October 9, 2002
Metropolitan Water District of Southern California, Los Angeles	October 10, 2002
Convention and Conference Room, Fresno	October 15, 2002
Roberts Union Farm Center, Stockton	October 17, 2002

At each public scoping meeting, a project overview presentation and public comment session were provided. Meetings began with an open house, where attendees could review meeting materials and view display boards, and a presentation and a comment period followed. A series of display boards were prepared to illustrate the project area, project components, and issues. Handouts were also available at the meeting and included an agenda, comment card, SDIP fact sheet, a hard copy of the presentation, and informational brochures on DWR and Reclamation.

The open house provided the opportunity for attendees to review the display boards and speak with DWR and Reclamation staff. The presentation allowed the project managers from DWR and Reclamation to provide detailed information on the project background, description, and purpose. Individuals responded with verbal comments before or after the meeting.

Public Meetings

Two public informational meetings were held in Sacramento before the public release of the draft EIS/EIR. The purpose of the meetings was to inform the public on the status of the project and the EIS/EIR and the potential effects of the project. The public was given an opportunity to ask DWR and Reclamation questions about the project as well as voice concerns and expectations of the anticipated EIS/EIR.

Public Review of Draft Environmental Impact Statement/Environmental Impact Report

The Public Draft EIS/EIR will be available for review and comment for 90 days following filing of the Notice of Availability (NOA) of the EIS with the EPA and the Notice of Completion (NOC) of the EIR with the California State Clearinghouse.

After public comment period for the Draft EIS/EIR, a Final EIS/EIR will be prepared that will include responses to public and agency comments. DWR and

Reclamation will issue a Notice of Determination (NOD)/Record of Decision for the decision regarding the physical/structural component actions at the end of the Stage 1 decision-making process. No decision regarding the operational component of the SDIP will be made during the Stage 1 process.

For the Stage 1 decision of SDIP, DWR and Reclamation will assume that the current regulatory limits apply regarding SWP export operations. Proposed changes to these operating conditions will be finalized during the Stage 2 decision-making process of SDIP. DWR and Reclamation acknowledge that during the time before Stage 2 is completed, new information may become available about conditions affecting pelagic organisms in the Delta. DWR and Reclamation will complete the additional environmental analysis necessary to select and implement the operational component for Stage 2 pursuant to CEQA and NEPA using the best available information.

CEQA and NEPA compliance for the decision made under Stage 2 will most likely follow the preparation and circulation of supplemental information as authorized by the CEQA Guidelines (see Article 11) and CEQ NEPA Regulations (40 CFR 1502.9(c)). At a minimum, DWR and Reclamation will issue a document explaining the preferred operational component, the rationale for its selection, and the necessary supporting information for CEQA and NEPA compliance. This document would be available for public comment and review for a period of at least 45 days and will provide opportunity for the public to submit additional comments on the environmental analysis of the operational component of the SDIP. A second Notice of Determination from DWR and an ROD from Reclamation regarding the selection of the preferred operational component will be filed to complete the environmental compliance requirements for Stage 2 of the SDIP. Parties concerned about the operational component in Stage 2 should participate early in the EIR/S process and review and comment on this Draft EIS/R. With respect to the future decision for Stage 2 that relies upon the SDIP EIS/EIR certified at the time of the NOD for Stage 1, and any supplements to the EIS/EIR, a new CEQA challenge period will commence at the time of the Stage 2 decision for parties to request judicial review of DWR's decision based on any cause of action under CEQA related to the Stage 2 decision. In any decision for Stage 2, DWR will state in the Notice of Determination that DWR has relied in part upon the SDIP EIS/EIR certified in Stage 1 and intends that those aspects of the SDIP EIS/R relied upon in the Stage 2 decision will be subject to further judicial review.

Other Agency Involvement and Coordination

Because of the multi-agency, interrelated nature of the Delta region, proposed actions are subject to compliance and conformity with multiple laws, regulations, policies, plans, and agency requirements. Through ongoing meetings, consultations, and correspondence, DWR and Reclamation have been coordinating with multiple agencies that have interest in and/or jurisdictional responsibility over resources associated with the south Delta and proposed SDIP.

Specifically, DWR and Reclamation facilitated a series of meetings with DFG, USFWS, and NOAA Fisheries in 2004 and 2005 to develop the ASIP.

Early Agency Coordination

At the beginning of the project planning phase, DWR assembled single-component alternatives based on their potential to meet one or more project objectives. The objectives were to meet the needs of exporters, fish, and local water users. These alternatives were developed from a series of interagency meetings that DWR and Reclamation convened during 2001 with the USFWS, NOAA Fisheries, DFG, and the Corps. At these meetings, the agencies discussed and commented on the SDIP.

Chapter 12
List of Preparers

Following is a list of persons who contributed to preparation of this EIS/EIR. This list is consistent with the requirements set forth in NEPA and CEQA (40 CFR 1502.17 and Section 15129 of the State CEQA Guidelines).

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Chapter 13
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