Chapter 4 Biological Environment

This chapter provides the results of the assessment of effects on biological resources. Each resource area addressed includes a discussion of existing conditions, assessment methods, environmental consequences, and applicable mitigation measures. This chapter is organized as follows:

- Section 4.1, *Fish*;
- Section 4.2, *Vegetation and Wetlands*; and
- Section 4.3, *Wildlife*.

4.1 Fish

4.1.1 Introduction

This assessment covers species in aquatic environments potentially affected by the Intertie, including the Sacramento, American, Feather, and San Joaquin Rivers, the Delta, and Suisun Bay. Although many fish species occur in 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), Central Valley steelhead (ESA, threatened), delta smelt (ESA, endangered and CESA, threatened; CESA candidate for endangered status), longfin smelt (CESA, threatened), splittail (ESA threatened [1999], removed from list of threatened species in 2003), striped bass (an important sport fish), and green sturgeon (ESA, 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.

The CVP and SWP facilities and the current OCAP for the reservoirs and Delta operations are currently under ESA review and assessment by NMFS and USFWS. The most recent BA for OCAP was provided by Reclamation in August 2008 (U.S. Department of the Interior, Bureau of Reclamation 2008). The Intertie facility was included as part of the near-term OCAP and the CALSIM simulations for the CVP/SWP Longterm Operations Plan included the Intertie operations evaluated in this EIS. The description of the fish life cycles and habitat conditions presumed necessary for successful spawning, rearing, migration, survival, and growth are comprehensively described and reviewed in the CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). In December 2008, the USFWS issued a BO for Delta smelt for OCAP (U.S. Fish and Wildlife Service 2008). The NMFS issued a BO for OCAP that addresses salmonids and green sturgeon in June 2009 (National Marine Fisheries Service 2009). Operation of the Intertie would comply with any terms and conditions included in these BOs, including the USFWS Reasonable and Prudent Alternative (RPA) and any other measures outlined in the NMFS Operations BO.

As described in Sections 3.1 and 3.2, changes in hydrology are limited to the Delta because the changes in flows resulting from the project are not detectable upstream of the Delta. As such, this fish impact assessment for the Intertie Alternatives focuses on potential Delta effects on those fish that use the Delta for at least some of their life cycle. Information from the CVP and SWP fish salvage facilities, as well as from the other Delta fish surveys, is used for this impact assessment.

This section includes the following information:

- 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 Delta effects on fish resulting from Intertie Alternatives; and

- a description of the effects (i.e., environmental consequences) of each Intertie Alternative on fish and fish habitat conditions in the Delta.

4.1.2 Affected Environment

This section describes the life history, habitat requirements, and factors that affect the abundance of species selected for the assessment of effects of the Intertie. 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, longfin 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. Table 4.1-1 lists some of the native and nonnative fishes that occur in the Central Valley system, including the Delta. Table 4.1-2 shows the assumed life stage timing and distribution of selected species potentially affected by the Intertie.

Table 4.1-1. 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

Common Name—Origin	Scientific Name	Distribution
Fathead minnow—nonnative	*Pimephales promelas*	Central Valley rivers and reservoirs; Delta
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
Mosquitofish—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

Table 4.1-2. Assumed Life Stage Timing and Distribution of Selected Species Potentially Affected by the Proposed Intertie 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			■	■	■	■	■	■	■			

	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning	Upper Sacramento River and Tributaries												
Egg Incubation	Upper Sacramento River and Tributaries												
Juvenile Rearing (Natal Stream)	Upper Sacramento River and Tributaries												
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												

	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Juvenile Rearing	Upper Sacramento River and Tributaries to SF Bay												
Juvenile Movement	Upper Sacramento River and Tributaries to SF Bay												
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												
Longfin Smelt													
Adult Migration	SF Bay and San Pablo Bay to Suisun Bay, Suisun Marsh, Delta, Lower Sacramento River and Lower San Joaquin River												

	Distribution	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spawning	Suisun Marsh, Lower Sacramento and San Joaquin Rivers												
Larval and Early Juvenile Rearing and Movement	Suisun Bay, San Pablo Bay, Lower Delta												
Adult and Juvenile Rearing	San Francisco Bay, Suisun Bay, San Pablo Bay												
Striped Bass													
Adult Migration	San Francisco Bay to lower Sacramento and San Joaquin Rivers												
Spawning	Delta, Lower Sacramento and San Joaquin Rivers												
Larval rearing	Delta, Suisun Bay												
Juvenile rearing	SF Bay to Delta												
Green Sturgeon													
Adult Migration	San Francisco Bay to upper Sacramento River												
Spawning	Upper Sacramento River												
Larval rearing	Upper Sacramento River												
Juvenile rearing	Delta, Suisun Bay												

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

Life Histories

This section describes the key environmental requirements for each life stage of the selected species. Table 4.1-2 shows the assumed months for each life stage that were included in the calculations of habitat conditions for the Intertie Alternatives. Actual occurrence and relative abundance may vary between months and from year to year. More details about most of these fish species can be found in the CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008).

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 4.1-2). 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 Sacramento River in March and continue to their spawning streams, where they hold until September in deep cold pools (Table 4.1-2). 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 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 4.1-2). Optimal water temperatures for egg incubation are 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 4.1-2).

Adult winter-run Chinook salmon leave the ocean and migrate through the Delta into the Sacramento River from December through July (Table 4.1-2). Adults migrate upstream past Red Bluff Diversion Dam (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 4.1-2). Spawning takes place from mid-April through August, and incubation continues through October (Table 4.1-2). 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).

The south Delta is within the designated critical habitat for winter-run and spring-run Chinook salmon.

Steelhead

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, and anadromous individuals are called steelhead (National Marine Fisheries Service 1996).

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 4.1-2) (McEwan and Jackson 1994; Hallock 1989). Most steelhead spawn from December through April (Table 4.1-2), 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 4.1-2). 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).

The south Delta is within the designated critical habitat for steelhead.

Delta Smelt

Estuarine rearing habitat for immature and adult delta smelt typically is found in the waters of the lower Delta and Suisun Bay where salinity is between 2 and 7 parts per thousand (ppt). As a species, Delta smelt tolerate 0 ppt to 19 ppt salinity, with larval, egg, and spawning life stages occurring in fresh water. 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). Delta smelt move into shallow water feeding areas with low salinity to feed during daytime hours in a reverse diel migratory pattern (Hobbs et al. 2006).

Adult delta smelt spawning migration into the upper Delta typically begins after the onset of the first precipitation events in the basin, which often occur in December and January (Table 4.1-2) and may continue over several months. Spawning occurs between late February and May, 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. Hatching takes approximately 9 to 13 days, and larvae begin feeding 4 to 5 days later. Newly hatched larvae are positively phototactic, swimming to the surface during the day. Larval smelt feed on rotifers and zooplankton. As their fins and swim bladder develop, they move higher into the water column. Larvae and juveniles move from fresh water to low salinities during May and June (Nobriga et al. 2008; Kimmerer 2008). Adults are taken to salvage prior to and during the spawning period, and juveniles are taken to salvage after hatch begins in April. The fractional loss of the population to salvage is a function of exports, outflows, seasonality, overall population abundance, and the relative abundance of delta smelt in the south Delta (Kimmerer et al. 2008). Most authors agree that these losses are significant and important to the recovery of this species (U.S. Fish and Wildlife Service 2008).

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 FR 852; January 6, 1994). The primary constituent elements for the critical habitat described below were taken directly from the USFWS Operations BO for Delta Smelt pages 190–191:

1) “Physical habitat” is defined as the structural components of habitat. Because delta smelt is a pelagic fish, spawning substrate is the only known important structural component of habitat. It is possible that depth variation is an important structural characteristic of pelagic habitat that helps fish maintain position within the estuary’s LSZ (Bennett et al. 2002).

2) “Water” is defined as water of suitable quality to support various delta smelt life stages with the abiotic elements that allow for survival and reproduction. Delta smelt inhabit open waters of the Delta and Suisun Bay. Certain conditions of temperature, turbidity, and food availability characterize suitable pelagic habitat for delta smelt and are discussed in detail in the Status of the Species/Environmental Baseline section, above. Factors such as high entrainment risk and contaminant exposure can degrade this PCE even when the basic water quality is consistent with suitable habitat.

3) “River flow” is defined as transport flow to facilitate spawning migrations and transport of offspring to LSZ rearing habitats. River flow includes both inflow to and outflow from the Delta, both of which influence the movement of migrating adult, larval, and juvenile delta smelt. Inflow, outflow, and OMR influence the vulnerability of delta smelt larvae, juveniles, and adults to entrainment at Banks and Jones (refer to Status of the Species/Environmental Baseline section, above). River flow interacts with the fourth primary constituent element, salinity, by influencing the extent and location of the highly productive LSZ where delta smelt rear.

4) “Salinity” is defined as the LSZ nursery habitat. The LSZ is where freshwater transitions into brackish water; the LSZ is defined as 0.5–6.0 psu (parts per thousand salinity; Kimmerer 2004). The 2 psu isohaline is a specific point within the LSZ where the average daily salinity at the bottom of the water is 2 psu (Jassby et al. 1995). By local convention the location of the LSZ is described in terms of the distance from the 2 psu isohaline to the Golden Gate Bridge (X2); X2 is an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby et al. 1995; Kimmerer 2002). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low.

During the past 40 years, monthly average X2 has varied from as far downstream as San Pablo Bay (45 km) to as far upstream as Rio Vista on the Sacramento River (95 km). At all times of year, the location of X2 influences both the area and quality of habitat available for delta smelt to successfully complete their life cycle (see Biology and Life History section above). In general, delta smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence.”

Longfin Smelt

The State of California has designated longfin smelt as threatened under CESA. USFWS is currently conducting a status review on the species to determine whether protection under the ESA is warranted. Longfin smelt are anadromous, euryhaline, and nektonic (free-swimming). Adults and juveniles are found in estuaries and can tolerate salinities from 0 ppt to pure seawater (35 ppt). The salinity tolerance of longfin smelt larvae and early juveniles ranges from 1 to 18.5 ppt. After the early juvenile stage, they prefer salinities in the 15–30 ppt range (Moyle 2002). Longfin smelt in the San Francisco estuary spawn in fresh or slightly brackish water (Moyle 2002:236). Prior to spawning, these fish aggregate in deepwater habitats available in the northern Delta, including primarily the channel habitats of Suisun Bay and the Sacramento River. Catches of gravid adults and larval longfin smelt indicate that the primary spawning locations for these fish are in or near the Suisun Bay channel, the Sacramento River channel near Rio Vista, and (at least historically) Suisun Marsh (Moyle 2002). Moyle (2002) indicated that longfin smelt may spawn in the San Joaquin River as far upstream as Medford Island. Two sampling programs operated by DFG during the spawning season—the Fall Mid-Water Trawl (FMWT) and the Bay Study (mid-water and bottom “otter” trawls)—found most of the juveniles were caught in the lower Sacramento River and Suisun Bay. Longfin smelt spend most of their life cycle in brackish-to-marine waters and nearshore environments (Moyle 2002). They are capable of living their entire life cycle in fresh water, as demonstrated by landlocked populations, but the Bay study distribution indicates they are most abundant in Suisun, San Pablo, and central San Francisco Bays.

Prespawning adults generally are restricted to brackish or marine habitats. In the fall and winter, yearlings move upstream into fresher water to spawn. Spawning may occur as early as November, and larval surveys indicate it may extend into June (Moyle 2002). The exact nature and extent of spawning habitat are still unknown for this species (Moyle 2002), although major aggregations of gravid adults occur in the northwestern Delta and eastern Suisun Bay.

Embryos hatch in 40 days at 7°C and are buoyant. They move into the upper part of the water column and are carried into the estuary. High outflows transport the larvae into Suisun and San Pablo Bays. In low outflow years, larvae move into the western Delta and Suisun Bay. Higher outflows are associated with higher juvenile production and adult abundance. Rearing habitat is highly suitable in Suisun and San Pablo Bays in part because juveniles require brackish water in the 2–18 ppt range. Longfin smelt are pelagic foragers that feed extensively on copepods, amphipods, and shrimp (U.S. Fish and Wildlife Service 1996; Moyle 2002). Alterations in the composition and abundance of the primary producer and primary/secondary consumer assemblages in Suisun Bay and Delta have been implicated as a factor in the recent decline of longfin smelt and other native fish species (U.S. Fish and Wildlife Service 1996); however, Delta outflows appear to be a strong correlate of longfin performance (Kimmerer 2002).

Splittail

Splittail previously were listed as threatened under the ESA. More recent improvements in population performance coupled with extensive habitat restoration programs resulted in its delisting in 2003 (Sommer et al. 2007). Adult splittail migrate from Suisun Bay and the Delta to upstream spawning habitat during December through March (Table 4.1-2).

Surveys conducted indicate that the Yolo and Sutter Bypasses provide important spawning habitat (Sommer et al. 1997). Spawning aggregates appear to demonstrate reproductive isolation, suggesting some sub-population structure within the Delta (Baerwald et al. 2006, 2008). 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 4.1-2) (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 shrimp, *Neomysis mercedis,* is a primary prey species, although decayed organic material constitutes a larger percentage of the stomach contents (Daniels and Moyle 1983). Diet, physiology, and growth all appear to be affected by flow conditions for age-0 fish (Feyrer et al. 2007).

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 4.1-2). 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 1991). 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) or to increased adult mortality from harvest and other factors (Kimmerer et al. 2001).

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 fresh water, 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, and the southern distinct population segment includes populations extending from south of the Eel River to the Sacramento River. Spawning populations have been confirmed, however, only 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, 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 also may 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 metamorphosis 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 fresh water 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 (Interagency Ecological Program 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 be mostly bottom invertebrates and small fish (Ganssle 1966). Juveniles in the Delta feed on opossum shrimp and amphipods (Radtke 1966).

The south Delta is within the proposed critical habitat for green sturgeon.

Other Species

The species discussed above are explicitly included in the assessment of impacts for the Intertie. Central Valley rivers and reservoirs support many other native and nonnative fish species that may be indirectly affected by the Intertie (Table 4.1-1). Several other fish species are included in the Delta fish assemblage that may be directly affected by the Intertie through salvage or habitat condition modification. In general, the effects of the Intertie on other fish species are assumed to be similar and encompassed by the assessment of the selected species presented here.

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 potentially have affected the abundance of special-status and other important species in the Central Valley. Although not all species are discussed, many of the factors affecting the special-status species also have affected the abundance of other native and nonnative species. Because the Intertie would affect only environmental conditions in the Delta, the factors within the Delta are emphasized.

Spawning Habitat Area

Spawning habitat area may limit the production of juveniles and subsequent adult abundance of some species. Chinook salmon and steelhead spawn in upstream river gravel habitats. Green sturgeon spawn in deep, fast water habitats. Most striped bass spawning occurs upstream in the Sacramento River and tributaries. However, because upstream river spawning is assumed not to be changed by the Intertie Alternatives, only Delta spawning, rearing, and migration effects are evaluated in this impact assessment.

Delta smelt spawn in tidal fresh water 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. Longfin smelt also spawn in both brackish and freshwater areas of Suisun Bay and the Delta. Delta outflow controls the location of the salinity gradient within Suisun Bay. The major variations are caused by low runoff years and high outflow years. Minor variations in outflow within the spawning period may shift the location of suitable spawning salinities, or may affect the food resources within these salinity zones.

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 longer days (Moyle 2002). The Sutter and Yolo Bypasses along the Sacramento River are important spawning habitat areas during high flow.

Rearing Habitat Area

Rearing habitat area may limit the production of juveniles and subsequent adult abundance of some species. Although most rearing of Chinook salmon, steelhead, and green sturgeon occurs in upstream river habitats, some rearing may occur in the Delta, especially in high-flow years when fry or young juveniles are transported during major storms into the Delta. Chinook salmon rear along the shallow vegetated edges of Delta channels (Grimaldo et al. 2000).

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 are 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).

Striped bass larvae are present in the Delta during the spring and summer months, but young of the year rear throughout the freshwater Delta year-round. Rearing habitat for striped bass may be related to the location of X2 and corresponding volume of low salinity estuary (Kimmerer et al. 2001). One assessment suggested a relationship between pesticide runoff and striped bass rearing (Bailey et al. 1994). This hypothesis has since been refuted (Kimmerer et al. 2001). Although the availability of rearing habitat varies with environmental conditions, rearing habitat does not seem to limit striped bass production in the Delta because of density-dependent recruitment (Kimmerer et al. 2001).

Longfin smelt generally rear in Suisun Bay and San Pablo Bay. Older juveniles and adults disperse throughout the full range of salinity. Some juveniles are found upstream in freshwater areas of the Delta, especially in lower runoff years. This makes them more vulnerable to salvage, especially in April and May of low outflow springs.

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 adults are able to tolerate salinity concentrations as high as 29 ppt and as low as 0 ppt (Moyle 2002).

Migratory Habitat Conditions

The Delta provides a migration pathway between freshwater and ocean habitats for adult and juvenile steelhead and all runs of Chinook salmon. 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 >20 mm are active swimmers, allowing them to orient in the water column to maximize directed movement in tidal areas. However, as with all fishes, delta smelt have limitations to their swimming abilities (Swanson et al. 1998). Therefore, changes in 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 migrate through the Delta, but the conditions that may affect adult or juvenile migrations through the Delta are not identified.

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 physiologically can tolerate warmer temperatures (25°C thermal maxima for delta smelt) (Swanson et al. 2000), but they tend to select colder water areas . 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, and delta smelt eggs perform best in waters below 16 °C (Mager et al. 2004).

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 moving to take advantage of local water temperature refugia (e.g., moving into stratified pools, shaded habitat, and subsurface flow) and to improve feeding efficiency (e.g., moving into riffles).

The Intertie is not expected to change upstream river temperatures below the CVP and SWP reservoirs. Upstream temperature effects on Chinook salmon, steelhead, and green sturgeon therefore are not expected. 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).

Juvenile steelhead 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 also have been observed to migrate at water temperatures warmer than expected based on laboratory experimental results (Baker et al. 1995).

Delta smelt, longfin smelt, and splittail populations are adapted to water temperature conditions in the Bay-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).

Salvage

All fish species are salvaged to varying degrees by the SWP and CVP Delta export facilities. Fish salvage and subsequent mortality are a function of the size of the diversion, the location of the diversion, the behavior of the fish (i.e., their residence time and distribution in the south Delta), and other factors such as fish screens (louvers for the CVP and SWP fish facilities), presence of predatory species, and water temperature. Low approach velocities are assumed to minimize stress and protect fish from salvage. The louvers work best at relatively high velocities because the water turbulence at the louvers is a major cue for fish avoidance.

The CVP and SWP salvage records for 1980–2008 were used to evaluate the potential for changes in salvage resulting from the Intertie. The number of fish per volume of pumping (i.e., salvage density [fish/taf]) indicates when a species is most likely to be salvaged. The sizes of the salvaged fish indicate the dominant life stage each month, although the CVP and SWP fish facilities cannot capture fish shorter than about 20 mm.

For example, the CVP and SWP fish facilities indicate salvage of adult delta smelt during spawning migration from December through March (U.S. Fish and Wildlife Service 2008). Juvenile delta smelt are salvaged primarily from April through July. Juvenile longfin smelt are salvaged in April and May. Young-of-year splittail are salvaged between April and August when fish are moving downstream into the estuary (Moyle 2002). Juvenile Chinook salmon are salvaged in all months but primarily from November through June when juveniles (of each run) are migrating downstream. Few green sturgeon are entrained at the CVP and SWP fish facilities; however, salvage has occurred in every month (Interagency Ecological Program 2005).

The number of fish salvaged at SWP and CVP export pumps is a function of the rate of exports, reversed Old and Middle River flows (a function of exports and inflows), and the density of fish (fish/taf) near the fish salvage facilities. In addition to exports, the monthly fish density patterns at Jones or Banks Pumping Plants are indirectly influenced by biological conditions such as the annual population abundance, estuary food-web interactions (i.e., predator losses in route to salvage), life history patterns (at large spatial scales), and fish behavior (at smaller spatial scales). These variables are specific to each covered species and are influenced by their population status. The rate and timing of pumping directly affect the quantity of water passed through the facilities, and therefore the number of fish entrained is the export volume (taf) times the fish density (estimated from salvage density—see Assessment Methods below). The CVP and SWP fish facilities report the number of fish salvaged as part of ongoing monitoring programs. Salvage is highly variable by year for most species but shows strong seasonal trends associated with their life history. These salvage data are described in the impact assessment section below.

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. These contaminants enter rivers in winter runoff and enter the estuary in concentrations that can be toxic to invertebrates (CALFED Bay-Delta Program 2000). 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. However, the Intertie would not change the discharge or river flows that control the resulting concentrations of contaminants within the Delta channels.

Predation

Predation is sometimes considered a habitat condition that may be partially controlled by physical habitat alterations. Nonnative species may cause substantial predation mortality on native species. Studies at CCF have estimated high predator-related mortality. Although the predation contribution to mortality is uncertain, the estimated mortality suggests that white catfish, striped bass, and other predatory fish pose a threat to juvenile fish in the Delta. 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). The Intertie would have no effects on predators in the Delta.

Food

Food availability and type affect survival of all fish species. Species such as threadfin shad and Mississippi silversides may affect delta smelt survival through competition for food. Introduction of nonnative food organisms also may 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 inflows may 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 is assumed to increase the availability of suitable prey organisms for delta smelt and other fish species. Food sources in the Delta also may be affected by export operations directly through entrainment of food organisms (e.g., phytoplankton and zooplankton), or indirectly through changes in flows that alter the location or composition of the available food source. However, the export pumping changes caused by the Intertie operations are not expected to be large enough to influence these indirect effects on food availability, which are generally more characteristic of the differences between low-flow and high-flow conditions.

Regulatory Setting

Federal Regulations

Endangered Species Act

The ESA protects fish and wildlife species and their habitats that have been identified by the USFWS as threatened or endangered. *Endangered* refers to species, subspecies, or distinct population segments (DPSs) that are in danger of extinction through all or a significant portion of their range. *Threatened* refers to those likely to become endangered in the near future.

The ESA is administered by USFWS and NMFS. In general, NMFS is responsible for protection of ESA-listed marine species and anadromous fishes, whereas other listed species are under USFWS jurisdiction. Provisions of Sections 7 and 9 of ESA are relevant to this project and are summarized below.

Section 7: Endangered Species Act Authorization Process for Federal Actions

Section 7 provides a means for authorizing take of threatened and endangered species by federal agencies. It applies to actions that are conducted, permitted, or funded by a federal agency. Under Section 7, the federal agency conducting, funding, or permitting an action (the federal lead agency) must consult with USFWS, as appropriate, to ensure that the proposed action will not jeopardize endangered or threatened species or destroy or adversely modify designated critical habitat. If a proposed action "may affect" a listed species or designated critical habitat, the lead agency is required to prepare a BA evaluating the nature and severity of the expected effect. In response, USFWS issues a BO, with a determination that the proposed action either:

- may jeopardize the continued existence of one or more listed species (jeopardy finding) or result in the destruction or adverse modification of critical habitat (adverse modification finding), or

- will not jeopardize the continued existence of any listed species (no jeopardy finding) or result in adverse modification of critical habitat (no adverse modification finding).

The BO may stipulate discretionary “reasonable and prudent” alternatives. If the proposed action would not jeopardize a listed species, USFWS issues an incidental take statement to authorize the proposed project.

Operations Biological Opinions

The operation of the Intertie was included in the CVP/SWP Longterm Operations Plan (described in Chapter 1 of this EIS), and actual operations will be governed by the RPAs outlined in the subsequent Operations BOs as summarized below.

The USFWS determined (December 2008) that an RPA is necessary for the protection of delta smelt. The RPA includes measures to: 1) prevent/reduce entrainment of delta smelt at Jones and Banks Pumping Plants; 2) provide adequate habitat conditions that will allow the adult delta smelt to successfully migrate and spawn in the Bay-Delta; 3) provide adequate habitat conditions that will allow larvae and juvenile delta smelt to rear in the Bay-Delta; 4) provide suitable habitat conditions that will allow successful recruitment of juvenile delta smelt to adulthood; and 5) monitor delta smelt abundance and distribution through continued sampling programs through the IEP. The RPA is comprised of the following actions:

Action 1: To protect pre-spawning adults, exports would be limited starting as early as December 1 (depending on monitoring triggers) so that the average daily Old and Middle River (OMR) flow is no more negative than -2,000 cfs for a total duration of 14 days.

Action 2: To further protect pre-spawning adults, the range of net daily OMR flows will be no more negative than -1,250 to -5,000 cfs (as recommended by smelt working group) beginning immediately after Action 1 as needed.

Action 3: To protect larvae and small juveniles, the net daily OMR flow will be no more negative than -1,250 to -5,000 cfs (as recommended by smelt working group) for a period that depends on monitoring triggers (generally March through June 30).

Action 4: To protect fall habitat conditions, sufficient Delta outflow will be provided to maintain average X2 for September and October no greater (more eastward) than 74 km (Chipps Island) in the fall following wet years and 81 km (Collinsville) in the fall following above normal years.

Action 5: The head of Old River barrier will not be installed if delta smelt entrainment is a concern. If installation of the head of Old River barrier is not allowed, the agricultural barriers would be installed as described in the Project Description.

Action 6: A program to create or restore a minimum of 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh will be implemented within 10 years. A monitoring program will be developed to focus on the effectiveness of the restoration program.

NMFS determined (June 2009) that an RPA is necessary for the protection of salmon, steelhead, and green sturgeon. The RPA includes measures to improve habitat, reduce entrainment, and improve salvage, through both operational and physical changes in the system. Additionally, the RPA includes development of new monitoring and reporting groups to assist in water operations throughout the CVP and SWP systems and a requirement to study passage and other migratory conditions. The more substantial actions of the RPA include:

- Providing fish passage at Shasta, Nimbus, and Folsom Dams.
- Providing adequate rearing habitat on the lower Sacramento River and Yolo Bypass through alteration of operations, weirs, and restoration projects.
- Engineering projects to further reduce hydrologic effects and indirect loss of juveniles in the interior Delta.
- Technological modifications to improve temperature management in Folsom Reservoir.

Overall the RPA is intended to avoid jeopardizing listed species or adversely modifying their critical habitat, but not necessarily to achieve recovery. Nonetheless, the RPA would result in benefits to salmon, steelhead, green sturgeon and other fish and species that use the same habitats.

Section 9: Endangered Species Act Prohibitions

Section 9 prohibits the take of any wildlife species federally listed as endangered. Take of threatened species also is prohibited under Section 9, unless otherwise authorized by federal regulations.[1] *Take,* as defined by ESA, means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” *Harm* is defined as “any act that kills or injures the species, including significant habitat modification.” In addition, Section 9 prohibits removing, digging up, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction.

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 NMFS 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 essential fish habitat but that may, nonetheless, have an impact on essential fish habitat waters and substrate also must be considered in the consultation process.

[1] In some cases, exceptions may be made for threatened species under Section 4[d]. In such cases, USFWS or NMFS issues a “4[d] rule” describing protections for the threatened species and specifying the circumstances under which take is allowed.

Under the Magnuson-Stevens Act, effects on habitat managed under the Pacific Salmon Fishery Management Plan also must 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, Fish and Wildlife Coordination Act (FWCA), Clean Water Act (CWA), and ESA. Essential fish habitat consultation requirements can be satisfied through concurrent environmental compliance if the lead agency provides NMFS with timely notification of actions that may adversely affect essential fish habitat and if the notification meets requirements for essential fish habitat assessments. Reclamation has complied with Magnuson-Stevens Act regulations through the OCAP consultation process. The NMFS Operations BO (National Marine Fisheries Service 2009) includes consultation on Essential Fish Habitat.

4.1.3 Environmental Consequences

Assessment Methods

The assessment of environmental consequences links project actions to changes in environmental conditions that individually or synergistically affect the survival, growth, fecundity, and/or movement of a species. Environmental conditions addressed in this assessment of potential Delta effects on fish are spawning habitat condition, rearing habitat condition, migration habitat condition, and salvage in Delta diversions.

The Intertie may cause changes in exports and inflows that could affect environmental conditions in the Delta. Changes in water supply operations (i.e., Delta exports and inflows) potentially affect upstream environmental conditions in the Sacramento River, San Joaquin River, and tributaries. The potential changes in water supply operations, affecting river flows, reservoir operations, and diversions and exports were simulated using CALSIM over a range of conditions represented by the 1922–2003 hydrology (Section 3.1, Water Supply). The 1922–2003 years include wet and dry conditions and provide an indication of operations 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 hydrologic conditions within the Delta. Upstream changes were shown to be very small in the CALSIM results described in Section 3.1. The fish assessment for the Intertie therefore is focused on Delta effects. A more complete description of these potential upstream effects of the CVP and SWP reservoir operations on fish can be found in the CVP/SWP Longterm Operations Plan, USFWS Operations BO for delta smelt (U.S. Department of the Interior, Bureau of Reclamation 2008), and the NMFS Operations BO for salmon (National Marine Fisheries Service 2009).

Quantitative methods were used to assess change in environmental conditions potentially affected by Intertie project actions that could cause a measurable species response (i.e., a measurable change in survival, growth, fecundity, and/or movement). The primary environmental conditions important for fish survival associated with the Intertie project are the acres of suitable habitat in terms of water volume (taf), temperature (degrees Fahrenheit), salinity (psu as the position of X2), and the rate of salvage (numbers of fish). The assessment methods are similar to previously published studies and recent assessments of the overall CVP and SWP impacts (e.g., U.S. Fish and Wildlife Service

2008; U.S. Department of the Interior, Bureau of Reclamation 2008; National Marine Fisheries Service 2009).

The impacts of each project alternative on exports and salvage were estimated based on the CALSIM outputs discussed in Section 3.1and Appendix B, and summarized in Tables 3.1-1 through 3.1-20. The low-salinity estuarine habitat conditions that are important for delta smelt rearing, longfin smelt spawning, and striped bass rearing were assessed relative to the position of X2 using the DSM2 outputs described in Section 3.3 and Appendix C, and summarized in Table 3.3-1.

The monthly historical records of CVP and SWP exports from 1980 to 2003 were used to assess salvage impacts. Table 4.1-3 shows the historical CVP monthly pumping (taf) for water years 1980–2008. The CVP pumping was seasonally uniform in almost every year. Pumping was lower in May and June for years before 1995 because the D-1485 CVP pumping limits were 3,000 cfs in these two months. Pumping has been lower in April and May since 1995 because D-1641 CVP pumping limits were reduced for VAMP and CVPIA (b)(2) fish protection actions. These 29 years of historical monthly pumping are summarized using the average monthly values and characterized by the distribution of monthly pumping (i.e., minimum, 10%, 30%, 50%, 70%, 90%, and maximum values). The annual CVP pumping and the distribution of annual pumping also are shown. The average annual CVP pumping was 2.4 maf. The minimum annual CVP pumping was about 1.4 maf in 1991 and 1992, and the maximum annual CVP pumping was 2.9 maf in 1988 and 1989.

Table 4.1-4 shows the historical SWP monthly pumping (taf) for water years 1980–2008. The SWP pumping was more variable from month to month and between years. Monthly pumping was highest in the winter (December–February) and in the summer (July–September). Pumping was lowest in the spring (April–June) because of D-1485 restrictions (3,000 cfs maximum in May and June) and because of VAMP reductions and the 35% export/import (E/I) limits since 1995. The annual SWP pumping and the distribution of annual pumping also are shown. The average annual SWP pumping was 2.6 maf. The minimum annual SWP pumping was about 1.5 maf in 2008, and the maximum annual SWP pumping was 3.7 maf in 2000. Combined CVP and SWP historical exports are summarized in Table 4.1-5.

Historical salvage estimates are presented for the covered species in Tables 4.1-6 through 4.1-20. For each facility, species, month, and water year during 1980–2008, historical salvage densities were estimated based on the equation:

Equation 4.1. salvage density = salvage / exports (taf)

These density estimates are displayed in Tables 4.1-21 through 4.1-30. Salvage under the future no action and intertie alternatives was estimated for each covered species, facility, and scenario as:

Equation 4.2 monthly salvage = monthly exports * historic density

For a given month in the 1980–2003 record. Historical densities were used because changes in exports associated with the project are small compared to other hydrodynamics in the system, and “the specific effects of the intertie on delta smelt cannot be analytically distinguished” (U.S. Fish and Wildlife Service 2008: 216). The

Intertie will not reverse Old and Middle River flows significantly, and would not likely alter average fish densities at the pumps (through attraction or entrainment into Old or Middle River). In using Equations 4.1 and 4.2, it is assumed that the impacts of the Intertie, although not completely distinguishable from other parallel operational impacts, can be quantified in direct proportion to changes in exports attributable to the proposed action. Mathematically this is accomplished by assuming that fish densities will not change because of the Intertie, but the abundance of fish to salvage will be altered based on changing exports.

Exports were those that were simulated using CALSIM and discussed in Section 3, whereas historic density was derived from the record using equation 4.1. This assessment method assumes that the historical salvage records are representative of future conditions. Monthly salvage density at CVP and SWP would remain the same for the No Action and the Intertie Alternatives, and impacts on salvage densities discussed in the NMFS and USFWS Operations BOs such as those caused by Old and Middle River flows are represented in the historical record. Increased salvage risk and salvage densities associated with water quality (i.e. reduced X2 habitat) or flows (i.e. reversed OMR flows) are assumed to be represented in the historic record due to the large variation in flow and export conditions that are included therein.

The No Action and the potential change in monthly pumping for each Intertie Alternative were estimated using CALSIM (Section 3.1). The CALSIM model does not simulate the last 5 years of hydrologic conditions (2003–2008). The monthly simulated exports under the future no action alternative are presented for CVP, SWP, and combined facilities in Tables 4.1-31, 4.1-32, and 4.1-33, respectively.

The average annual No Action CVP pumping was 2,338 taf, and the historical annual CVP pumping for the same 24 years was 2,385 taf. Comparison of the annual values indicate that the simulated No Action CVP pumping would be reduced by more than 25% in the 4-year dry period of 1987–1990 in comparison to the historical record. The D-1641 objectives were more restrictive on CVP and SWP pumping than the D-1485 objectives that governed the historical pumping (since 1978). The annual No Action CVP pumping was greater than the historical CVP pumping in most years, with increases of 1% to 11% simulated.

The average annual No Action SWP pumping was 3,467 taf, and the historical annual SWP pumping for the same 24 years was 2,525 taf. The average No Action pumping was 40% more than the historical pumping. Comparison of the yearly values indicates that No Action SWP pumping was reduced by more than 25% in the 5-year dry period of 1988–1992. No Action SWP pumping was increased in all other years compared to the historical SWP pumping because of increased simulated SWP demands.

The average annual CVP pumping for 1980–2003 increased from 2,338 taf to 2,371 taf, an increase of 33 taf (about 1.5%). The annual simulated CVP pumping changes ranged from about -11% (1991) to 7% (1992). Most of the annual changes were very small, with the 10% cumulative value of -1% change and the 90% cumulative value of 5% change. The average annual SWP pumping for 1980–2003 was nearly identical. There were many monthly changes and some year to year changes simulated for the Intertie alternative.

The historical annual combined pumping averaged about 5,000 taf and ranged from about 3,000 taf to 6,300 taf. Table 4.1-31 shows the CALSIM-simulated No Action combined monthly and annual export pumping for 1980–2003. The No Action annual combined pumping averaged about 5,800 taf and ranged from about 2,500 taf to 7,700 taf. The combined pumping increased more from the historical pumping than did the CVP pumping, because the CVP pumping has been near monthly capacity (either physical or permitted limits) for many years. The annual combined No Action export pumping increased from historical pumping by 1 maf to 3 maf in 1980–1986 because of increased water demands assumed in the No Action simulation. The No Action combined pumping was reduced from historical pumping in 1987–1992 because of higher outflow requirements and reduced pumping limits during this low-runoff period. The No Action pumping was 1 maf to 3 maf higher than historical pumping in 1993–1999 period because of higher assumed water demands. The No Action combined pumping was similar to the historical pumping in 2000–2003 because the historical demands and Delta objectives were the same as assumed in the CALSIM model.

The combined pumping changes caused by the Intertie were sometimes smaller than the simulated CVP pumping changes because SWP pumping of CVP water (wheeling) in the No Action often was reduced with the Intertie pumping. The average annual change in combined pumping was 28 taf with the Intertie. The annual pumping changes for the Intertie ranged from a reduction of 150 taf to an increase of 250 taf. The change in annual combined pumping as a percentage of the No Action combined pumping ranged from -5% to 10%, with an average increase of just 0.5%.

Historical monthly salvage densities (fish/taf) were multiplied by the simulated future no action exports (taf) to estimate the future no action salvage (fish per month) for the water years 1980–2003. These years are assumed to have the most reliable salvage data and represent the most recent 24-year period (CALSIM results end in 2003) with highest historical CVP and SWP pumping. Future no action simulated salvage estimates are presented in Tables 4.1-34 through 4.1-47.

The monthly simulated change in exports for the intertie alternative are discussed in Section 3 and summarized for CVP, SWP, and combined facilities in Tables 4.1-48, 4.1-49, and 4.1-50 respectively. Intertie impacts were estimated by multiplying the historical fish density (fish per taf) for each species at each facility times the change in exports associated with the intertie alternative for each facility. The estimated intertie impacts are shown for the CVP and SWP facilities in Tables 4.1-51 through 4.1-64.

An integrated biological (i.e., population or ecosystem) modeling framework is lacking for the fish living in the Delta and migrating from upstream rivers and tributaries. In the case of striped bass, the stock-recruitment model developed by Kimmerer et al. (2001) was used to estimate the population level impacts of juvenile salvage impacts at CVP and SWP in regard to density-dependent recruitment. Density-dependent recruitment has not been validated for the remaining covered species; therefore, the population-level impacts of salvage were not addressed. Given that the impacts of the Intertie on X2 were minimal, the combined or synergistic impacts of changes in X2 and changes in salvage associated with the alternatives were not analyzed. The analysis assumes that the project alternative would be operated within the constraints of the USFWS and NMFS Operations BO and therefore could be analyzed using the approach to impact assessment presented in those documents.

4.1.4 Environmental Effects

Alternative 1 (No Action)

Under the No Action alternative, there would be no new facilities or changes in operations. As such, there would be no effects on fish in the Delta.

The No Action conditions for estuarine habitat (X2) and fish salvage are important for comparison with the Intertie Alternatives. The No Action habitat and salvage conditions are assumed similar to the recent historical conditions. However, the No Action habitat and salvage conditions are somewhat different from the observed historical conditions because the No Action CALSIM results are different from the historical reservoir storages, releases, and Delta inflows, exports, and Delta outflows. The changes in the seasonal patterns of flows and exports are presented in Section 3.1, and the changes in exports are used to evaluate fish salvage effects caused by the Intertie. Changes in Delta outflow and X2 are used to evaluate estuarine habitat effects caused by the Intertie Alternatives. Only the changes from the simulated No Action conditions to the simulated Intertie conditions are considered and evaluated for potential Delta fish impacts.

Alternative 2 (Proposed Action)

Construction Impacts

All construction activities would occur downstream of the pumping and screening facilities and would have no impacts on water quality or physical habitat. Construction would not result in direct salvage or harassment of any fishes. Therefore, construction activities would have no impacts on fish.

Operational Impacts

Two major effects of Intertie Alternatives are evaluated for each fish of concern. The most direct effect is the change in salvage caused by the changes in Jones and Banks Pumping Plant pumping that would result from the Intertie facility. Possible indirect effects such as changes in migration success or estuarine habitat conditions (i.e., salinity-habitat size and location) may be caused by operational changes in Delta inflow or outflow resulting from the Intertie facility.

It was determined that there would be no upstream fish effects on river habitat conditions (including spawning area, water temperature, and rearing growth and survival) because the upstream changes in hydrology were found to be very small through the CALSIM modeling. Migration success and salvage in the Delta are evaluated for each covered species.

Chinook Salmon

The following assessment identifies potential operations-related impacts of implementing the Proposed Action on winter-, spring-, and fall-/late fall–run Chinook salmon in the Delta. The changes in environmental conditions created by the Proposed Action would have small impacts on Chinook salmon because population and distribution would not be reduced by the construction, operation, or maintenance of the Intertie facilities.

Impact FISH-1: Operations-Related Decline in Migration Habitat Conditions for Chinook Salmon

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, with fall-run juveniles joining in 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 and in coordination with the tides; 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 primary factors affecting the proportion of flow diverted off of the Sacramento River are Sacramento River flow and DCC gate operations. DCC gate operations are not changed under the Proposed Action, and Sacramento River flow under the Proposed Action is similar to the No Action Alternative. The proportion of Sacramento River flow diverted into the DCC and Georgiana Slough under the Proposed Action is generally the same as the proportion diverted under the No Action, especially during the primary period of juvenile Chinook salmon migration from November through June. The DCC is closed for the protection of Chinook salmon and other migrating fish. D-1641 objectives provide for DCC closure for about half the days of November–January, all of the days from February 1 to May 20, and about half the days from May 21 to June 15.

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 from CWT recovery at Chipps Island suggest 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 remains unchanged under the Proposed Action and would not affect the flow diverted into Old River (which is about 50% of the San Joaquin River flow). SWP and CVP pumping is also a factor in the proportion of flow diverted off the San Joaquin River at the head of Old River. The change in CVP and SWP pumping is minimal during April and May, when the majority of Chinook juveniles migrate through the Delta, and would have little effect on the proportion of flow drawn into Old River and the resulting survival of the San Joaquin River Chinook salmon juveniles.

Operations under the Proposed Action would have a very small impact on survival of juvenile Chinook salmon migrating from the Sacramento and San Joaquin Rivers because the proportion of flow diverted off the main river channels is similar to the proportion of flow diverted under the No Action Alternative, and the total CVP and SWP pumping is similar to the No Action pumping during the migration months for each of the Chinook salmon runs. No migration impacts on Chinook salmon, including their critical habitat, are identified.

Impact FISH-2: Operations-Related Increases in Salvage of Chinook Salmon

Simulated SWP and CVP export pumping under the Proposed Action changes pumping compared to the simulated No Action. Changes in pumping have the potential to change the amount of salvage of juvenile Chinook salmon.

The average historic annual CVP Chinook salmon salvage for water years 1980–2008 was about 95,000 fish. The months with highest Chinook salmon salvage were February–June. The average historic annual SWP Chinook salmon salvage was about 70,000 fish, somewhat less than the Chinook salmon salvage at the CVP pumps. This may be caused by the lower fraction of San Joaquin River water pumped at the SWP pumps, if most of the salvaged Chinook salmon originate from the San Joaquin River. The lower SWP salvage might be caused by higher predation losses of Chinook salmon in Clifton Court Forebay. The historical combined Chinook salmon salvage varied from about 15,000 in 1994 to more than 1.2 million in 1986. This large variation in the historical salvage suggests that many factors may affect the salvage of Chinook salmon at the CVP and SWP pumps.

The highest Chinook salmon salvage density values were in April, May, and June. The 90% cumulative CVP Chinook salmon salvage density values were about 350 fish/taf in April, 450 fish/taf in May, and 150 fish/taf in June. The 90% cumulative SWP Chinook salmon salvage density values were about 200 fish/taf in April, 500 fish/taf in May, and 250 fish/taf in June. A few years had high CVP Chinook salmon salvage in February, which may correspond with high San Joaquin River flows flushing Chinook salmon fry into the Delta. Many other factors also may cause the Chinook salmon salvage density to vary from year to year.

Under the No Action alternative, the calculated annual salvage of Chinook salmon would be about 250,000 fish. Most fall-run Chinook salmon salvage historically has occurred during April, May, and June. Winter-run Chinook salmon salvage typically occurs in the winter months. Spring-run Chinook salmon salvage occurs in the spring for fry and in the fall and spring for larger yearling fish.

Chinook salmon salvage losses calculated for the Proposed Intertie Action were similar to salvage losses under the simulated No Action. Simulated annual changes in Chinook salvage varied from a decrease in salvage of about 3% to an increase in salvage of about 8%. The average calculated Chinook salmon salvage impact was about 1%, with the majority of these calculated increases in May and June, caused by indirect operational effects from the Intertie pumping earlier in the year. May and June salvage would be predominantly fall-run Chinook salmon from the San Joaquin River.

There is the possibility for increased salvage of winter-run or spring-run Chinook salmon in the winter and early spring months. However, these isolated occurrences of increased Chinook salmon salvage of protected runs would be avoided as a result of implementation of Operations BOs that limit pumping in winter and spring months.

Because the Intertie operations will be in compliance with the BOs, there would be no adverse effect.

Steelhead

The following assessment identifies potential impacts of implementing the Proposed Action on Central Valley steelhead. This section assesses the potential effects of those changes on Delta migration, survival, and salvage.

Impact FISH-3: Operations-Related Decline in Migration Habitat Conditions for Steelhead

In the Delta, juvenile steelhead migration survival is assumed to be similar to Chinook salmon survival, which 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 steelhead enter the Delta from upstream habitat in the Sacramento River and its tributaries beginning in December. Downstream movement and migration continue through May or June. Few juvenile steelhead move through the Delta from July through November. As described for Chinook salmon, operations under the Proposed Action would have a small effect on survival of juvenile steelhead migrating from the Sacramento and San Joaquin Rivers or their critical habitat because the proportion of flow diverted off the main river channels is similar to the proportion of flow diverted under the simulated No Action, for both Sacramento River and San Joaquin River migrating steelhead.

Impact FISH-4: Operations-Related Increases in Salvage of Steelhead

Changes in pumping potentially alter salvage of juvenile steelhead. The average annual historical CVP salvage of steelhead from 1980–2008 was about 3,000 fish. The average annual historical SWP steelhead salvage was about 4,500 fish. The majority of the CVP and SWP steelhead salvage was highest in the months of January to May.

The calculated annual average steelhead salvage for the No Action combined (CVP and SWP) pumping for 1980–2003 was about 9,000 fish, which is higher than the average historical annual combined steelhead salvage of about 7,500 fish. Salvage with the Intertie is projected to be slightly less than the No Action because the increased pumping of about 28 taf/yr would occur in months with little or no assumed steelhead salvage, while the reduction in February and March (from filling San Luis Reservoir earlier) would provide a slight reduction in annual steelhead juvenile salvage on average. This is can be seen throughout the simulated record. However, certain years have historically produced high densities of steelhead which resulted in high estimates of salvage during some March months. In the long-term the Intertie is likely to have a beneficial effect from the shifting of CVP exports to the November–December–January period and away from the spring months.

Delta Smelt

The following assessment identifies potential impacts of implementing the Proposed Action on delta smelt. Delta smelt occur primarily in the Delta and Suisun Bay, with sporadic occurrence in San Pablo Bay and frequent occurrence in the Napa River estuary. The entire life history of delta smelt occurs in the estuary. This section assesses the potential effects of changes in exports and Delta flows on delta smelt spawning, survival, growth, fecundity, and movement of specific life stages. Environmental impacts considered for delta smelt include spawning habitat conditions, rearing habitat conditions, migration habitat conditions, and salvage in Delta export pumping.

Impact FISH-5: Operations-Related Loss of Spawning Habitat Area for Delta Smelt

Delta smelt spawn in the freshwater Delta upstream of X2, in Suisun Marsh, and in the Napa River estuary, in the months of February, March, and April. Delta smelt spawn primarily in fresh water (salinity of less than 5 ppt). Because water supply operations under the Proposed Action would have little effect on the location of X2 during the spawning period, there would not be any adverse effects on Delta smelt spawning areas.

Impact FISH-6: Operations-Related Loss of Rearing Habitat Area for Delta Smelt

Changes in water supply operations (i.e., Delta outflow) potentially affect estuarine rearing habitat area for delta smelt. The location of the preferred salinity range for delta smelt in Suisun Bay impacts estuarine rearing habitat quantity and quality in concert with other environmental variables (Feyrer et al. 2007). The range of salinity preferred by juvenile rearing delta smelt (32 ppt to 10 ppt) is well within Suisun Bay during the summer and fall.

The CALSIM-simulated changes in X2, which depend directly on the simulated outflow, were relatively small. Because the outflow does not change substantially, the X2 location does not shift significantly as a result of Intertie pumping and CVP operational changes. The changes in rearing habitat area attributable to water supply operations under the Proposed Intertie Action are therefore small. The changes in the estuarine rearing habitat area position within Suisun Bay under the Proposed Action are small (generally less than 0.1 km) and infrequent for most years during all rearing months (June through December). Given that these changes are small and infrequent, effects on survival of delta smelt are not considered adverse.

The USFWS Operations BO (December 2008) requires sufficient Delta outflow to maintain average X2 for September and October downstream of 74 km (Chipps Island) in the fall following wet years and downstream of 81 km (Collinsville) in the fall following above normal years to increase the protection of delta smelt rearing habitat area in these months prior to upstream migration to spawning areas. The USFWS Operations BO for delta smelt also requires the creation or restoration of 8,000 acres of intertidal and associated subtidal habitat in the Delta and Suisun Marsh. This habitat is expected to increase delta smelt rearing habitat by providing more suitable and accessible habitat areas downstream of X2. This would more than offset the small changes in X2 and rearing habitat availability attributable to the Intertie.

Impact FISH-7: Operations-Related Decline in Migration Habitat Conditions for Delta Smelt

Net flow in the Delta channels could be affected by the Intertie pumping and operational changes. Although net channel flows may contribute to downstream movement of larvae and juvenile fish, actual effects of net flow changes on the movement of larvae or juvenile delta smelt have not been demonstrated. Given that net flow changes attributable to water supply operations caused by the Intertie are small relative to No Action net flows, and are very small relative to channel tidal flows, effects on delta smelt juvenile migrations are expected to be very small, and are not considered adverse.

In addition, Reclamation will implement the USFWS Operations BO RPA Action 3, which essentially prohibits the Intertie from operating during the period of juvenile migration from upstream spawning areas to downstream estuarine rearing areas, thus avoiding the potential impact on juvenile delta smelt migration.

Impact FISH-8: Operations-Related Increases in Central Valley Project and State Water Project Pumping Resulting in Salvage of Delta Smelt

Change in CVP and SWP pumping potentially alters salvage of juvenile delta smelt. The historical combined salvage of delta smelt averaged about 45,000 fish for the 1980–2008 period. The historical salvage of adult delta smelt in the months of December–March averaged about 7,000 fish.

Under the simulated No Action, annual calculated salvage of delta smelt was about 70,000 fish, with an average adult salvage of about 25,000 fish. These calculated No Action salvage values are higher than the historical averages. Although most delta smelt (about 85%) are salvaged during May–July, the adult life stage in December–March is potentially more important for the estuary population abundance. Therefore, the change in adult salvage is considered more important than the change in total delta smelt salvage. The calculated Intertie impact on delta smelt was an increase in annual average salvage of about 2,250 fish (1.3%). The calculated Intertie effect on adult salvage in December–March showed a slight decrease in salvage due the shifting of pumping to the summer and fall months. Therefore the Intertie alternative showed a slight benefit to adult salvage.

The actual Intertie impacts would depend on the increased pumping that would be allowed with the Intertie facility and on the actual delta smelt CVP salvage density during the month of increased pumping. In addition, the USFWS Operations BO RPA Actions 1, 2, and 3 would provide protection for adult and juvenile delta smelt salvage. RPA Action 1 will limit exports starting as early as December 1 so that the average daily Old and Middle River flow is no more negative than -2,000 cfs for a total duration of 14 days. Action 2 will limit the range of net daily Old and Middle River flows so that they are no more negative than -1,250 to -5,000 cfs beginning immediately after Action 1 as needed. Action 3 continues this reverse Old and Middle River protection through June. These actions would reduce flows toward the export facilities in the winter and spring, effectively eliminating Intertie operations and any potential effects. As such, there would be no adverse effect.

Longfin Smelt

The following assessment identifies potential impacts of implementing the Proposed Action on longfin smelt. Longfin smelt occur throughout the San Francisco estuary, but spawning is primarily in Suisun Bay and the lower San Joaquin River and Sacramento River habitats. This section assesses the potential effects of changes in exports and Delta flows on longfin smelt spawning, survival, growth, fecundity, and movement of specific life stages. Environmental impacts considered for longfin smelt include spawning habitat conditions, rearing habitat conditions, and salvage in Delta export pumping.

Impact FISH-9: Operations-Related Loss of Spawning Habitat Area for Longfin Smelt

Longfin smelt spawn in the brackish water of Suisun Bay and in some freshwater Delta areas in the months of December, January, and February. Existing information does not indicate that spawning habitat is limiting population abundance and production. Intertie pumping and indirect operational changes are not expected to have any measurable effect on longfin smelt spawning habitat conditions because the simulated changes in the X2 parameter caused by the Intertie were very small during the spawning months of December–February and because longfin spawning occurs throughout a wide range of salinity (upstream and downstream of X2).

Impact FISH-10: Operations-Related Loss of Rearing Habitat Area for Longfin Smelt

Longfin smelt larvae and juveniles rear in Suisun Bay and downstream in San Pablo and central San Francisco Bays. Juveniles may disperse throughout the estuary in search of food. Therefore, it is unlikely that the Intertie will have any effects on this wide distribution of rearing habitat conditions because Intertie operations would only slightly change the X2 position and have no effects on the higher salinity regions of the San Francisco Bay.

Impact FISH-11: Operations-Related Increases in Central Valley Project and State Water Project Pumping Resulting in Salvage of Longfin Smelt

The historical CVP longfin smelt salvage for water years 1980–2008 averaged about 5,000 fish. There was a wide range of salvage, with 17 years with fewer than 1,000 longfin smelt salvaged. The maximum CVP salvage of longfin smelt was 43,000 in 2002. The average annual historical SWP longfin smelt salvage was 13,000 fish, with 13 years with fewer than 1,000 longfin smelt salvaged at SWP. The maximum SWP longfin smelt salvage was 145,000 in 1988, and about 55,000 longfin smelt were salvaged in 2002. The CVP and SWP salvage of longfin smelt was highest in April and May, with some salvage in June.

The calculated No Action longfin smelt salvage averaged about 17,500 fish. This is similar to the historical combined salvage of 22,000 longfin smelt. The largest Intertie impact on estimated monthly salvage of longfin smelt was approximately 3000 fish, but on average the Intertie alternative had no impact on salvage. A few years had increased calculated salvage (5% maximum), and several years had decreased salvage (2.5% maximum). As such, there would be no adverse effect.

Splittail

The following assessment identifies potential impacts of implementing the Proposed Intertie Action on splittail. Adult and juvenile splittail spend most of their lives in the Delta and Suisun Bay. Splittail are dependent on conditions upstream of the Delta for rearing and spawning, especially inundated floodplain in the Yolo and Sutter Bypasses, and in the San Joaquin River tributaries. This section assesses the potential effects of those changes on survival, growth, fecundity, and movement of specific life stages. Environmental conditions addressed for splittail include spawning habitat conditions, rearing habitat conditions, migration habitat conditions, food, and salvage.

Impact FISH-12: Operations-Related Loss of Spawning Habitat Area for Splittail

Splittail spawn primarily from February through May in upstream floodplains. Water supply operations under the Proposed Action would not affect the inundation of upstream floodplains during these months. Some splittail spawning may occur in the Delta, but these habitat areas would not be affected by the Intertie operations. The frequency and duration of floodplain inundation would be similar for the simulated No Action and the Proposed Action, and spawning habitat area would not be affected. No adverse effects from the Intertie are expected on splittail spawning habitat conditions.

Impact FISH-13: 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, the small changes in river flows under the Proposed Action would not affect higher-volume flows. The frequency and duration of floodplain inundation would be similar for the simulated No Action and the Proposed Action, and rearing habitat area would not be affected. No adverse effects from the Intertie on splittail rearing habitat are expected.

Impact FISH-14: Operations-Related Decline in Migration Habitat Conditions for Splittail

The Sacramento River and lower San Joaquin River provide the migration pathways between freshwater and estuarine habitats for splittail. As indicated above for spawning and rearing habitat area, only small changes in river flows would result from the Intertie operations. There would be no adverse effects on migration habitat.

Impact FISH-15: Operations-Related Increases in Salvage Losses of Splittail

The average annual historical CVP splittail salvage for 1980–2008 was about 450,000 fish. The highest salvage was in the wet years with high spring San Joaquin River flows that may have provided substantial spawning and rearing floodplain habitat. The historical CVP salvage of splittail was 2.4 million in 1986, 5.3 million in1995, 3 million in 1998, and 5.4 million in 2006. The months with substantial splittail salvage were May, June, and July. The average annual historical SWP splittail salvage was about 200,000 fish, about half of the splittail salvaged at CVP. This may be caused by the lower fraction of San Joaquin River water pumped at the SWP pumps. The highest annual historical SWP splittail salvage was 1.1 million in 1986, 2.2 million in 1995, 1 million in 1998, and 0.4 million in 2006. The SWP salvage of splittail was highest in May, June, and July.

The No Action splittail salvage averaged approximately 700,000 fish per year. This is higher than the historic salvage. The impacts of the Intertie alternative were on average a net benefit for splittail. Most years and months showed a decrease in salvage due to the shift in export timing. These were mostly related to simulated decreases in exports in February correlated with very high historic splittail densities. As such, there would be no adverse effects.

Striped Bass

The following assessment identifies potential impacts of implementing the Proposed Action on striped bass. Striped bass occur in the Delta, Suisun Bay, San Francisco Bay, and the coastal waters near San Francisco Bay. Because most spawning is upstream of the Delta, no effects from the Intertie on spawning of striped bass are expected. Adult striped bass migrate upstream to the Delta and into the Sacramento River to spawn. Some juvenile and adult striped bass occur in rivers upstream of the Delta throughout the year. Environmental impacts considered for striped bass include migration habitat condition, rearing habitat condition, and salvage.

Impact FISH-16: 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.

Spawning in the Sacramento River upstream of the Delta occurs during May and June. Simulated Sacramento River flow under the Proposed Action would be similar to flow under the simulated No Action. No effects on striped bass egg and larvae transport conditions are identified.

Impact FISH-17: Operations-Related Loss of Rearing Habitat Area for Striped Bass

Striped bass larvae and juveniles rear in the Delta and Suisun Bay. Changes in water supply operations potentially could have small effects on the estuarine rearing habitat area for striped bass in Suisun Bay. The location of the preferred salinity range for striped bass in the Delta and Suisun Bay is assumed to determine estuarine rearing habitat availability. The range of salinity preferred by striped bass larvae and early juveniles is generally 0 to 5 ppt, based on summer tow net survey catch. This is centered on the X2 position, and movement of X2 is assumed to indicate a change in the rearing habitat conditions. This in turn could affect survival of rearing fish and recruitment to the population (Kimmerer 2001).

As indicated previously, comparison of X2 for the simulated No Action and the Intertie indicates that for all juvenile rearing months of May–August, the distribution of X2 is similar. Given the relatively small changes in X2 and assumed estuarine rearing habitat conditions, no adverse effects on survival of rearing striped bass would occur. Small changes in X2 associated with the proposed alternative would not result in decreased recruitment to the population, and the impacts from small X2 shifts would not be adverse.

Impact FISH-18: Operations-Related Increases in Central Valley Project and State Water Project Pumping Resulting in Salvage of Striped Bass

The average annual historical CVP salvage of striped bass for 1980–2008 was about 1.5 million fish. The highest annual salvage was about 8.5 million fish (in 1981), and the minimum annual salvage was about 40,000 fish in 2006. The average annual CVP striped bass salvage in the first 14 years (1980–1993) was about 2.5 million, and for the last 15 years (1994–2008) was about 500,000 fish. The average annual SWP striped bass salvage was about 3 million fish. The SWP striped bass salvage was almost 14 million fish (in 1986), and was also more than 10 million fish in 1987 and 1988. The minimum SWP salvage of striped bass was about 150,000 fish (in 2006). The SWP salvage of striped bass was higher in the first half of the period than in the second half. The average annual SWP striped bass salvage in the first 14 years (1980–1993) was about 5.5 million, and for last 15 years (1994–2008) was about 850,000 fish.

The highest CVP and SWP salvage of striped bass was in the months of May, June, and July. The minimum CVP and SWP striped bass salvage was in the spring months of March and April. The highest months correspond to the early juvenile life stage. The juveniles may move downstream to higher salinity habitat for rearing, and the average mortality will tend to reduce the number of striped bass as the fish grow in size.

The average No Action salvage for striped bass was approximately 6 million fish. This was higher than the historic salvage by approximately 10%. On average the Intertie Alternative would result in increased striped bass salvage by approximately 75,000 fish per year, or approximately 1% of the overall average salvage combined for both facilities. We used the Beverton-Holt calculations and methods described by Kimmerer et al. (2001) to estimate the impacts of this increased salvage on adult recruitment with density dependence. Due to low juvenile survival rates and slow recruitment to the adult population increased salvage would result in an average decrease of only ~100 fish. Because the calculated salvage impact is less than 1% of the No Action striped bass YOY salvage and because the overall impacts on the population would be small, this is not considered an adverse effect.

Green Sturgeon

The following assessment identifies potential impacts of implementing the Proposed Action on green sturgeon. Green sturgeon occur in the Delta, Suisun Bay, San Francisco Bay, and the coastal waters near San Francisco Bay. Adult green sturgeon migrate upstream to the Delta and into the Sacramento River to spawn. Environmental impacts considered for green sturgeon include migration habitat conditions and salvage in Delta export diversions.

Because green sturgeon spawn and rear in the Sacramento River upstream of the Delta, Intertie operations have no effect on spawning habitat or rearing habitat conditions.

Impact FISH-19: Operations-Related Decline in Migration Habitat Conditions for Green Sturgeon

Water supply operations could affect Sacramento River flow and survival of migrating green sturgeon. Adult green sturgeon move upstream during higher flow conditions to seek spawning habitat. Juvenile sturgeon migrate downstream to higher salinity habitats to rear. Because the upstream changes from the Intertie are so small, no adverse effects on green sturgeon or their proposed critical habitat are expected from operation of the Intertie.

Impact FISH-20: Operations-Related Increases in CVP and State Water Project Pumping Resulting in Salvage of Green Sturgeon

Green sturgeon are salvaged very infrequently compared to other Delta fish, and the low salvage density observed from month to month is similar. The average annual historical CVP salvage of green sturgeon for 1980–2008 was 183 fish. The average annual SWP salvage of green sturgeon was 75 fish. This is a fish with a very low salvage risk, which appears to be generally uniform through months and years. The salvage impacts were evaluated from the No Action and Intertie pumping changes.

Estimated annual average green sturgeon salvage for the No Action combined pumping for water years 1980–2003 was less than 200 fish. The Intertie impacts would be the same as the Intertie pumping effects (0.5%). This small change in salvage would have no adverse effects on the green sturgeon population.

Alternative 3 (TANC Site)

Construction Impacts

Similar to Alternative 2, all construction activities would occur downstream of the pumping and screening facilities and would have no impacts on water quality or physical habitat. Construction would not result in direct salvage or harassment of any fishes. Therefore, it is assumed that construction activities would have no impacts on fish.

Operation Impacts

The operational impacts of Alternative 3 are the same as described for Alternative 2.

Alternative 4 (Virtual Intertie)

Construction Impacts

Similar to Alternative 2, all construction activities would occur downstream of the pumping and screening facilities and would have no impacts on water quality or physical habitat. Construction would not result in direct salvage or harassment of any fishes. Therefore, it is assumed that construction activities would have no impacts on fish.

Operation Impacts

Impacts of the Virtual Intertie Alternative are similar in nature to those of the implementation of the Proposed Action. Although there may be some differences in fish densities between the CVP the SWP fish facilities, the seasonal occurrence and magnitudes are similar. Because the combined pumping changes would be nearly identical, the changes in fish salvage also would be about the same. Because the upstream operational changes also would be nearly the same, the effects of the Virtual Intertie on spawning and rearing Delta habitat conditions (functions of Delta outflow) also would be the same. Therefore, the operational effects of Alternative 4 are the same as described for Alternative 2.

Table 4.1-3. Monthly Historical CVP Banks Pumping (taf) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	240	61	0	0	158	199	228	179	170	281	279	209	**2,006**
1981	219	229	233	251	203	119	219	193	206	268	253	197	**2,590**
1982	130	85	48	111	210	254	205	183	175	179	267	123	**1,971**
1983	138	199	193	238	219	242	218	174	177	244	262	199	**2,502**
1984	128	57	99	84	219	263	236	184	178	288	269	186	**2,190**
1985	222	232	243	237	224	243	232	184	178	281	269	244	**2,790**
1986	241	221	238	239	219	150	166	184	178	274	270	239	**2,618**
1987	246	220	247	246	224	146	258	184	178	273	281	255	**2,758**
1988	246	234	248	250	236	251	243	183	178	275	279	273	**2,895**
1989	218	214	256	257	228	253	237	184	178	291	289	263	**2,870**
1990	259	248	253	254	227	253	253	170	178	225	186	190	**2,697**
1991	68	94	140	116	145	229	172	79	53	100	102	110	**1,408**
1992	106	120	114	197	142	252	102	52	47	55	61	95	**1,342**
1993	59	76	75	246	224	251	171	94	118	265	268	261	**2,108**
1994	265	252	255	140	215	139	93	69	79	154	150	211	**2,023**
1995	152	148	217	255	234	146	198	184	242	274	270	261	**2,581**
1996	266	251	263	263	206	45	143	128	263	274	269	256	**2,626**
1997	258	245	251	124	31	267	162	107	264	270	272	257	**2,510**
1998	263	250	251	243	164	127	86	143	170	250	269	259	**2,474**
1999	256	127	2	183	240	253	102	105	199	272	270	255	**2,262**
2000	261	250	156	197	236	208	131	78	181	266	270	253	**2,487**
2001	259	242	240	168	195	116	130	53	178	254	254	243	**2,332**
2002	223	223	226	255	200	257	128	53	151	268	267	255	**2,505**
2003	251	218	205	262	237	268	113	90	263	258	265	254	**2,685**
2004	265	257	255	268	228	255	116	59	216	269	272	261	**2,722**
2005	267	255	233	259	216	208	126	66	248	269	271	260	**2,679**
2006	267	255	263	241	240	201	49	111	200	271	271	261	**2,628**
2007	265	240	255	268	243	247	162	52	147	270	272	258	**2,679**
2008	265	210	204	187	192	111	65	55	56	216	220	237	**2,018**

Monthly Distribution of Jones Pumping Plant Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg
Min	59	57	0	0	31	45	49	52	47	55	61	95	**1,342**
10%	124	84	70	115	156	119	92	53	74	174	179	173	**1,999**
25%	218	148	156	183	200	146	116	69	170	250	262	209	**2,190**
50%	246	223	233	241	219	242	162	111	178	269	269	254	**2,510**
75%	263	248	251	255	228	253	219	183	200	274	271	259	**2,679**
90%	266	253	255	262	238	258	238	184	251	281	279	261	**2,764**
Max	267	257	263	268	243	268	258	193	264	291	289	273	**2,895**
Avg	**217**	**197**	**195**	**208**	**205**	**205**	**164**	**123**	**174**	**246**	**248**	**228**	**2,412**

Table 4.1-4. Monthly Historical Banks Pumping Plant Pumping (taf) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	227	281	362	388	194	66	89	104	179	139	283	243	**2,555**
1981	185	148	178	252	195	173	256	70	20	151	308	197	**2,132**
1982	226	190	267	206	312	384	363	183	57	65	226	188	**2,668**
1983	183	159	321	380	345	83	7	25	117	72	174	45	**1,912**
1984	21	44	30	19	109	159	219	176	183	286	306	134	**1,685**
1985	114	238	274	117	193	280	200	190	202	291	343	267	**2,710**
1986	222	207	362	310	114	43	111	196	182	247	333	377	**2,705**
1987	212	180	191	131	150	190	153	134	122	269	312	275	**2,319**
1988	108	82	297	383	334	260	260	196	166	207	254	201	**2,747**
1989	118	139	177	361	220	370	381	192	128	285	397	367	**3,136**
1990	378	361	380	390	351	391	315	31	23	150	215	153	**3,138**
1991	141	126	171	177	100	365	271	84	59	53	128	136	**1,812**
1992	212	62	73	190	203	385	74	50	66	33	97	166	**1,612**
1993	47	62	169	465	289	115	163	109	126	265	388	384	**2,583**
1994	397	154	387	215	106	118	20	43	30	106	217	220	**2,013**
1995	171	213	240	462	254	33	9	79	204	367	297	172	**2,500**
1996	181	74	7	351	171	168	107	161	305	374	385	349	**2,633**
1997	339	347	220	39	95	158	108	83	160	327	275	345	**2,496**
1998	266	293	420	196	13	0	1	56	130	220	272	266	**2,134**
1999	297	130	127	88	52	181	185	101	67	386	411	414	**2,439**
2000	307	309	232	397	425	342	181	105	261	360	387	387	**3,692**
2001	311	316	295	242	263	362	103	37	16	227	251	215	**2,635**
2002	60	193	376	398	276	240	126	42	135	384	421	250	**2,900**
2003	108	187	256	355	355	382	153	60	355	412	431	404	**3,458**
2004	176	228	263	420	369	424	127	46	101	390	409	298	**3,251**
2005	175	228	260	480	274	222	230	118	333	440	439	425	**3,625**
2006	388	314	403	196	272	164	161	127	218	422	439	424	**3,527**
2007	370	320	405	212	137	186	124	33	27	405	416	318	**2,954**
2008	191	172	201	181	195	97	75	54	49	141	113	59	**1,527**

Monthly Distribution of Banks Pumping Plant Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg
Min	21	44	7	19	13	0	1	25	16	33	97	45	**1,527**
10%	98	71	117	111	99	61	18	36	26	71	165	136	**1,786**
25%	141	139	178	190	137	118	103	50	59	150	251	188	**2,134**
50%	191	190	260	252	203	186	153	84	128	269	308	266	**2,633**
75%	297	281	362	388	289	362	219	134	183	374	397	367	**2,954**
90%	372	317	390	428	351	384	280	191	270	407	423	406	**3,472**
Max	397	361	420	480	425	424	381	196	355	440	439	425	**3,692**
Avg	**211**	**198**	**253**	**276**	**220**	**219**	**158**	**99**	**139**	**258**	**308**	**265**	**2,603**

Table 4.1-5. Historical Combined CVP and SWP Export Pumping (taf) for Water Years 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	467	342	362	388	353	265	317	283	350	419	562	452	**4,561**
1981	404	377	411	503	398	292	475	262	226	419	560	394	**4,723**
1982	356	276	315	317	522	638	569	366	231	244	493	311	**4,639**
1983	320	357	514	617	564	325	225	198	295	316	437	245	**4,413**
1984	149	100	128	103	328	422	454	360	361	574	575	320	**3,875**
1985	337	470	517	354	417	523	432	374	381	572	612	511	**5,500**
1986	463	429	600	549	333	193	276	380	360	521	603	616	**5,323**
1987	458	399	437	377	374	336	412	319	301	542	593	529	**5,077**
1988	354	316	545	633	569	511	503	378	344	483	532	475	**5,642**
1989	336	353	433	618	448	623	619	376	306	576	686	630	**6,006**
1990	637	608	633	645	578	644	568	201	201	375	402	343	**5,835**
1991	209	221	311	293	244	594	443	163	112	154	230	246	**3,220**
1992	318	181	187	386	345	637	176	102	113	88	158	261	**2,953**
1993	107	139	244	711	513	366	335	203	245	529	656	645	**4,691**
1994	662	407	641	355	321	258	113	113	109	260	367	431	**4,036**
1995	323	361	457	716	488	179	207	262	446	642	566	433	**5,081**
1996	448	325	270	614	378	214	250	288	567	648	654	605	**5,259**
1997	597	593	471	163	126	426	269	191	424	597	547	602	**5,006**
1998	529	543	671	440	177	127	87	199	301	469	541	526	**4,608**
1999	553	257	129	271	292	434	287	206	265	658	681	669	**4,701**
2000	568	558	389	594	661	549	313	183	442	625	656	640	**6,178**
2001	569	558	535	410	458	477	232	89	194	481	505	457	**4,967**
2002	283	417	602	652	477	497	253	94	286	652	687	504	**5,405**
2003	359	405	461	617	592	650	266	151	618	671	696	658	**6,142**
2004	441	485	518	688	597	678	244	105	317	659	681	560	**5,973**
2005	442	483	493	739	490	430	356	184	581	709	710	685	**6,303**
2006	655	569	666	437	512	364	210	238	418	693	709	685	**6,155**
2007	636	560	660	480	380	433	287	85	175	675	688	576	**5,634**
2008	456	382	405	368	387	207	140	109	105	358	333	297	**3,546**

Monthly Distribution of Historical Jones Pumping Plant Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Avg
Min	107	100	128	103	126	127	87	85	105	88	158	245	**2,953**
10%	269	213	232	289	282	205	169	101	113	257	360	290	**3,809**
25%	336	325	362	368	345	292	232	151	226	419	505	394	**4,608**
50%	442	399	461	480	417	430	287	201	301	542	575	511	**5,077**
75%	553	485	545	618	513	549	432	288	381	648	681	616	**5,642**
90%	636	562	645	693	581	639	516	375	470	671	690	660	**6,145**
Max	662	608	671	739	661	678	619	380	618	709	710	685	**6,303**
Avg	**429**	**396**	**449**	**484**	**425**	**424**	**321**	**223**	**313**	**504**	**556**	**493**	**5,016**

Table 4.1-6. Historical CVP Chinook Salvage for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	0	745	0	0	125	299	93,825	50,063	7,320	1,187	0	0	**153,564**
1981	316	1,328	308	95	0	1,709	28,907	28,975	5,458	0	0	0	**67,096**
1982	2,360	488	6,872	2,911	5,414	13,170	6,535	95,864	68,290	295	233	0	**202,432**
1983	0	14,635	12,814	5,952	4,110	6,149	47,667	112,807	31,935	928	0	0	**236,997**
1984	2,302	459	66	162	0	8,461	86,803	81,617	1,904	990	0	0	**182,764**
1985	10,714	6,671	5,009	0	7,319	4,540	46,780	59,700	1,633	103	0	0	**142,469**
1986	8,053	3,898	5,060	1,810	401,293	34,146	67,614	189,070	46,166	10,257	0	0	**767,367**
1987	642	75	966	306	504	2,477	47,962	39,077	0	0	0	0	**92,009**
1988	0	0	2,395	3,726	2,196	1,484	24,196	22,219	205	57	0	0	**56,478**
1989	0	0	302	73	0	6,151	13,539	20,685	2,489	0	0	0	**43,239**
1990	0	0	0	92	103	71	2,085	2,840	916	0	0	0	**6,107**
1991	0	0	0	0	198	2,527	18,360	7,006	292	0	0	0	**28,383**
1992	0	2,705	138	510	3,907	18,002	17,349	1,893	0	0	0	0	**44,504**
1993	0	0	24	36	360	360	5,364	11,724	1,020	0	0	0	**18,888**
1994	12	492	1,134	256	2,796	1,668	4,293	888	36	0	0	0	**11,575**
1995	12	0	2,262	3,852	816	684	9,390	24,516	23,820	1,044	0	0	**66,396**
1996	144	0	132	864	1,044	96	19,068	15,486	3,072	0	0	0	**39,906**
1997	24	192	72	240	12	16,668	20,100	13,464	3,992	12	12	24	**54,812**
1998	48	48	341	49,512	37,752	11,002	12,552	43,872	12,816	180	0	0	**168,123**
1999	0	84	0	2,196	38,148	9,773	33,378	36,851	12,252	36	36	0	**132,754**
2000	12	96	132	1,212	27,472	7,296	30,024	9,846	1,872	36	0	204	**78,202**
2001	36	48	168	276	1,176	2,977	21,804	2,550	516	0	12	0	**29,563**
2002	0	0	168	936	204	1,839	9,274	1,766	660	12	12	0	**14,871**
2003	160	155	555	2,980	1,800	3,469	5,544	1,704	276	0	0	0	**16,643**
2004	38	230	456	1,944	1,117	15,948	2,640	2,088	312	12	48	0	**24,833**
2005	0	12	96	469	2,049	4,128	8,668	8,499	1,644	48	0	0	**25,613**
2006	12	0	120	859	468	781	437	6,299	25,719	660	0	0	**35,355**
2007	0	0	96	444	1,104	1,873	3,306	459	372	0	0	0	**7,654**
2008	0	0	64	1,371	870	494	2,266	3,651	124	0	0	0	**8,841**

Monthly Distribution of CVP Chinook Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	0	71	437	459	0	0	0	0	**6,107**
10%	0	0	0	29	10	348	2,565	1,754	106	0	0	0	**11,028**
25%	0	0	72	162	204	1,484	5,544	2,840	312	0	0	0	**24,833**
50%	12	75	168	510	1,104	2,977	17,349	13,464	1,644	12	0	0	**44,504**
75%	144	488	966	1,944	3,907	8,461	30,024	39,077	7,320	180	0	0	**132,754**
90%	2,314	2,944	5,019	3,751	29,528	16,092	51,892	84,466	26,962	1,001	17	0	**186,698**
Max	10,714	14,635	12,814	49,512	401,293	34,146	93,825	189,070	68,290	10,257	233	204	**767,367**
Avg	**858**	**1,116**	**1,371**	**2,865**	**18,702**	**6,146**	**23,784**	**30,879**	**8,797**	**547**	**12**	**8**	**95,084**

Table 4.1-7. Historical SWP Chinook Salvage for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	1,516	5,392	5,249	5,968	383	188	18,668	27,041	22,836	725	22	931	**88,919**
1981	966	943	1,462	1,756	3,504	6,327	55,039	19,115	352	0	85	0	**89,549**
1982	395	2,937	12,095	6,700	26,805	22,973	28,353	110,299	24,446	0	0	0	**235,003**
1983	0	6,086	52,757	12,509	12,758	4,796	0	1,138	37,445	134	0	0	**127,623**
1984	0	162	0	0	80	1,659	27,260	40,078	46,130	3	575	0	**115,947**
1985	10,514	8,859	9,883	121	847	2,261	28,246	96,273	8,768	408	0	19	**166,199**
1986	719	1,099	1,952	1,639	13,422	18,900	133,773	176,557	90,240	0	0	0	**438,301**
1987	0	153	549	63	405	4,316	40,804	95,002	9,783	573	69	83	**151,800**
1988	2	16	26,764	2,943	4,235	3,905	44,736	71,008	21,453	1,781	308	24	**177,175**
1989	39	460	1,016	2,592	170	8,319	49,525	42,859	602	0	122	0	**105,704**
1990	38	755	1,277	2,463	1,103	4,668	17,377	8,964	595	75	0	0	**37,315**
1991	9	0	42	91	99	4,765	19,904	12,268	680	0	0	0	**37,858**
1992	72	1,282	9	904	8,445	9,255	1,058	2,365	0	0	0	6	**23,396**
1993	0	0	160	1,622	956	136	1,487	2,626	728	8	84	0	**7,807**
1994	22	77	901	193	209	283	269	1,787	20	0	0	0	**3,761**
1995	0	10	707	5,048	1,389	18	14	3,505	8,994	184	12	0	**19,881**
1996	0	0	0	3,013	280	444	2,637	6,586	1,583	14	0	10	**14,567**
1997	3	112	46	18	35	1,674	6,027	2,964	647	30	0	9	**11,565**
1998	8	22	463	352	108	4	0	1,713	1,610	120	0	0	**4,400**
1999	27	10	12	34	844	1,974	23,646	23,786	458	48	44	42	**50,925**
2000	6	39	59	630	6,825	3,355	20,690	9,144	3,951	33	15	526	**45,272**
2001	227	52	151	263	1,220	6,422	13,223	6,747	0	0	0	0	**28,305**
2002	0	0	452	1,083	272	524	1,606	2,096	32	0	15	0	**6,080**
2003	0	4	716	4,830	800	3,320	6,550	1,579	287	0	0	0	**18,086**
2004	0	0	126	3,553	1,149	4,556	2,230	773	84	0	0	0	**12,471**
2005	0	0	66	814	506	506	3,787	5,338	1,859	12	0	0	**12,888**
2006	0	0	243	250	216	568	2,047	471	5,268	132	0	0	**9,195**
2007	0	0	13	52	227	408	1,024	227	3	0	0	0	**1,954**
2008	0	0	0	406	635	190	1,374	2,149	172	0	0	0	**4,926**

Monthly Distribution of CVP Chinook Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	35	4	0	227	0	0	0	0	**1,954**
10%	0	0	7	48	106	178	218	1,065	17	0	0	0	**4,821**
25%	0	0	46	193	227	444	1,487	2,096	287	0	0	0	**11,565**
50%	3	39	452	904	800	2,261	6,550	6,586	728	8	0	0	**28,305**
75%	39	755	1,277	2,943	1,389	4,765	27,260	27,041	8,994	120	22	9	**105,704**
90%	768	3,428	10,325	5,232	9,308	8,506	45,694	95,256	27,046	441	92	50	**168,394**
Max	10,514	8,859	52,757	12,509	26,805	22,973	133,773	176,557	90,240	1,781	575	931	**438,301**
Avg	**502**	**982**	**4,040**	**2,066**	**3,032**	**4,025**	**19,012**	**26,705**	**9,966**	**148**	**47**	**57**	**70,582**

Table 4.1-8. Historical Monthly CVP Steelhead Salvage (fish) for Water Year 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	0	0	0	0	0	90	743	126	0	0	0	0	**959**
1981	0	0	252	248	1,258	1,008	168	267	0	0	0	0	**3,201**
1982	0	0	0	0	0	0	0	297	0	0	0	0	**297**
1983	0	0	1,980	0	0	0	0	0	0	0	0	0	**1,980**
1984	0	14	0	0	0	146	187	70	0	0	0	0	**417**
1985	0	0	0	0	83	134	127	101	0	0	0	0	**445**
1986	0	0	0	26	524	127	505	238	46	45	0	0	**1,511**
1987	0	0	0	143	112	718	776	275	0	0	0	0	**2,024**
1988	0	0	0	248	0	491	1,039	1,646	0	0	0	0	**3,424**
1989	0	0	139	0	252	5,051	3,139	1,212	0	0	0	0	**9,793**
1990	0	0	0	0	1,085	2,139	786	0	0	0	0	0	**4,010**
1991	0	0	0	95	109	4,412	1,263	98	0	0	0	0	**5,977**
1992	0	0	0	4,216	1,788	2,716	342	0	0	0	0	0	**9,062**
1993	0	0	0	0	3,480	3,060	684	84	24	0	0	0	**7,332**
1994	0	0	12	30	676	336	127	36	12	0	0	0	**1,229**
1995	0	0	48	12	276	648	228	108	72	0	0	0	**1,392**
1996	0	0	0	1,008	838	24	264	84	12	0	0	0	**2,230**
1997	0	0	24	12	0	168	396	60	36	12	0	0	**708**
1998	0	0	12	300	180	120	36	48	12	168	0	0	**876**
1999	0	12	0	96	324	395	484	161	24	0	0	0	**1,496**
2000	0	24	24	451	1,822	396	204	60	0	0	0	0	**2,981**
2001	0	12	12	156	2,388	1,517	468	12	12	0	0	0	**4,577**
2002	0	0	0	96	402	847	203	0	24	0	0	0	**1,572**
2003	0	0	84	4,555	1,188	816	240	60	0	0	0	0	**6,943**
2004	0	0	12	108	3,600	1,321	97	48	0	0	0	0	**5,186**
2005	0	12	0	85	513	497	108	96	36	12	0	0	**1,359**
2006	0	0	0	24	324	1,840	1	72	243	12	0	0	**2,516**
2007	0	0	0	24	748	2,096	1,140	48	12	0	0	0	**4,068**
2008	0	0	0	316	1,256	224	79	12	0	0	0	0	**1,887**

Monthly Distribution of CVP Steelhead Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	0	0	0	0	0	0	0	0	**297**
10%	0	0	0	0	0	77	29	0	0	0	0	0	**655**
25%	0	0	0	0	109	146	127	48	0	0	0	0	**1,359**
50%	0	0	0	85	402	497	240	72	0	0	0	0	**2,024**
75%	0	0	12	248	1,188	1,517	684	126	24	0	0	0	**4,068**
90%	0	12	95	562	1,935	2,785	1,059	279	38	12	0	0	**7,021**
Max	0	24	1,980	4,555	3,600	5,051	3,139	1,646	243	168	0	0	**9,793**
Avg	**0**	**3**	**90**	**422**	**801**	**1,081**	**477**	**183**	**19**	**9**	**0**	**0**	**3,085**

Table 4.1-9. Historical Monthly SWP Steelhead Salvage (fish) for Water Year 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	0	20	23	381	835	74	118	210	80	0	0	0	**1,741**
1981	33	0	25	119	1,509	3,088	4,902	0	0	0	0	0	**9,676**
1982	0	0	309	792	1,432	1,110	10,965	2,441	179	0	0	0	**17,228**
1983	17	0	0	280	89	0	0	256	0	0	0	0	**642**
1984	0	0	0	0	0	41	357	18	0	0	0	0	**416**
1985	0	0	22	0	325	1,221	1,165	647	0	0	0	0	**3,380**
1986	0	0	0	0	139	54	1,328	446	0	0	0	0	**1,967**
1987	0	0	1,268	0	69	3,387	976	446	0	0	0	0	**6,146**
1988	0	0	172	88	2,403	823	2,116	426	25	0	0	0	**6,053**
1989	0	0	0	46	499	4,767	2,105	404	0	0	0	0	**7,821**
1990	0	0	0	0	1,317	2,195	1,039	19	0	0	0	0	**4,570**
1991	0	0	41	22	23	5,799	2,692	91	0	0	0	0	**8,668**
1992	92	489	0	148	5,418	3,867	201	33	0	0	0	0	**10,248**
1993	0	0	16	1,330	8,561	792	353	200	0	0	0	0	**11,252**
1994	0	0	0	21	107	154	22	61	0	15	0	0	**380**
1995	2	0	4	360	362	78	6	86	117	30	0	0	**1,045**
1996	4	0	0	2,009	597	190	192	151	7	0	0	0	**3,150**
1997	0	17	17	0	9	88	101	23	0	0	0	0	**255**
1998	28	0	30	52	16	0	0	0	6	0	0	0	**132**
1999	39	0	0	13	7	177	588	199	42	6	4	0	**1,075**
2000	6	36	3	730	4,405	791	231	27	56	6	0	0	**6,291**
2001	3	54	83	387	2,932	4,468	258	57	0	0	0	0	**8,242**
2002	0	0	2	612	537	656	159	22	18	12	0	0	**2,018**
2003	0	0	165	3,653	1,143	591	256	62	37	0	0	0	**5,907**
2004	0	0	24	255	2,769	1,493	28	18	0	0	0	0	**4,587**
2005	0	0	42	453	687	469	399	154	34	0	0	0	**2,238**
2006	0	0	0	54	198	541	205	123	154	0	0	6	**1,281**
2007	0	0	6	25	242	786	484	24	0	0	0	0	**1,567**
2008	0	0	0	60	1,498	207	102	54	14	9	0	0	**1,944**

Monthly Distribution of SWP Steelhead Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	0	0	0	0	0	0	0	0	**132**
10%	0	0	0	0	15	51	19	18	0	0	0	0	**409**
25%	0	0	0	21	107	154	118	24	0	0	0	0	**1,281**
50%	0	0	6	88	537	656	258	86	0	0	0	0	**3,150**
75%	3	0	30	387	1,498	1,493	1,039	210	34	0	0	0	**6,291**
90%	29	23	166	900	3,227	3,987	2,231	446	87	10	0	0	**9,790**
Max	92	489	1,268	3,653	8,561	5,799	10,965	2,441	179	30	4	6	**17,228**
Avg	**8**	**21**	**78**	**410**	**1,315**	**1,307**	**1,081**	**231**	**27**	**3**	**0**	**0**	**4,480**

Table 4.1-10. Historical Monthly CVP Delta Smelt Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	CVP Total	Adults Total
1980	22,114	167	0	0	4,086	7,749	4,005	551	947	2,503	394	1,656	44,172	11,835
1981	12,145	3,189	6,395	9,838	11,950	6,206	1,674	91,004	45,913	49,380	49,081	2,879	289,654	34,389
1982	1,468	4,895	0	2,814	6,818	4,041	165	624	2,536	0	524	917	24,802	13,673
1983	772	425	0	1,851	502	0	71	55	1,621	958	0	77	6,332	2,353
1984	0	0	593	0	0	1,676	102	17,826	5,867	0	897	0	26,961	2,269
1985	152	120	0	161	164	60	206	5,733	1,721	3,866	2,177	401	14,761	385
1986	87	0	0	413	418	3	0	0	100	288	1,353	0	2,662	834
1987	180	0	0	0	0	543	18,520	13,263	0	0	0	334	32,840	543
1988	0	43	1,394	1,831	246	0	0	3,620	1,831	0	0	0	8,965	3,471
1989	72	0	100	0	0	0	3,800	2,364	295	803	413	258	8,105	100
1990	111	0	0	0	0	0	5,322	4,917	1,167	152	0	0	11,669	0
1991	0	0	142	178	0	239	440	516	0	0	0	486	2,001	559
1992	0	0	0	0	76	406	85	77	0	0	0	0	644	482
1993	0	0	0	0	36	60	0	888	2,580	240	0	0	3,804	96
1994	0	0	0	0	120	108	728	16,536	3,648	12	0	0	21,152	228
1995	0	0	12	120	24	12	24	0	0	0	0	0	192	168
1996	0	0	0	1,080	444	24	102	11,038	996	72	0	0	13,756	1,548
1997	0	12	12	0	48	1,584	1,020	16,068	1,736	12	0	0	20,492	1,644
1998	0	0	24	12	24	584	48	0	36	24	0	0	752	644
1999	0	0	0	24	1,356	440	234	20,671	24,036	324	12	0	47,096	1,820
2000	0	24	60	564	2,328	1,056	1,464	13,680	8,772	264	0	0	28,212	4,008
2001	0	240	156	156	2,208	1,008	276	6,378	1,320	0	0	0	11,742	3,528
2002	0	0	348	1,248	168	84	372	11,724	3,984	24	0	0	17,952	1,848
2003	0	0	792	2,136	540	468	492	11,358	1,536	12	0	0	17,334	3,936
2004	0	0	120	1,189	480	852	276	3,348	624	0	0	0	6,889	2,641
2005	0	0	0	540	108	0	0	74	108	0	0	0	830	648
2006	0	0	0	24	72	216	0	0	0	0	0	0	312	312
2007	0	0	0	0	36	0	24	216	60	12	0	0	348	36
2008	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Distribution of CVP Delta Smelt Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	CVP Annual	Adults Annual
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0	341	84
25%	0	0	0	0	24	3	24	77	60	0	0	0	2,001	312
50%	0	0	0	120	120	216	206	3,348	1,167	12	0	0	11,669	834
75%	87	24	120	1,080	502	852	728	11,724	2,536	264	12	77	21,152	2,641
90%	911	277	633	1,908	2,680	2,149	3,841	16,794	6,448	1,267	988	572	35,106	5,573
Max	22,114	4,895	6,395	9,838	11,950	7,749	18,520	91,004	45,913	49,380	49,081	2,879	289,654	34,389
Avg	**1,279**	**314**	**350**	**834**	**1,112**	**945**	**1,360**	**8,708**	**3,843**	**2,033**	**1,891**	**242**	**22,911**	**3,241**

Table 4.1-11. Historical Monthly SWP Salvage of Delta Smelt for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	SWP Total	Adults Total
1980	311	1,237	0	4,607	90	157	229	686	12,181	13,698	7,332	84	40,612	4,854
1981	354	338	2,020	10,541	9,111	3,339	3,891	6,170	4,909	6,972	0	20	47,665	25,011
1982	86	361	662	3,372	3,382	2,011	186	50	8	1,251	1,386	0	12,755	9,427
1983	12	466	804	2,507	716	257	0	69	2,999	764	0	294	8,888	4,284
1984	0	0	0	0	35	5	77	474	2,423	3,033	0	24	6,071	40
1985	0	0	321	30	471	490	1,229	1,461	8,073	68	0	656	12,799	1,312
1986	0	0	442	929	853	658	522	180	71	112	0	0	3,767	2,882
1987	0	43	257	48	144	176	524	117	14,824	1,958	2,697	81	20,869	625
1988	57	0	6,294	4,498	415	170	0	4,929	41,836	3,627	0	0	61,826	11,377
1989	121	4	510	1,012	107	277	145	1,678	2,702	4,568	896	171	12,191	1,906
1990	0	474	0	226	623	356	325	1,046	5,190	14,595	58	0	22,893	1,205
1991	0	0	7	420	369	951	984	119	6,238	5,337	1,164	0	15,589	1,747
1992	381	0	0	119	681	440	0	1,903	2,367	24	0	0	5,915	1,240
1993	0	0	0	3,086	1,154	89	0	15,901	6,265	807	24	0	27,326	4,329
1994	0	0	88	16	54	61	217	15,341	5,157	1,506	0	0	22,440	219
1995	0	0	42	1,937	457	4	0	0	0	0	0	0	2,440	2,440
1996	0	0	0	3,109	846	131	9	19,361	8,445	76	0	0	31,977	4,086
1997	0	0	6	0	32	146	139	16,760	6,140	216	0	0	23,439	184
1998	0	0	257	118	0	8	0	4	30	100	0	0	517	383
1999	0	0	16	4	110	124	176	38,258	49,332	19,534	36	0	107,590	254
2000	0	0	66	238	5,491	1,690	282	35,721	40,352	1,249	6	26	85,121	7,485
2001	27	70	36	25	1,662	2,740	244	6,756	1,005	6	0	0	12,571	4,463
2002	0	0	781	3,983	112	141	0	35,637	7,942	0	0	0	48,596	5,017
2003	0	0	2,008	7,413	951	15	0	4,819	8,044	0	0	0	23,250	10,387
2004	0	0	6	3,405	681	1,415	0	2,407	5,768	18	0	0	13,700	5,507
2005	0	0	0	1,107	263	0	0	467	1,085	0	0	0	2,922	1,370
2006	0	0	0	12	0	0	12	0	0	0	0	0	24	12
2007	0	0	0	0	0	0	0	195	1,449	699	0	0	2,343	0
2008	0	0	0	14	60	24	2	416	499	14	0	0	1,029	98

Monthly Distribution of SWP Delta Smelt Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	SWP Annual	Adults Annual
Min	0	0	0	0	0	0	0	0	0	0	0	0	24	0
10%	0	0	0	3	26	3	0	41	26	0	0	0	2,080	86
25%	0	0	0	25	90	24	0	180	1,085	18	0	0	5,915	383
50%	0	0	36	420	415	157	77	1,461	5,157	699	0	0	13,700	1,906
75%	12	4	442	3,109	846	490	244	6,756	8,044	3,033	24	20	27,326	4,854
90%	159	382	1,045	4,520	2,006	1,754	616	22,616	19,930	8,317	1,208	101	51,242	9,619
Max	381	1,237	6,294	10,541	9,111	3,339	3,891	38,258	49,332	19,534	7,332	656	107,590	25,011
Avg	**47**	**103**	**504**	**1,820**	**996**	**547**	**317**	**7,273**	**8,460**	**2,767**	**469**	**47**	**23,349**	**3,867**

Table 4.1-12. Historical CVP Longfin Smelt Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1981	0	0	0	251	0	0	0	0	0	0	0	0	**251**
1982	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1983	0	0	0	0	0	0	0	0	57	0	0	0	**57**
1984	0	0	0	0	0	0	0	20,582	0	1,953	0	0	**22,535**
1985	0	0	0	0	0	0	1,426	1,357	112	0	0	95	**2,990**
1986	522	0	0	0	0	0	0	21	26	121	0	0	**690**
1987	0	0	0	0	0	0	1,239	3,091	0	584	375	0	**5,289**
1988	0	0	805	248	97	0	8,495	12,619	2,546	0	0	0	**24,810**
1989	0	0	0	0	0	0	5,648	184	204	0	0	0	**6,036**
1990	0	0	0	0	64	0	6,113	5,024	1,458	0	9,700	1,545	**23,904**
1991	404	0	0	0	0	0	1,876	152	377	0	0	0	**2,809**
1992	0	0	0	0	0	103	54	371	0	0	0	0	**528**
1993	0	0	0	0	0	0	0	132	0	0	0	0	**132**
1994	0	0	0	0	0	36	615	2,268	96	0	0	0	**3,015**
1995	0	0	0	0	0	0	0	0	0	0	0	0	**0**
1996	0	0	0	24	12	0	12	72	36	0	0	0	**156**
1997	0	0	0	0	12	0	96	288	0	0	0	0	**396**
1998	0	0	48	48	12	0	0	0	0	0	0	0	**108**
1999	0	0	0	0	12	0	43	65	0	0	12	0	**132**
2000	0	0	0	12	0	0	396	96	0	0	0	0	**504**
2001	0	0	24	36	24	96	2,268	1,968	0	0	0	0	**4,416**
2002	0	0	12	84	0	852	26,268	15,816	132	0	0	0	**43,164**
2003	0	0	36	48	0	0	1,608	2,894	12	0	0	0	**4,598**
2004	0	0	0	24	0	72	204	348	0	0	0	0	**648**
2005	0	0	0	24	0	0	12	0	0	0	0	0	**36**
2007	0	0	0	12	12	0	0	12	0	0	0	0	**36**
2008	0	0	12	0	0	0	0	0	0	0	0	0	**12**

Monthly Distribution of CVP Longfin Smelt Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	0	0	0	0	0	0	0	0	**0**
10%	0	0	0	0	0	0	0	0	0	0	0	0	**8**
25%	0	0	0	0	0	0	0	0	0	0	0	0	**95**
50%	0	0	0	0	0	0	49	142	0	0	0	0	**516**
75%	0	0	0	24	12	0	1,472	2,043	67	0	0	0	**4,462**
90%	0	0	28	59	16	79	5,788	7,303	256	36	4	0	**22,946**
Max	522	0	805	251	97	852	26,268	20,582	2,546	1,953	9,700	1,545	**43,164**
Avg	**32**	**0**	**32**	**28**	**8**	**40**	**1,944**	**2,323**	**174**	**92**	**348**	**57**	**5,078**

Table 4.1-13. Historical SWP Longfin Smelt Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	0	0	419	0	82	0	2,546	5,161	850	0	0	652	**9,710**
1981	0	0	0	272	339	454	135	550	274	364	0	101	**2,489**
1982	0	0	0	0	28	0	0	0	0	0	0	0	**28**
1983	0	24	0	273	0	0	0	0	0	0	0	0	**297**
1984	0	0	0	0	0	0	374	455	0	0	0	0	**829**
1985	0	0	0	0	0	0	2,852	14,414	437	0	43	0	**17,746**
1986	0	0	198	42	15	0	325	949	0	0	0	0	**1,529**
1987	0	265	532	14	47	64	25,952	19,030	0	360	0	0	**46,264**
1988	12	0	5,274	7,068	701	6,769	67,508	47,897	10,028	0	0	0	**145,257**
1989	0	0	69	313	27	263	46,282	7,059	5,317	880	1,368	0	**61,578**
1990	0	0	0	0	0	78	11,528	10,824	3,752	65	0	10	**26,257**
1991	0	0	0	44	1	727	3,782	1,222	216	751	0	517	**7,260**
1992	0	0	0	0	0	4	8	819	2,227	0	0	0	**3,058**
1993	0	0	4	12	0	0	8	206	12	240	32	0	**514**
1994	0	0	6	8	18	0	340	2,903	121	0	0	0	**3,396**
1995	0	0	10	56	12	0	4	12	18	0	0	0	**112**
1996	0	0	0	56	16	0	1	24	0	32	8	0	**137**
1997	0	0	0	0	0	0	4	704	16	12	0	0	**736**
1998	0	0	6	12	0	0	616	0	0	0	0	0	**634**
1999	0	0	0	0	0	14	338	171	48	54	48	0	**673**
2000	0	0	0	39	18	60	960	264	33	24	6	0	**1,404**
2001	33	18	0	0	24	15	219	1,917	0	0	0	0	**2,226**
2002	0	0	0	81	0	0	11,022	41,925	1,536	6	0	0	**54,570**
2003	0	0	12	191	10	0	81	370	54	0	0	0	**718**
2004	0	0	0	204	24	0	0	48	33	0	0	24	**333**
2005	0	0	0	6	0	0	0	33	120	24	0	0	**183**
2007	0	0	0	0	0	0	0	47	9	0	3	0	**59**
2008	0	0	0	22	10	8	146	924	2	0	0	0	**1,112**

Monthly Distribution of SWP Longfin Smelt Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	0	0	0	0	0	0	0	0	**28**
10%	0	0	0	0	0	0	0	8	0	0	0	0	**130**
25%	0	0	0	0	0	0	4	48	0	0	0	0	**469**
50%	0	0	0	13	10	0	272	627	33	0	0	0	**1,258**
75%	0	0	7	62	24	26	2,623	3,468	315	38	1	0	**7,873**
90%	0	5	264	272	58	320	15,855	15,799	2,685	361	35	47	**48,756**
Max	33	265	5,274	7,068	701	6,769	67,508	47,897	10,028	880	1,368	652	**145,257**
Avg	**2**	**11**	**225**	**300**	**47**	**292**	**6,036**	**5,446**	**866**	**97**	**52**	**45**	**13,418**

Table 4.1-14. Historical CVP Splittail Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	CVP Total	Combined Total
1980	0	0			195	515	2,363	147,310	53,256	32,197	2,440	181	238,457	538,530
1981	161	0	161	299	1,314	362	7,496	83,501	32,038	2,442	1,057	0	128,831	141,621
1982	0	0	0	0	9,333	6,064	2,228	5,292	55,888	91,712	27,823	1,869	200,209	365,618
1983	77	0	1,642	1,716	11,874	9,626	3,860	44,833	186,375	54,607	28,709	3,776	347,095	439,951
1984	911	14	83	72	3,691	7,824	2,382	8,542	36,097	15,467	2,514	0	77,597	139,670
1985	0	0	0	78	1,615	3,030	1,453	3,362	8,357	10,037	3,444	478	31,854	70,837
1986	87	1,297	0	56	1,343	3,981	37,931	953,254	210,755	17,538	2,754	2,441	1,231,437	2,390,560
1987	777	366	87	795	2,353	1,607	2,291	3,393	750	197	195	230	13,041	68,248
1988	0	0	132	2,490	658	1,631	3,030	2,572	2,341	1,131	0	0	13,985	78,126
1989	0	0	0	262	692	3,213	3,820	5,044	1,960	66	0	0	15,057	60,450
1990	0	0	0	0	0	2,665	1,561	949	22,136	2,967	0	0	30,278	43,931
1991	0	0	0	524	218	3,538	2,778	876	3,573	231	0	0	11,738	36,426
1992	0	0	40	170	1,992	2,101	141	364	2,510	0	37	0	7,355	12,462
1993	0	0	0	11,412	2,796	1,836	1,662	57,156	57,072	9,396	84	12	141,426	199,694
1994	0	12	0	0	196	240	36	132	1,896	324	0	0	2,836	3,339
1995	0	0	0	648	108	12	132	200,148	2,680,028	254,676	5,616	588	3,141,956	5,332,391
1996	708	288	204	300	948	0	912	24,014	18,540	3,504	1,140	360	50,918	87,854
1997	540	120	60	0	72	2,388	1,200	5,988	9,756	822	108	48	21,102	31,704
1998	24	0	48	838	252	1,664	6,484	248,964	1,101,960	681,222	8,412	1,332	2,051,200	3,093,565
1999	484	48	0	252	408	706	89	102	4,920	10,500	372	198	18,079	33,012
2000	96	108	24	60	1,126	580	1,644	33,696	21,120	888	132	36	59,510	130,171
2001	36	0	12	24	228	253	540	252	4,860	444	60	72	6,781	16,911
2002	12	24	240	804	100	558	877	0	588	253	12	12	3,480	9,647
2003	0	24	41	967	156	639	96	780	10,632	324	36	12	13,707	19,845
2004	0	0	24	468	132	1,119	120	5,988	4,560	708	12	24	13,155	18,364
2005	0	0	0	866	154	220	1,092	29,079	292,644	18,300	216	48	342,619	444,936
2006	12	12	12	60	0	48	0	231,858	4,565,037	205,032	576	0	5,002,647	5,420,414
2007	0	0	0	0	0	60	60	132	192	300	12	24	780	1,431
2008	0	0	0	360	401	92	32	144	220	178	0	0	1,427	6,424

Monthly Distribution of SWP Splittail Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual	Combined
Min	0	0	0	0	0	0	0	0	192	0	0	0	780	1,431
10%	0	0	0	0	58	58	55	132	718	193	0	0	3,351	9,002
25%	0	0	0	59	154	253	132	780	2,510	324	12	0	13,041	19,845
50%	0	0	12	281	401	1,119	1,453	5,292	10,632	2,442	132	24	30,278	70,837
75%	87	24	66	797	1,343	2,665	2,382	44,833	55,888	17,538	2,440	230	200,209	365,618
90%	574	154	174	1,192	2,975	4,398	4,385	206,490	454,507	114,376	6,175	1,439	1,395,390	2,531,161
Max	911	1,297	1,642	11,412	11,874	9,626	37,931	953,254	4,565,037	681,222	28,709	3,776	5,002,647	5,420,414
Avg	**135**	**80**	**100**	**840**	**1,461**	**1,951**	**2,976**	**72,335**	**323,795**	**48,809**	**2,957**	**405**	**455,812**	**663,315**

Table 4.1-15. Historical SWP Splittail Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	SWP Total
1980	48	109	1,272	41,252	63,845	538	1,763	85,453	84,972	15,235	4,814	772	300,073
1981	38	0	241	804	4,254	3,368	2,818	1,192	13	0	62	0	12,790
1982	0	47	727	12,304	20,884	8,497	3,937	25,232	29,152	15,685	48,782	162	165,409
1983	9	0	766	366	3,110	1,504	0	1,346	63,041	9,149	13,382	183	92,856
1984	9	0	0	2	680	1,189	3,951	2,962	12,836	32,236	7,928	280	62,073
1985	0	227	1,220	55	5,879	2,674	4,128	4,083	17,160	2,995	398	164	38,983
1986	106	83	0	118	294	849	25,170	608,493	467,101	43,455	8,910	4,544	1,159,123
1987	255	0	1,116	213	1,172	1,978	717	3,777	39,886	5,216	703	174	55,207
1988	29	8	3,220	18,176	14,593	3,790	3,480	2,392	12,168	5,692	180	413	64,141
1989	0	70	209	459	585	6,643	10,628	10,348	2,832	1,816	10,191	1,612	45,393
1990	78	163	172	1,146	5,797	3,576	1,267	988	267	199	0	0	13,653
1991	0	0	0	60	75	2,948	8,571	279	10,510	2,245	0	0	24,688
1992	353	0	0	172	1,972	2,188	108	32	272	0	6	4	5,107
1993	0	0	13	25,727	5,991	289	222	16,847	7,151	1,610	350	68	58,268
1994	122	88	14	13	28	55	0	72	75	18	6	12	503
1995	0	0	0	2,331	469	4	2	31,542	2,051,764	99,246	4,828	249	2,190,435
1996	58	24	0	461	268	182	35	23,377	10,884	1,207	384	56	36,936
1997	46	12	4	15	57	1,571	4,208	592	2,992	899	162	44	10,602
1998	12	12	1,136	448	0	30	12	10,218	421,899	592,518	14,824	1,256	1,042,365
1999	874	148	12	25	117	703	824	261	504	9,344	1,840	283	14,933
2000	71	43	102	169	3,348	5,590	1,623	19,253	34,763	5,121	452	127	70,661
2001	383	124	60	108	1,948	3,897	3,214	36	36	186	72	66	10,130
2002	0	0	555	2,460	852	767	983	50	179	215	53	53	6,167
2003	0	36	120	720	354	409	111	51	4,147	103	52	35	6,138
2004	6	12	66	430	1,622	1,540	102	601	335	117	342	36	5,209
2005	12	24	15	1,423	136	401	342	42,121	50,867	6,894	55	27	102,317
2006	0	0	42	54	69	7	66	13,034	285,229	116,097	3,118	51	417,767
2007	72	39	23	0	18	92	46	18	2	287	45	9	651
2008	0	21	0	175	2,582	784	680	596	33	122	4	0	4,997

Monthly Distribution of SWP Splittail Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	0	0	0	0	0	4	0	18	2	0	0	0	503
10%	0	0	0	15	51	50	10	47	35	86	6	0	5,085
25%	0	0	4	60	136	401	102	279	272	199	53	27	10,130
50%	12	21	60	366	852	1,189	824	2,392	10,510	2,245	350	66	38,983
75%	72	70	555	1,146	3,348	2,948	3,480	16,847	39,886	9,344	4,814	249	92,856
90%	275	129	1,153	13,478	7,711	4,236	5,081	33,658	312,563	54,613	10,829	869	542,687
Max	874	227	3,220	41,252	63,845	8,497	25,170	608,493	2,051,764	592,518	48,782	4,544	2,190,435
Avg	**89**	**44**	**383**	**3,782**	**4,862**	**1,933**	**2,724**	**31,215**	**124,520**	**33,376**	**4,205**	**368**	**207,503**

Table 4.1-16. Historical Monthly CVP Striped Bass Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	70,899	24,850			11,246	3,169	9,116	1,775	177,993	655,002	128,300	63,915	**1,146,265**
1981	69,132	139,792	68,231	25,975	30,448	10,187	22,613	1,413,715	5,796,925	775,982	98,835	50,415	**8,502,250**
1982	46,081	50,796	19,712	52,311	70,295	20,812	24,687	8,829	205,092	814,320	350,387	38,017	**1,701,339**
1983	25,140	52,352	33,462	28,449	21,203	7,063	5,537	2,600	14,928	22,150	75,957	15,446	**304,287**
1984	1,439	4,586	4,998	3,141	2,566	1,713	7,663	175,569	1,700,672	1,883,149	142,767	30,195	**3,958,458**
1985	215,335	105,471	86,650	28,783	20,529	9,990	11,626	135,851	657,585	562,714	100,959	21,429	**1,956,922**
1986	13,198	19,348	35,198	51,540	164,071	10,084	1,974	23,044	2,570,923	1,385,600	251,575	88,746	**4,615,301**
1987	47,023	64,812	30,601	37,015	23,351	10,769	12,955	1,223,560	818,755	76,836	22,673	17,612	**2,385,962**
1988	5,891	5,032	21,138	27,490	41,286	20,378	7,834	13,965	400,086	168,670	49,134	18,030	**778,934**
1989	6,689	4,399	27,516	28,329	33,991	15,215	7,896	186,667	886,116	261,952	29,671	16,490	**1,504,931**
1990	12,348	3,938	4,582	8,476	15,122	23,107	4,086	173,709	481,853	421,767	76,720	24,305	**1,250,013**
1991	2,124	1,825	17,064	14,553	21,055	26,536	25,148	26,399	693,284	920,842	75,971	16,447	**1,841,248**
1992	6,922	3,845	4,533	14,745	167,552	50,952	2,931	1,233,979	458,611	72,035	6,218	11,413	**2,033,736**
1993	10,319	10,838	6,414	159,612	45,912	34,488	4,050	222,744	2,775,576	1,364,520	57,240	48,312	**4,740,025**
1994	24,768	20,750	13,902	10,174	15,980	10,920	4,467	29,892	1,186,620	496,932	25,380	14,608	**1,854,393**
1995	8,328	6,068	8,726	110,652	31,700	9,942	2,514	2,094	19,064	60,882	32,868	27,948	**320,786**
1996	16,830	8,198	10,056	6,214	7,374	84	1,440	1,962	56,148	37,560	13,624	8,208	**167,698**
1997	15,982	13,356	14,460	7,344	324	2,568	4,728	98,148	352,692	41,826	12,248	9,084	**572,760**
1998	9,804	9,688	12,270	17,380	8,004	1,760	420	792	1,608	70,458	37,416	15,840	**185,440**
1999	3,872	2,664		2,364	2,208	1,389	532	1,461	464,460	234,576	22,216	7,152	**742,894**
2000	9,936	11,952	3,900	9,240	14,196	2,184	2,340	17,736	334,284	133,764	18,677	14,448	**572,657**
2001	12,576	43,644	11,112	3,948	16,620	15,148	3,960	174,012	818,191	96,480	8,772	5,880	**1,210,343**
2002	2,436	16,992	20,244	31,656	26,050	41,352	7,872	7,662	245,052	107,167	10,692	1,623	**518,798**
2003	921	4,878	13,531	16,272	10,188	18,184	3,036	7,564	49,248	25,320	11,985	5,892	**167,019**
2004	5,271	4,081	8,220	18,332	22,435	65,073	5,537	49,656	279,240	53,781	25,619	8,708	**545,953**
2005	2,811	5,986	4,894	21,985	19,210	11,510	434	199	33,160	17,972	10,006	3,270	**131,437**
2006	1,379	3,276	2,244	2,983	1,344	2,179	564	278	2,603	14,016	6,511	2,455	**39,832**
2007	1,559	2,111	756	1,212	5,728	3,201	2,004	13,379	231,912	180,183	7,089	1,057	**450,191**
2008	428	880	898	14,292	17,282	3,544	228	27,662	111,035	189,497	8,184		**373,929**

Monthly Distribution of CVP Striped Bass Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	CVP Salvage
Min	428	880	756	1,212	324	84	228	199	1,608	14,016	6,218	1,057	**39,832**
10%	1,427	2,553	3,238	3,094	2,494	1,751	512	1,328	18,237	24,686	7,965	3,026	**167,562**
25%	2,811	4,081	4,946	8,193	10,188	3,169	2,004	2,600	111,035	60,882	11,985	7,944	**373,929**
50%	9,804	8,198	12,270	16,826	19,210	10,187	4,086	23,044	352,692	168,670	25,619	15,643	**778,934**
75%	16,830	20,750	20,691	28,533	30,448	20,378	7,872	173,709	818,191	562,714	75,971	25,216	**1,854,393**
90%	51,445	54,844	34,156	51,771	50,789	35,861	14,887	422,907	1,874,722	1,009,578	131,193	48,943	**4,089,827**
Max	215,335	139,792	86,650	159,612	167,552	65,073	25,148	1,413,715	5,796,925	1,883,149	350,387	88,746	**8,502,250**
Avg	**22,395**	**22,290**	**17,975**	**26,945**	**29,906**	**14,948**	**6,489**	**181,893**	**752,542**	**384,343**	**59,231**	**20,962**	**1,537,028**

Table 4.1-17. Historical Monthly SWP Striped Bass Salvage (fish) for Water Years 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980	47,463	120,099	146,766	32,757	8,218	417	269	312	490,985	1,367,670	472,167	88,580	**2,775,703**
1981	9,274	64,489	120,487	60,038	18,951	4,300	1,432	110,606	319,724	298,111	177,712	6,177	**1,191,301**
1982	4,082	41,262	63,077	56,587	30,985	14,433	6,750	1,438	19,659	279,532	313,190	32,067	**863,062**
1983	23,059	28,661	170,137	13,797	7,130	443		6,841	16,897	18,152	39,211	2,502	**326,830**
1984	340	5,930	19,796	896	1,105	845	1,170	20,806	2,561,150	3,332,583	109,484	14,550	**6,068,655**
1985	83,868	130,027	119,676	14,836	9,130	3,086	1,311	337,358	2,423,066	883,696	106,632	15,339	**4,128,025**
1986	4,934	101,565	96,768	35,023	11,044	1,050	159	34,689	6,983,012	6,110,155	362,440	129,027	**13,869,866**
1987	65,625	63,309	59,126	12,956	15,185	1,770	568	5,583,941	5,062,254	1,105,983	26,879	17,381	**12,014,977**
1988	271	24,848	199,565	23,197	47,947	4,350	252	102,460	8,492,849	3,736,998	387,058	4,913	**13,024,708**
1989	4,604	131,921	101,586	23,518	10,469	6,664	1,346	1,613,156	5,164,908	1,977,378	200,165	13,154	**9,248,869**
1990	5,124	35,595	11,205	53,120	35,925	14,837	564	209,548	194,792	778,605	238,207	9,165	**1,586,687**
1991	3,296	38,630	17,542	10,953	5,612	4,975	15,457	1,650	1,256,031	461,694	100,723	17,749	**1,934,312**
1992	5,636	4,183	80,772	26,122	58,901	31,554	439	461,692	1,626,755	113,199	9,149	1,256	**2,419,658**
1993	62	19,446	16,482	292,277	77,994	1,332	73	438,310	3,790,309	3,577,380	394,974	23,511	**8,632,150**
1994	5,603	72,316	5,502	1,220	1,119	416	5	146,634	227,454	116,080	9,600	15,488	**601,437**
1995	251	83,943	20,588	101,357	60,885	796	4	86	83,973	785,010	142,992	7,762	**1,287,647**
1996	3,264	3,586	191	5,549	928	600	20	6,892	355,963	269,771	6,625	6,727	**660,116**
1997	50,166	123,016	7,973	2,291	578	162	282	5,049	615,196	120,608	5,349	3,337	**934,007**
1998	21,777	2,452	165,330	5,876	191	136		6	3,354	96,548	154,342	38,257	**488,269**
1999	37,575	17,129	2,398	566	126	97	1,145	2,435	95,685	1,078,510	446,634	4,309	**1,686,609**
2000	1,156	6,585	56,220	7,491	10,136	3,734	324	91,795	1,796,001	833,774	131,601	11,489	**2,950,306**
2001	324,552	279,346	39,546	4,840	10,878	13,972	4,984	3,606	64,536	266,820	9,996	668	**1,023,744**
2002	78	87,825	65,798	31,042	26,560	5,228	312	1,173	481,268	300,582	13,339	14,858	**1,028,063**
2003	2,626	94,195	41,015	12,185	17,520	6,446	865	13,901	344,438	283,922	22,771	6,588	**846,472**
2004	1,436	25,632	17,851	15,139	24,116	29,959	2,635	3,017	76,284	56,672	9,845	5,130	**267,716**
2005	1,707	35,775	23,727	24,540	9,841	4,318	1,503	529	28,652	137,307	17,252	3,519	**288,670**
2006	15,270	9,436	17,766	6,847	1,840	756	442	253	2,561	75,220	23,522	4,160	**158,073**
2007	3,318	6,814	15,062	4,249	1,064	938	809	5,485	6,438	362,104	89,747	3,520	**499,548**
2008	1,335	367	3,506	50,111	18,418	1,719	131	2,559	14,461	49,386			**141,993**

Monthly Distribution of SWP Striped Bass Salvage (fish) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
Min	62	367	191	566	126	97	4	6	2,561	18,152	5,349	668	**141,993**
10%	267	4,064	5,103	2,077	858	365	52	300	12,856	71,510	9,465	3,087	**284,479**
25%	1,436	9,436	16,482	5,876	1,840	756	261	1,650	64,536	120,608	16,274	4,271	**601,437**
50%	4,604	35,775	39,546	14,836	10,469	1,770	564	6,841	344,438	300,582	103,678	8,464	**1,191,301**
75%	21,777	87,825	96,768	32,757	24,116	5,228	1,329	110,606	1,796,001	1,078,510	209,676	15,961	**2,950,306**
90%	53,258	124,418	150,479	57,277	50,138	14,514	3,575	442,986	5,082,785	3,381,542	389,433	33,924	**9,802,091**
Max	324,552	279,346	199,565	292,277	77,994	31,554	15,457	5,583,941	8,492,849	6,110,155	472,167	129,027	**13,869,866**
Avg	**25,095**	**57,186**	**58,809**	**32,048**	**18,027**	**5,494**	**1,602**	**317,456**	**1,468,919**	**995,636**	**143,629**	**17,899**	**3,136,120**

Table 4.1-18. Monthly Historical CVP Salvage of Green Sturgeon for Water Years 1980–2008 (fish)

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980													**0**
1981						75				199			**274**
1982											163	283	**446**
1983			124								1,415		**1,539**
1984	60				132	92		109		184			**577**
1985		233			83					767	487		**1,570**
1986		37											**37**
1987	49				91								**140**
1988													**0**
1989													**0**
1990													**0**
1991													**0**
1992							114						**114**
1993					12								**12**
1994		12											**12**
1995			48								12		**60**
1996	24									12			**36**
1997							12	12	24			12	**60**
1998	12	12											**24**
1999								12				12	**24**
2000													**0**
2001	12		12										**24**
2002													**0**
2003													**0**
2004													**0**
2005	12												**12**
2006	60	84	12						12	96	24	36	**324**
2007				12									**12**
2008													**0**
Avg	**8**	**13**	**7**	**0**	**11**	**6**	**4**	**5**	**1**	**43**	**72**	**12**	**183**

Table 4.1-20. Monthly Historical SWP Salvage of Green Sturgeon for Water Years 1980–2008 (fish)

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1980			251							24	23		**298**
1981							48				363		**411**
1982						138	385						**523**
1983													**0**
1984	1									33	61		**95**
1985							3						**3**
1986													**0**
1987						37							**37**
1988					50								**50**
1989													**0**
1990				17		103							**120**
1991	4			14		31							**49**
1992						49							**49**
1993			1	5								4	**10**
1994		18			1	4							**23**
1995				9	4					36	52		**101**
1996		8				8			16			16	**48**
1997							1					18	**19**
1998											96	16	**112**
1999	24				24							12	**60**
2000					21								**21**
2001		3	6			6							**15**
2002			48			12							**60**
2003				6	6					6			**18**
2004													**0**
2005				9						7			**16**
2006				6						6		12	**24**
2007			15			2							**17**
2008													**0**
Avg	**1**	**1**	**11**	**2**	**4**	**13**	**15**	**0**	**1**	**4**	**21**	**3**	**75**

Table 4.1-21. Historical CVP Chinook Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.0	12.2			0.8	1.5	411.5	279.7	43.1	4.2	0.0	0.0
1981	1.4	5.8	1.3	0.4	0.0	14.4	132.0	150.1	26.5	0.0	0.0	0.0
1982	18.2	5.7	143.2	26.2	25.8	51.9	31.9	523.8	390.2	1.6	0.9	0.0
1983	0.0	73.5	66.4	25.0	18.8	25.4	218.7	648.3	180.4	3.8	0.0	0.0
1984	18.0	8.1	0.7	1.9	0.0	32.2	367.8	443.6	10.7	3.4	0.0	0.0
1985	48.3	28.8	20.6	0.0	32.7	18.7	201.6	324.5	9.2	0.4	0.0	0.0
1986	33.4	17.6	21.3	7.6	1832.4	227.6	407.3	1027.6	259.4	37.4	0.0	0.0
1987	2.6	0.3	3.9	1.2	2.3	17.0	185.9	212.4	0.0	0.0	0.0	0.0
1988	0.0	0.0	9.7	14.9	9.3	5.9	99.6	121.4	1.2	0.2	0.0	0.0
1989	0.0	0.0	1.2	0.3	0.0	24.3	57.1	112.4	14.0	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.4	0.5	0.3	8.2	16.7	5.1	0.0	0.0	0.0
1991	0.0	0.0	0.0	0.0	1.4	11.0	106.7	88.7	5.5	0.0	0.0	0.0
1992	0.0	22.5	1.2	2.6	27.5	71.4	170.1	36.4	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.3	0.1	1.6	1.4	31.4	124.7	8.6	0.0	0.0	0.0
1994	0.0	2.0	4.4	1.8	13.0	12.0	46.2	12.9	0.5	0.0	0.0	0.0
1995	0.1	0.0	10.4	15.1	3.5	4.7	47.4	133.2	98.4	3.8	0.0	0.0
1996	0.5	0.0	0.5	3.3	5.1	2.1	133.3	121.0	11.7	0.0	0.0	0.0
1997	0.1	0.8	0.3	1.9	0.4	62.4	124.1	125.8	15.1	0.0	0.0	0.1
1998	0.2	0.2	1.4	203.8	230.2	86.6	146.0	306.8	75.4	0.7	0.0	0.0
1999	0.0	0.7	0.0	12.0	159.0	38.6	327.2	351.0	61.6	0.1	0.1	0.0
2000	0.0	0.4	0.8	6.2	116.4	35.1	229.2	126.2	10.3	0.1	0.0	0.8
2001	0.1	0.2	0.7	1.6	6.0	25.7	167.7	48.1	2.9	0.0	0.0	0.0
2002	0.0	0.0	0.7	3.7	1.0	7.2	72.5	33.3	4.4	0.0	0.0	0.0
2003	0.6	0.7	2.7	11.4	7.6	12.9	49.1	18.9	1.0	0.0	0.0	0.0
2004	0.1	0.9	1.8	7.3	4.9	62.5	22.8	35.4	1.4	0.0	0.2	0.0
2005	0.0	0.0	0.4	1.8	9.5	19.8	68.8	128.8	6.6	0.2	0.0	0.0
2006	0.0	0.0	0.5	3.6	2.0	3.9	8.9	56.7	128.6	2.4	0.0	0.0
2007	0.0	0.0	0.4	1.7	4.5	7.6	20.4	8.8	2.5	0.0	0.0	0.0
2008	0.0	0.0	0.3	7.3	4.5	4.5	34.9	66.4	2.2	0.0	0.0	0.0

Monthly Distribution of CVP Chinook Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.0	0.3	8.2	8.8	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.2	0.2	0.3	2.0	22.3	18.5	0.9	0.0	0.0	0.0
25%	0.0	0.0	0.4	1.5	1.4	5.9	46.2	48.1	2.5	0.0	0.0	0.0
50%	0.0	0.3	1.0	2.9	4.9	17.0	106.7	124.7	9.2	0.0	0.0	0.0
75%	0.5	5.7	4.0	8.5	18.8	35.1	185.9	279.7	43.1	0.7	0.0	0.0
90%	18.0	18.6	20.8	18.1	124.9	64.3	335.4	459.6	139.0	3.8	0.1	0.0
Max	48.3	73.5	143.2	203.8	1832.4	227.6	411.5	1027.6	390.2	37.4	0.9	0.8
Avg	4.3	6.2	10.5	13.0	86.9	30.6	135.5	196.0	47.5	2.0	0.0	0.0

Table 4.1-22. Historical SWP Chinook Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	6.7	19.2	14.5	15.4	2.0	2.8	209.8	260.0	127.6	5.2	0.1	3.8
1981	5.2	6.4	8.2	7.0	18.0	36.6	215.0	273.1	17.6	0.0	0.3	0.0
1982	1.7	15.5	45.3	32.5	85.9	59.8	78.1	602.7	428.9	0.0	0.0	0.0
1983	0.0	38.3	164.4	32.9	37.0	57.8	0.0	45.5	320.0	1.9	0.0	0.0
1984	0.0	3.7	0.0	0.0	0.7	10.4	124.5	227.7	252.1	0.0	1.9	0.0
1985	92.2	37.2	36.1	1.0	4.4	8.1	141.2	506.7	43.4	1.4	0.0	0.1
1986	3.2	5.3	5.4	5.3	117.7	439.5	1205.2	900.8	495.8	0.0	0.0	0.0
1987	0.0	0.9	2.9	0.5	2.7	22.7	266.7	709.0	80.2	2.1	0.2	0.3
1988	0.0	0.2	90.1	7.7	12.7	15.0	172.1	362.3	129.2	8.6	1.2	0.1
1989	0.3	3.3	5.7	7.2	0.8	22.5	130.0	223.2	4.7	0.0	0.3	0.0
1990	0.1	2.1	3.4	6.3	3.1	11.9	55.2	289.2	25.9	0.5	0.0	0.0
1991	0.1	0.0	0.2	0.5	1.0	13.1	73.4	146.0	11.5	0.0	0.0	0.0
1992	0.3	20.7	0.1	4.8	41.6	24.0	14.3	47.3	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.9	3.5	3.3	1.2	9.1	24.1	5.8	0.0	0.2	0.0
1994	0.1	0.5	2.3	0.9	2.0	2.4	13.5	41.6	0.7	0.0	0.0	0.0
1995	0.0	0.0	2.9	10.9	5.5	0.5	1.6	44.4	44.1	0.5	0.0	0.0
1996	0.0	0.0	0.0	8.6	1.6	2.6	24.6	40.9	5.2	0.0	0.0	0.0
1997	0.0	0.3	0.2	0.5	0.4	10.6	55.8	35.7	4.0	0.1	0.0	0.0
1998	0.0	0.1	1.1	1.8	8.3		0.0	30.6	12.4	0.5	0.0	0.0
1999	0.1	0.1	0.1	0.4	16.2	10.9	127.8	235.5	6.8	0.1	0.1	0.1
2000	0.0	0.1	0.3	1.6	16.1	9.8	114.3	87.1	15.1	0.1	0.0	1.4
2001	0.7	0.2	0.5	1.1	4.6	17.7	128.4	182.4	0.0	0.0	0.0	0.0
2002	0.0	0.0	1.2	2.7	1.0	2.2	12.7	49.9	0.2	0.0	0.0	0.0
2003	0.0	0.0	2.8	13.6	2.3	8.7	42.8	26.3	0.8	0.0	0.0	0.0
2004	0.0	0.0	0.5	8.5	3.1	10.7	17.6	16.8	0.8	0.0	0.0	0.0
2005	0.0	0.0	0.3	1.7	1.8	2.3	16.5	45.2	5.6	0.0	0.0	0.0
2006	0.0	0.0	0.6	1.3	0.8	3.5	12.7	3.7	24.2	0.3	0.0	0.0
2007	0.0	0.0	0.0	0.2	1.7	2.2	8.3	6.9	0.1	0.0	0.0	0.0
2008	0.0	0.0	0.0	2.2	3.3	2.0	18.3	39.8	3.5	0.0	0.0	0.0

Monthly Distribution of SWP Chinook Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.4	0.5	0.0	3.7	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.4	0.8	2.1	6.9	22.6	0.2	0.0	0.0	0.0
25%	0.0	0.0	0.2	1.0	1.7	2.6	13.5	39.8	3.5	0.0	0.0	0.0
50%	0.0	0.2	1.1	2.7	3.1	10.5	55.2	49.9	11.5	0.0	0.0	0.0
75%	0.3	3.7	5.4	7.7	12.7	18.9	128.4	260.0	44.1	0.5	0.1	0.0
90%	3.6	19.5	37.9	14.0	37.9	42.9	210.8	525.9	265.7	1.9	0.3	0.2
Max	92.2	38.3	164.4	32.9	117.7	439.5	1205.2	900.8	495.8	8.6	1.9	3.8
Avg	3.8	5.3	13.4	6.2	13.8	29.0	113.4	189.8	71.3	0.7	0.2	0.2

Table 4.1-23. Historical CVP Steelhead Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.00	0.00			0.00	0.45	3.26	0.70	0.00	0.00	0.00	0.00
1981	0.00	0.00	1.08	0.99	6.20	8.47	0.77	1.38	0.00	0.00	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.62	0.00	0.00	0.00	0.00
1983	0.00	0.00	10.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.00	0.25	0.00	0.00	0.00	0.56	0.79	0.38	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.00	0.00	0.37	0.55	0.55	0.55	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.11	2.39	0.85	3.04	1.29	0.26	0.16	0.00	0.00
1987	0.00	0.00	0.00	0.58	0.50	4.92	3.01	1.49	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.99	0.00	1.96	4.28	8.99	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.54	0.00	1.11	19.96	13.24	6.59	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	4.78	8.45	3.11	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.82	0.75	19.27	7.34	1.24	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	21.40	12.59	10.78	3.35	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	15.54	12.19	4.00	0.89	0.20	0.00	0.00	0.00
1994	0.00	0.00	0.05	0.21	3.14	2.42	1.37	0.52	0.15	0.00	0.00	0.00
1995	0.00	0.00	0.22	0.05	1.18	4.44	1.15	0.59	0.30	0.00	0.00	0.00
1996	0.00	0.00	0.00	3.83	4.07	0.53	1.85	0.66	0.05	0.00	0.00	0.00
1997	0.00	0.00	0.10	0.10	0.00	0.63	2.44	0.56	0.14	0.04	0.00	0.00
1998	0.00	0.00	0.05	1.23	1.10	0.94	0.42	0.34	0.07	0.67	0.00	0.00
1999	0.00	0.09	0.00	0.52	1.35	1.56	4.75	1.53	0.12	0.00	0.00	0.00
2000	0.00	0.10	0.15	2.29	7.72	1.90	1.56	0.77	0.00	0.00	0.00	0.00
2001	0.00	0.05	0.05	0.93	12.25	13.08	3.60	0.23	0.07	0.00	0.00	0.00
2002	0.00	0.00	0.00	0.38	2.01	3.30	1.59	0.00	0.16	0.00	0.00	0.00
2003	0.00	0.00	0.41	17.39	5.01	3.04	2.12	0.67	0.00	0.00	0.00	0.00
2004	0.00	0.00	0.05	0.40	15.79	5.18	0.84	0.81	0.00	0.00	0.00	0.00
2005	0.00	0.05	0.00	0.33	2.38	2.39	0.86	1.45	0.15	0.04	0.00	0.00
2006	0.00	0.00	0.00	0.10	1.35	9.15	0.02	0.65	1.22	0.04	0.00	0.00
2007	0.00	0.00	0.00	0.09	3.08	8.49	7.04	0.92	0.08	0.00	0.00	0.00
2008	0.00	0.00	0.00	1.69	6.54	2.02	1.22	0.22	0.00	0.00	0.00	0.00

Monthly Distribution of CVP Steelhead Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.00	0.52	0.34	0.00	0.00	0.00	0.00	0.00
25%	0.00	0.00	0.00	0.04	0.50	0.85	0.84	0.38	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.00	0.35	2.01	2.42	1.85	0.67	0.00	0.00	0.00	0.00
75%	0.00	0.00	0.06	0.99	5.01	8.47	3.35	1.29	0.14	0.00	0.00	0.00
90%	0.00	0.06	0.45	2.75	12.32	12.37	5.20	1.55	0.21	0.04	0.00	0.00
Max	0.00	0.25	10.26	21.40	15.79	19.96	13.24	8.99	1.22	0.67	0.00	0.00
Avg	0.00	0.02	0.46	1.94	3.83	5.09	2.67	1.21	0.10	0.03	0.00	0.00

Table 4.1-24. Historical SWP Steelhead Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.00	0.07	0.06	0.98	4.30	1.12	1.33	2.02	0.45	0.00	0.00	0.00
1981	0.18	0.00	0.14	0.47	7.74	17.85	19.15	0.00	0.00	0.00	0.00	0.00
1982	0.00	0.00	1.16	3.84	4.59	2.89	30.21	13.34	3.14	0.00	0.00	0.00
1983	0.09	0.00	0.00	0.74	0.26	0.00	0.00	10.24	0.00	0.00	0.00	0.00
1984	0.00	0.00	0.00	0.00	0.00	0.26	1.63	0.10	0.00	0.00	0.00	0.00
1985	0.00	0.00	0.08	0.00	1.68	4.36	5.83	3.41	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	1.22	1.26	11.96	2.28	0.00	0.00	0.00	0.00
1987	0.00	0.00	6.64	0.00	0.46	17.83	6.38	3.33	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.58	0.23	7.19	3.17	8.14	2.17	0.15	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.13	2.27	12.88	5.52	2.10	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	3.75	5.61	3.30	0.61	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.24	0.12	0.23	15.89	9.93	1.08	0.00	0.00	0.00	0.00
1992	0.43	7.89	0.00	0.78	26.69	10.04	2.72	0.66	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.09	2.86	29.62	6.89	2.17	1.83	0.00	0.00	0.00	0.00
1994	0.00	0.00	0.00	0.10	1.01	1.31	1.10	1.42	0.00	0.14	0.00	0.00
1995	0.01	0.00	0.02	0.78	1.43	2.36	0.67	1.09	0.57	0.08	0.00	0.00
1996	0.02	0.00	0.00	5.72	3.49	1.13	1.79	0.94	0.02	0.00	0.00	0.00
1997	0.00	0.05	0.08	0.00	0.09	0.56	0.94	0.28	0.00	0.00	0.00	0.00
1998	0.11	0.00	0.07	0.27	1.23		0.00	0.00	0.05	0.00	0.00	0.00
1999	0.13	0.00	0.00	0.15	0.13	0.98	3.18	1.97	0.63	0.02	0.01	0.00
2000	0.02	0.12	0.01	1.84	10.36	2.31	1.28	0.26	0.21	0.02	0.00	0.00
2001	0.01	0.17	0.28	1.60	11.15	12.34	2.50	1.54	0.00	0.00	0.00	0.00
2002	0.00	0.00	0.01	1.54	1.95	2.73	1.26	0.52	0.13	0.03	0.00	0.00
2003	0.00	0.00	0.64	10.29	3.22	1.55	1.67	1.03	0.10	0.00	0.00	0.00
2004	0.00	0.00	0.09	0.61	7.50	3.52	0.22	0.39	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.16	0.94	2.51	2.11	1.73	1.31	0.10	0.00	0.00	0.00
2006	0.00	0.00	0.00	0.28	0.73	3.30	1.27	0.97	0.71	0.00	0.00	0.01
2007	0.00	0.00	0.01	0.12	1.77	4.23	3.90	0.73	0.00	0.00	0.00	0.00
2008	0.00	0.00	0.00	0.33	7.68	2.13	1.36	1.00	0.29	0.06	0.00	0.00

Monthly Distribution of SWP Steelhead Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.21	0.85	0.58	0.23	0.00	0.00	0.00	0.00
25%	0.00	0.00	0.00	0.12	1.01	1.29	1.27	0.61	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.02	0.33	2.27	2.81	1.79	1.08	0.00	0.00	0.00	0.00
75%	0.01	0.00	0.14	0.98	7.19	5.93	5.52	2.02	0.15	0.00	0.00	0.00
90%	0.11	0.08	0.59	3.06	10.52	13.78	10.34	3.34	0.58	0.04	0.00	0.00
Max	0.43	7.89	6.64	10.29	29.62	17.85	30.21	13.34	3.14	0.14	0.01	0.01
Avg	0.03	0.29	0.36	1.20	4.97	5.02	4.52	1.95	0.23	0.01	0.00	0.00

Table 4.1-25. Historical CVP Delta Smelt Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	92.1	2.7			25.9	38.9	17.6	3.1	5.6	8.9	1.4	7.9
1981	55.5	13.9	27.4	39.2	58.9	52.2	7.6	471.5	222.9	184.3	194.0	14.6
1982	11.3	57.6	0.0	25.4	32.5	15.9	0.8	3.4	14.5	0.0	2.0	7.5
1983	5.6	2.1	0.0	7.8	2.3	0.0	0.3	0.3	9.2	3.9	0.0	0.4
1984	0.0	0.0	6.0	0.0	0.0	6.4	0.4	96.9	33.0	0.0	3.3	0.0
1985	0.7	0.5	0.0	0.7	0.7	0.2	0.9	31.2	9.7	13.8	8.1	1.6
1986	0.4	0.0	0.0	1.7	1.9	0.0	0.0	0.0	0.6	1.1	5.0	0.0
1987	0.7	0.0	0.0	0.0	0.0	3.7	71.8	72.1	0.0	0.0	0.0	1.3
1988	0.0	0.2	5.6	7.3	1.0	0.0	0.0	19.8	10.3	0.0	0.0	0.0
1989	0.3	0.0	0.4	0.0	0.0	0.0	16.0	12.8	1.7	2.8	1.4	1.0
1990	0.4	0.0	0.0	0.0	0.0	0.0	21.0	28.9	6.6	0.7	0.0	0.0
1991	0.0	0.0	1.0	1.5	0.0	1.0	2.6	6.5	0.0	0.0	0.0	4.4
1992	0.0	0.0	0.0	0.0	0.5	1.6	0.8	1.5	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.2	0.2	0.0	9.4	21.9	0.9	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.6	0.8	7.8	239.7	46.2	0.1	0.0	0.0
1995	0.0	0.0	0.1	0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	4.1	2.2	0.5	0.7	86.2	3.8	0.3	0.0	0.0
1997	0.0	0.0	0.0	0.0	1.5	5.9	6.3	150.2	6.6	0.0	0.0	0.0
1998	0.0	0.0	0.1	0.0	0.1	4.6	0.6	0.0	0.2	0.1	0.0	0.0
1999	0.0	0.0	0.0	0.1	5.7	1.7	2.3	196.9	120.8	1.2	0.0	0.0
2000	0.0	0.1	0.4	2.9	9.9	5.1	11.2	175.4	48.5	1.0	0.0	0.0
2001	0.0	1.0	0.7	0.9	11.3	8.7	2.1	120.3	7.4	0.0	0.0	0.0
2002	0.0	0.0	1.5	4.9	0.8	0.3	2.9	221.2	26.4	0.1	0.0	0.0
2003	0.0	0.0	3.9	8.2	2.3	1.7	4.4	126.2	5.8	0.0	0.0	0.0
2004	0.0	0.0	0.5	4.4	2.1	3.3	2.4	56.7	2.9	0.0	0.0	0.0
2005	0.0	0.0	0.0	2.1	0.5	0.0	0.0	1.1	0.4	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.1	0.3	1.1	0.0	0.0	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.1	0.0	0.1	4.2	0.4	0.0	0.0	0.0
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Monthly Distribution of CVP Delta Smelt Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25%	0.0	0.0	0.0	0.0	0.1	0.0	0.1	1.5	0.4	0.0	0.0	0.0
50%	0.0	0.0	0.0	0.6	0.7	1.0	0.9	19.8	5.8	0.0	0.0	0.0
75%	0.4	0.1	0.5	4.2	2.3	4.6	6.3	120.3	14.5	1.0	0.0	0.4
90%	6.7	2.3	4.4	7.9	14.2	10.1	16.3	201.7	46.6	4.9	3.7	5.0
Max	92.1	57.6	27.4	39.2	58.9	52.2	71.8	471.5	222.9	184.3	194.0	14.6
Avg	5.8	2.7	1.7	4.0	5.6	5.3	6.2	73.6	20.9	7.6	7.4	1.3

Table 4.1-26. Historical SWP Delta Smelt Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	1.4	4.4	0.0	11.9	0.5	2.4	2.6	6.6	68.1	98.5	25.9	0.3
1981	1.9	2.3	11.3	41.8	46.7	19.3	15.2	88.1	245.5	46.2	0.0	0.1
1982	0.4	1.9	2.5	16.4	10.8	5.2	0.5	0.3	0.1	19.2	6.1	0.0
1983	0.1	2.9	2.5	6.6	2.1	3.1	0.0	2.8	25.6	10.6	0.0	6.5
1984	0.0	0.0	0.0	0.0	0.3	0.0	0.4	2.7	13.2	10.6	0.0	0.2
1985	0.0	0.0	1.2	0.3	2.4	1.8	6.1	7.7	40.0	0.2	0.0	2.5
1986	0.0	0.0	1.2	3.0	7.5	15.3	4.7	0.9	0.4	0.5	0.0	0.0
1987	0.0	0.2	1.3	0.4	1.0	0.9	3.4	0.9	121.5	7.3	8.6	0.3
1988	0.5	0.0	21.2	11.7	1.2	0.7	0.0	25.1	252.0	17.5	0.0	0.0
1989	1.0	0.0	2.9	2.8	0.5	0.7	0.4	8.7	21.1	16.0	2.3	0.5
1990	0.0	1.3	0.0	0.6	1.8	0.9	1.0	33.7	225.7	97.3	0.3	0.0
1991	0.0	0.0	0.0	2.4	3.7	2.6	3.6	1.4	105.7	100.7	9.1	0.0
1992	1.8	0.0	0.0	0.6	3.4	1.1	0.0	38.1	35.9	0.7	0.0	0.0
1993	0.0	0.0	0.0	6.6	4.0	0.8	0.0	145.9	49.7	3.0	0.1	0.0
1994	0.0	0.0	0.2	0.1	0.5	0.5	10.9	356.8	171.9	14.2	0.0	0.0
1995	0.0	0.0	0.2	4.2	1.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	8.9	4.9	0.8	0.1	120.3	27.7	0.2	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.3	0.9	1.3	201.9	38.4	0.7	0.0	0.0
1998	0.0	0.0	0.6	0.6	0.0		0.0	0.1	0.2	0.5	0.0	0.0
1999	0.0	0.0	0.1	0.0	2.1	0.7	1.0	378.8	736.3	50.6	0.1	0.0
2000	0.0	0.0	0.3	0.6	12.9	4.9	1.6	340.2	154.6	3.5	0.0	0.1
2001	0.1	0.2	0.1	0.1	6.3	7.6	2.4	182.6	62.8	0.0	0.0	0.0
2002	0.0	0.0	2.1	10.0	0.4	0.6	0.0	848.5	58.8	0.0	0.0	0.0
2003	0.0	0.0	7.8	20.9	2.7	0.0	0.0	80.3	22.7	0.0	0.0	0.0
2004	0.0	0.0	0.0	8.1	1.8	3.3	0.0	52.3	57.1	0.0	0.0	0.0
2005	0.0	0.0	0.0	2.3	1.0	0.0	0.0	4.0	3.3	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	53.7	1.7	0.0	0.0
2008	0.0	0.0	0.0	0.1	0.3	0.2	0.0	7.7	10.2	0.1	0.0	0.0

Monthly Distribution of SWP Delta Smelt Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.2	0.2	0.0	0.0	0.0
25%	0.0	0.0	0.0	0.1	0.5	0.4	0.0	2.7	13.2	0.1	0.0	0.0
50%	0.0	0.0	0.1	2.3	1.8	0.8	0.4	8.7	40.0	1.7	0.0	0.0
75%	0.1	0.0	1.3	8.1	3.7	2.7	2.4	120.3	105.7	16.0	0.1	0.1
90%	1.1	2.0	3.9	12.8	8.2	5.9	5.0	343.5	229.6	59.9	6.6	0.4
Max	1.9	4.4	21.2	41.8	46.7	19.3	15.2	848.5	736.3	100.7	25.9	6.5
Avg	0.2	0.5	1.9	5.6	4.2	2.7	1.9	101.5	89.7	17.2	1.8	0.4

Table 4.1-27. Historical CVP Longfin Smelt Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1981	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1982	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	0.0	111.9	0.0	6.8	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0	6.1	7.4	0.6	0.0	0.0	0.4
1986	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.0	0.0
1987	0.0	0.0	0.0	0.0	0.0	0.0	4.8	16.8	0.0	2.1	1.3	0.0
1988	0.0	0.0	3.2	1.0	0.4	0.0	35.0	69.0	14.3	0.0	0.0	0.0
1989	0.0	0.0	0.0	0.0	0.0	0.0	23.8	1.0	1.1	0.0	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.3	0.0	24.2	29.6	8.2	0.0	52.2	8.1
1991	5.9	0.0	0.0	0.0	0.0	0.0	10.9	1.9	7.1	0.0	0.0	0.0
1992	0.0	0.0	0.0	0.0	0.0	0.4	0.5	7.1	0.0	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0	0.0	0.0
1994	0.0	0.0	0.0	0.0	0.0	0.3	6.6	32.9	1.2	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.1	0.1	0.0	0.1	0.6	0.1	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.4	0.0	0.6	2.7	0.0	0.0	0.0	0.0
1998	0.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.1	0.0	0.4	0.6	0.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.1	0.0	0.0	3.0	1.2	0.0	0.0	0.0	0.0
2001	0.0	0.0	0.1	0.2	0.1	0.8	17.4	37.1	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.1	0.3	0.0	3.3	205.2	298.4	0.9	0.0	0.0	0.0
2003	0.0	0.0	0.2	0.2	0.0	0.0	14.2	32.2	0.0	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.1	0.0	0.3	1.8	5.9	0.0	0.0	0.0	0.0
2005	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Monthly Distribution of CVP Longfin Smelt Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50%	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.3	0.0	0.0	0.0	0.0
75%	0.0	0.0	0.0	0.1	0.1	0.0	7.7	20.0	0.4	0.0	0.0	0.0
90%	0.0	0.0	0.1	0.3	0.2	0.3	23.9	46.7	3.0	0.1	0.0	0.0
Max	5.9	0.0	3.2	1.0	0.4	3.3	205.2	298.4	14.3	6.8	52.2	8.1
Avg	0.3	0.0	0.1	0.1	0.1	0.2	12.7	23.5	1.2	0.3	1.9	0.3

Table 4.1-28. Historical SWP Longfin Smelt Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.0	0.0	1.2	0.0	0.4	0.0	28.6	49.6	4.7	0.0	0.0	2.7
1981	0.0	0.0	0.0	1.1	1.7	2.6	0.5	7.9	13.7	2.4	0.0	0.5
1982	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1983	0.0	0.2	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1984	0.0	0.0	0.0	0.0	0.0	0.0	1.7	2.6	0.0	0.0	0.0	0.0
1985	0.0	0.0	0.0	0.0	0.0	0.0	14.3	75.9	2.2	0.0	0.1	0.0
1986	0.0	0.0	0.5	0.1	0.1	0.0	2.9	4.8	0.0	0.0	0.0	0.0
1987	0.0	1.5	2.8	0.1	0.3	0.3	169.6	142.0	0.0	1.3	0.0	0.0
1988	0.1	0.0	17.8	18.5	2.1	26.0	259.6	244.4	60.4	0.0	0.0	0.0
1989	0.0	0.0	0.4	0.9	0.1	0.7	121.5	36.8	41.5	3.1	3.4	0.0
1990	0.0	0.0	0.0	0.0	0.0	0.2	36.6	349.2	163.1	0.4	0.0	0.1
1991	0.0	0.0	0.0	0.2	0.0	2.0	14.0	14.5	3.7	14.2	0.0	3.8
1992	0.0	0.0	0.0	0.0	0.0	0.0	0.1	16.4	33.7	0.0	0.0	0.0
1993	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	0.1	0.9	0.1	0.0
1994	0.0	0.0	0.0	0.0	0.2	0.0	17.0	67.5	4.0	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.2	0.1	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.5	0.1	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.1	0.0		616.0	0.0	0.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.1	1.8	1.7	0.7	0.1	0.1	0.0
2000	0.0	0.0	0.0	0.1	0.0	0.2	5.3	2.5	0.1	0.1	0.0	0.0
2001	0.1	0.1	0.0	0.0	0.1	0.0	2.1	51.8	0.0	0.0	0.0	0.0
2002	0.0	0.0	0.0	0.2	0.0	0.0	87.5	998.2	11.4	0.0	0.0	0.0
2003	0.0	0.0	0.0	0.5	0.0	0.0	0.5	6.2	0.2	0.0	0.0	0.0
2004	0.0	0.0	0.0	0.5	0.1	0.0	0.0	1.0	0.3	0.0	0.0	0.1
2005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.1	0.0	0.0
2006	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0
2007	0.0	0.0	0.0	0.1	0.1	0.0	1.2	28.0	0.1	0.0	0.0	0.0
2008	0.0	0.0	1.2	0.0	0.4	0.0	28.6	49.6	4.7	0.0	0.0	2.7

Monthly Distribution of SWP Longfin Smelt Savlage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
25%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0
50%	0.0	0.0	0.0	0.1	0.0	0.0	1.8	7.0	0.1	0.0	0.0	0.0
75%	0.0	0.0	0.0	0.2	0.1	0.1	19.9	50.2	4.2	0.1	0.0	0.0
90%	0.0	0.0	0.7	0.8	0.3	1.2	135.9	172.7	36.1	1.7	0.1	0.2
Max	0.1	1.5	17.8	18.5	2.1	26.0	616.0	998.2	163.1	14.2	3.4	3.8
Avg	0.0	0.1	0.8	0.8	0.2	1.2	49.3	75.4	12.2	0.8	0.1	0.3

Table 4.1-27. Historical CVP Splittail Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.0	0.0			1.2	2.6	10.4	823.0	313.3	114.6	8.7	0.9
1981	0.7	0.0	0.7	1.2	6.5	3.0	34.2	432.6	155.5	9.1	4.2	0.0
1982	0.0	0.0	0.0	0.0	44.4	23.9	10.9	28.9	319.4	512.4	104.2	15.2
1983	0.6	0.0	8.5	7.2	54.2	39.8	17.7	257.7	1053.0	223.8	109.6	19.0
1984	7.1	0.2	0.8	0.9	16.9	29.7	10.1	46.4	202.8	53.7	9.3	0.0
1985	0.0	0.0	0.0	0.3	7.2	12.5	6.3	18.3	46.9	35.7	12.8	2.0
1986	0.4	5.9	0.0	0.2	6.1	26.5	228.5	5180.7	1184.0	64.0	10.2	10.2
1987	3.2	1.7	0.4	3.2	10.5	11.0	8.9	18.4	4.2	0.7	0.7	0.9
1988	0.0	0.0	0.5	10.0	2.8	6.5	12.5	14.1	13.2	4.1	0.0	0.0
1989	0.0	0.0	0.0	1.0	3.0	12.7	16.1	27.4	11.0	0.2	0.0	0.0
1990	0.0	0.0	0.0	0.0	0.0	10.5	6.2	5.6	124.4	13.2	0.0	0.0
1991	0.0	0.0	0.0	4.5	1.5	15.4	16.2	11.1	67.4	2.3	0.0	0.0
1992	0.0	0.0	0.4	0.9	14.0	8.3	1.4	7.0	53.4	0.0	0.6	0.0
1993	0.0	0.0	0.0	46.4	12.5	7.3	9.7	608.0	483.7	35.5	0.3	0.0
1994	0.0	0.0	0.0	0.0	0.9	1.7	0.4	1.9	24.0	2.1	0.0	0.0
1995	0.0	0.0	0.0	2.5	0.5	0.1	0.7	1087.8	11074.5	929.5	20.8	2.3
1996	2.7	1.1	0.8	1.1	4.6	0.0	6.4	187.6	70.5	12.8	4.2	1.4
1997	2.1	0.5	0.2	0.0	2.3	8.9	7.4	56.0	37.0	3.0	0.4	0.2
1998	0.1	0.0	0.2	3.4	1.5	13.1	75.4	1741.0	6482.1	2724.9	31.3	5.1
1999	1.9	0.4	0.0	1.4	1.7	2.8	0.9	1.0	24.7	38.6	1.4	0.8
2000	0.4	0.4	0.2	0.3	4.8	2.8	12.5	432.0	116.7	3.3	0.5	0.1
2001	0.1	0.0	0.1	0.1	1.2	2.2	4.2	4.8	27.3	1.7	0.2	0.3
2002	0.1	0.1	1.1	3.2	0.5	2.2	6.9	0.0	3.9	0.9	0.0	0.0
2003	0.0	0.1	0.2	3.7	0.7	2.4	0.8	8.7	40.4	1.3	0.1	0.0
2004	0.0	0.0	0.1	1.7	0.6	4.4	1.0	101.5	21.1	2.6	0.0	0.1
2005	0.0	0.0	0.0	3.3	0.7	1.1	8.7	440.6	1180.0	68.0	0.8	0.2
2006	0.0	0.0	0.0	0.2	0.0	0.2	0.0	2088.8	22825.2	756.6	2.1	0.0
2007	0.0	0.0	0.0	0.0	0.0	0.2	0.4	2.5	1.3	1.1	0.0	0.1
2008	0.0	0.0	0.0	1.9	2.1	0.8	0.5	2.6	3.9	0.8	0.0	0.0

Monthly Distribution of CVP Splittail Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.0	0.4	0.2	0.5	2.4	4.2	0.8	0.0	0.0
25%	0.0	0.0	0.0	0.2	0.7	2.2	1.0	7.0	24.0	1.7	0.0	0.0
50%	0.0	0.0	0.0	1.2	2.1	4.4	7.4	28.9	67.4	9.1	0.6	0.1
75%	0.4	0.1	0.4	3.3	6.5	12.5	12.5	432.6	319.4	64.0	8.7	0.9
90%	2.2	0.6	0.8	5.3	14.6	24.4	21.0	1218.4	2243.6	561.2	22.9	6.2
Max	7.1	5.9	8.5	46.4	54.2	39.8	228.5	5180.7	22825.2	2724.9	109.6	19.0
Avg	0.7	0.4	0.5	3.5	7.0	8.7	17.8	470.2	1585.0	193.7	11.1	2.0

Table 4.1-28. Historical SWP Splittail Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.2	0.3	3.3	212.6	967.3	6.0	17.0	477.4	611.3	53.8	19.8	0.3
1981	0.3	0.0	1.0	4.1	24.6	13.2	40.3	59.6	0.1	0.0	0.3	0.0
1982	0.0	0.2	3.5	39.4	54.4	23.4	21.5	442.7	448.5	69.4	259.5	0.1
1983	0.1	0.0	2.0	1.1	37.5	214.9	0.0	11.5	875.6	52.6	297.4	0.1
1984	0.2	0.0	0.0	0.0	4.3	5.4	22.4	16.2	44.9	105.3	59.2	0.2
1985	0.0	0.8	10.4	0.3	21.0	13.4	21.7	20.2	59.0	8.7	1.5	0.1
1986	0.5	0.2	0.0	1.0	6.8	7.6	128.4	3343.4	1891.1	130.5	23.6	1.7
1987	1.4	0.0	8.5	1.4	6.2	12.9	5.4	31.0	148.3	16.7	2.6	0.1
1988	0.4	0.0	8.4	54.4	56.1	14.6	17.8	14.4	58.8	22.4	0.9	0.2
1989	0.0	0.4	0.6	2.1	1.6	17.4	55.4	80.8	9.9	4.6	27.8	0.5
1990	0.2	0.4	0.4	3.3	14.8	11.4	40.9	43.0	1.8	0.9	0.0	0.0
1991	0.0	0.0	0.0	0.6	0.2	10.9	102.0	4.7	198.3	17.5	0.0	0.0
1992	5.7	0.0	0.0	0.8	5.1	29.6	2.2	0.5	8.2	0.0	0.0	0.0
1993	0.0	0.0	0.0	89.0	52.1	1.8	2.0	133.7	27.0	4.1	0.9	0.0
1994	0.8	0.2	0.1	0.1	0.2	2.8	0.0	2.4	0.7	0.1	0.0	0.0
1995	0.0	0.0	0.0	9.2	14.2	0.4	0.0	154.6	5590.6	334.2	28.1	0.1
1996	0.8	3.4	0.0	2.7	1.6	1.7	0.2	76.6	29.1	3.1	1.1	0.0
1997	0.1	0.1	0.1	0.2	0.4	14.5	50.7	3.7	9.1	3.3	0.5	0.0
1998	0.0	0.0	5.8	34.5		30.0	0.2	78.6	1917.7	2178.4	55.7	0.6
1999	6.7	1.2	0.1	0.5	0.6	3.8	8.2	3.9	1.3	22.7	4.4	0.1
2000	0.2	0.2	0.3	0.4	9.8	30.9	15.5	73.8	96.6	13.2	1.2	0.0
2001	1.2	0.4	0.2	0.4	5.4	37.8	86.9	2.3	0.2	0.7	0.3	0.0
2002	0.0	0.0	1.4	8.9	3.6	6.1	23.4	0.4	0.5	0.5	0.2	0.0
2003	0.0	0.1	0.3	2.0	0.9	2.7	1.9	0.1	10.1	0.2	0.1	0.0
2004	0.0	0.0	0.2	1.2	3.8	12.1	2.2	6.0	0.9	0.3	1.1	0.0
2005	0.1	0.1	0.0	5.2	0.6	1.7	2.9	126.5	115.6	15.7	0.1	0.0
2006	0.0	0.0	0.2	0.2	0.4	0.0	0.5	59.8	675.9	264.5	7.4	0.0
2007	0.2	0.1	0.1	0.0	0.1	0.7	1.4	0.7	0.0	0.7	0.1	0.0
2008	0.0	0.1	0.0	0.9	26.6	10.5	12.6	12.2	0.2	1.1	0.1	0.0

Monthly Distribution of SWP Splittail Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0
10%	0.0	0.0	0.0	0.2	0.3	1.5	0.2	0.6	0.2	0.2	0.0	0.0
25%	0.0	0.0	0.0	0.4	0.9	2.8	1.9	3.9	1.3	0.7	0.1	0.0
50%	0.1	0.1	0.2	1.2	5.3	10.9	12.6	20.2	29.1	8.7	1.1	0.0
75%	0.4	0.2	1.4	5.2	21.9	14.6	23.4	78.6	198.3	52.6	19.8	0.1
90%	1.3	0.5	6.3	42.4	52.8	30.2	61.7	212.2	1078.7	157.3	56.4	0.3
Max	6.7	3.4	10.4	212.6	967.3	214.9	128.4	3343.4	5590.6	2178.4	297.4	1.7
Avg	0.7	0.3	1.6	16.4	47.2	18.6	23.6	182.1	442.5	114.7	27.4	0.1

Table 4.1-29. Historical CVP Striped Bass Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	295	407			71	16	40	10	1047	2331	460	306
1981	316	610	293	103	150	86	103	7325	28140	2895	391	256
1982	354	598	411	471	335	82	120	48	1172	4549	1312	309
1983	182	263	173	120	97	29	25	15	84	91	290	78
1984	11	80	50	37	12	7	32	954	9554	6539	531	162
1985	970	455	357	121	92	41	50	738	3694	2003	375	88
1986	55	88	148	216	749	67	12	125	14443	5057	932	371
1987	191	295	124	150	104	74	50	6650	4600	281	81	69
1988	24	22	85	110	175	81	32	76	2248	613	176	66
1989	31	21	107	110	149	60	33	1014	4978	900	103	63
1990	48	16	18	33	67	91	16	1022	2707	1875	412	128
1991	31	19	122	125	145	116	146	334	13081	9208	745	150
1992	65	32	40	75	1180	202	29	23730	9758	1310	102	120
1993	175	143	86	649	205	137	24	2370	23522	5149	214	185
1994	93	82	55	73	74	79	48	433	15021	3227	169	69
1995	55	41	40	434	135	68	13	11	79	222	122	107
1996	63	33	38	24	36	2	10	15	213	137	51	32
1997	62	55	58	59	10	10	29	917	1336	155	45	35
1998	37	39	49	72	49	14	5	6	9	282	139	61
1999	15	21	0	13	9	5	5	14	2334	862	82	28
2000	38	48	25	47	60	11	18	227	1847	503	69	57
2001	49	180	46	24	85	131	30	3283	4597	380	35	24
2002	11	76	90	124	130	161	62	145	1623	400	40	6
2003	4	22	66	62	43	68	27	84	187	98	45	23
2004	20	16	32	68	98	255	48	842	1293	200	94	33
2005	11	23	21	85	89	55	3	3	134	67	37	13
2006	5	13	9	12	6	11	12	3	13	52	24	9
2007	6	9	3	5	24	13	12	257	1578	667	26	4
2008	2	4	4	76	90	32	4	503	1983	877	37	0

Monthly Distribution of CVP Striped Bass Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	2	4	0	5	6	2	3	3	9	52	24	0
10%	6	15	7	20	11	9	5	9	83	97	36	9
25%	15	21	30	45	49	14	12	15	1047	222	45	28
50%	48	41	53	76	90	67	29	257	1983	667	103	66
75%	93	143	111	122	145	86	48	954	4978	2331	375	128
90%	299	417	209	281	231	142	70	3957	14559	5075	574	266
Max	970	610	411	649	1180	255	146	23730	28140	9208	1312	371
Avg	111	128	91	125	154	69	36	1764	5216	1756	246	98

Table 4.1-28. Historical SWP Striped Bass Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	209	427	405	84	42	6	3	3	2743	9839	1668	365
1981	50	436	677	238	97	25	6	1580	15986	1974	577	31
1982	18	217	236	275	99	38	19	8	345	4300	1386	171
1983	126	180	530	36	21	5	0	274	144	252	225	56
1984	16	135	660	47	10	5	5	118	13995	11652	358	109
1985	736	546	437	127	47	11	7	1776	11995	3037	311	57
1986	22	491	267	113	97	24	1	177	38368	24737	1088	342
1987	310	352	310	99	101	9	4	41671	41494	4111	86	63
1988	3	303	672	61	144	17	1	523	51162	18053	1524	24
1989	39	949	574	65	48	18	4	8402	40351	6938	504	36
1990	14	99	29	136	102	38	2	6760	8469	5191	1108	60
1991	23	307	103	62	56	14	57	20	21289	8711	787	131
1992	27	67	1106	137	290	82	6	9234	24648	3430	94	8
1993	1	314	98	629	270	12	0	4021	30082	13500	1018	61
1994	14	470	14	6	11	4	0	3410	7582	1095	44	70
1995	1	394	86	219	240	24	0	1	412	2139	481	45
1996	18	48	27	16	5	4	0	43	1167	721	17	19
1997	148	355	36	59	6	1	3	61	3845	369	19	10
1998	82	8	394	30	15		0	0	26	439	567	144
1999	127	132	19	6	2	1	6	24	1428	2794	1087	10
2000	4	21	242	19	24	11	2	874	6881	2316	340	30
2001	1044	884	134	20	41	39	48	97	4034	1175	40	3
2002	1	455	175	78	96	22	2	28	3565	783	32	59
2003	24	504	160	34	49	17	6	232	970	689	53	16
2004	8	112	68	36	65	71	21	66	755	145	24	17
2005	10	157	91	51	36	19	7	4	86	312	39	8
2006	39	30	44	35	7	5	3	2	12	178	54	10
2007	9	21	37	20	8	5	7	166	238	894	216	11
2008	7	2	17	277	94	18	2	47	295	350	0	0

Monthly Distribution of SWP Striped Bass Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	1	2	14	6	2	1	0	0	12	145	0	0
10%	2	21	26	18	7	4	0	3	133	300	23	8
25%	9	99	44	34	15	5	1	24	412	689	44	11
50%	22	303	160	61	48	15	3	118	3845	2139	311	36
75%	82	436	405	127	97	24	6	1580	15986	5191	787	63
90%	229	512	662	246	163	38	19	7088	38765	12022	1164	149
Max	1044	949	1106	629	290	82	57	41671	51162	24737	1668	365
Avg	108	290	264	104	73	19	8	2746	11461	4487	474	68

Table 4.1-29. Historical CVP Green Sturgeon Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.00	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.63	0.00	0.00	0.00	0.74	0.00	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	2.30
1983	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.40	0.00
1984	0.47	0.00	0.00	0.00	0.60	0.35	0.00	0.59	0.00	0.64	0.00	0.00
1985	0.00	1.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	2.73	1.81	0.00
1986	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.20	0.00	0.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.00	1.12	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
1996	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.11	0.09	0.00	0.00	0.05
1998	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1999	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.05
2000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2005	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2006	0.22	0.33	0.05	0.00	0.00	0.00	0.00	0.00	0.06	0.35	0.09	0.14
2007	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Monthly Distribution of CVP Green Sturgeon Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
90%	0.11	0.07	0.05	0.00	0.12	0.00	0.00	0.02	0.00	0.41	0.19	0.05
Max	0.47	1.00	0.64	0.04	0.60	0.63	1.12	0.59	0.09	2.73	5.40	2.30
Avg	0.04	0.06	0.03	0.00	0.05	0.03	0.04	0.03	0.01	0.16	0.27	0.09

Table 4.1-30. Historical SWP Green Sturgeon Salvage Density (fish/taf) for 1980–2008

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0.00	0.00	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.08	0.00
1981	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	1.18	0.00
1982	0.00	0.00	0.00	0.00	0.00	0.36	1.06	0.00	0.00	0.00	0.00	0.00
1983	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1984	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.20	0.00
1985	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
1986	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1987	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00
1988	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1989	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1990	0.00	0.00	0.00	0.04	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00
1991	0.03	0.00	0.00	0.08	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00
1992	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00
1993	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
1994	0.00	0.12	0.00	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	0.00
1995	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.10	0.18	0.00
1996	0.00	0.11	0.00	0.00	0.00	0.05	0.00	0.00	0.05	0.00	0.00	0.05
1997	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.05
1998	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.35	0.06
1999	0.08	0.00	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.03
2000	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2001	0.00	0.01	0.02	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00
2002	0.00	0.00	0.13	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
2003	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00
2004	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2005	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00
2006	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.03
2007	0.00	0.00	0.04	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
2008	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Monthly Distribution of SWP Green Sturgeon Salvage Density (fish/taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
50%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
75%	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00
90%	0.01	0.00	0.02	0.02	0.02	0.15	0.01	0.00	0.00	0.03	0.18	0.03
Max	0.08	0.12	0.69	0.08	0.46	0.36	1.06	0.00	0.05	0.17	1.18	0.06
Avg	0.01	0.01	0.03	0.01	0.02	0.04	0.04	0.00	0.00	0.01	0.07	0.01

Table 4.1-31. CALSIM-Simulated Monthly No Action CVP Pumping for Water Years 1980–2003 with Comparison to Annual Historical CVP Pumping

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	No Action Annual	Historical Annual	Annual Change	Percent Change
1980	266	253	260	260	244	110	141	92	158	283	280	267	2,613	2,006	607	30%
1981	269	253	260	260	236	263	105	99	178	281	274	266	2,744	2,590	154	6%
1982	259	253	260	260	236	220	148	184	179	283	281	267	2,829	1,971	858	44%
1983	270	254	260	260	219	122	162	184	179	283	281	267	2,741	2,502	239	10%
1984	270	254	192	121	149	161	119	49	147	200	278	266	2,206	2,190	16	1%
1985	267	253	260	260	236	185	98	118	177	278	275	245	2,650	2,790	-140	-5%
1986	250	252	259	260	235	132	116	172	166	279	277	264	2,663	2,618	45	2%
1987	266	252	133	97	117	105	48	49	108	219	49	145	1,587	2,758	-1,171	-42%
1988	162	243	259	259	46	49	90	49	127	141	79	171	1,676	2,895	-1,219	-42%
1989	144	118	259	259	133	259	141	49	147	274	131	172	2,087	2,870	-783	-27%
1990	170	248	259	259	132	152	84	82	48	88	49	139	1,711	2,697	-987	-37%
1991	259	250	203	49	147	189	90	71	48	72	49	113	1,539	1,408	132	9%
1992	88	36	155	37	243	232	48	49	48	49	37	154	1,175	1,342	-167	-12%
1993	121	66	259	259	235	262	152	49	147	279	223	265	2,318	2,108	209	10%
1994	266	253	259	244	235	140	92	103	160	261	279	162	2,453	2,023	430	21%
1995	177	121	260	260	236	264	209	184	179	283	281	264	2,718	2,581	137	5%
1996	270	254	260	260	245	120	175	92	158	268	280	266	2,647	2,626	20	1%
1997	268	253	260	260	236	186	129	49	147	280	278	240	2,587	2,510	78	3%
1998	267	253	260	260	236	123	162	184	179	283	281	267	2,753	2,474	279	11%
1999	270	254	260	260	150	166	152	49	147	214	278	266	2,465	2,262	203	9%
2000	267	253	260	260	244	254	149	69	166	98	278	265	2,563	2,487	77	3%
2001	253	253	251	260	236	261	94	74	140	231	150	101	2,303	2,332	-30	-1%
2002	243	231	259	259	160	231	117	118	179	280	273	259	2,608	2,505	103	4%
2003	190	253	260	260	236	262	152	101	179	49	278	266	2,484	2,685	-201	-7%

Monthly Distribution of Simulated No Action Jones Pumping Plant Pumping (taf) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Action Annual	Historical Annual	Annual Change	Percent Change
Min	88	36	133	37	46	49	48	49	48	49	37	101	1,175	1,342	-1,219	-42%
10%	149	119	195	104	133	113	86	49	66	77	49	141	1,614	1,982	-926	-34%
30%	237	250	259	259	159	139	97	49	147	212	216	172	2,293	2,255	-41	-2%
50%	262	253	260	260	236	186	124	87	158	271	277	264	2,524	2,503	77	3%
70%	267	253	260	260	236	234	149	104	177	280	278	266	2,647	2,619	158	9%
90%	270	254	260	260	244	262	162	184	179	283	281	267	2,743	2,780	385	18%
Max	270	254	260	260	245	264	209	184	179	283	281	267	2,829	2,895	858	44%
Avg	**230**	**223**	**244**	**228**	**201**	**185**	**124**	**97**	**145**	**219**	**217**	**223**	**2,338**	**2,385**	**-46**	**-2%**

Table 4.1-32. CALSIM-Simulated No Action Banks Pumping Plant Pumping (taf) for Water Years 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	No Action Annual	Historical Annual	Annual Change	Percent Change
1980	324	397	434	523	428	431	258	216	232	269	402	397	4,311	2,555	1,757	68.8
1981	287	241	414	459	346	427	105	49	207	339	256	212	3,342	2,132	1,210	56.7
1982	261	397	434	490	472	442	364	320	397	431	441	427	4,877	2,668	2,209	82.8
1983	411	397	452	464	371	427	323	372	397	441	441	427	4,925	1,912	3,013	157.6
1984	411	397	429	405	392	427	158	153	283	377	380	294	4,106	1,685	2,421	143.6
1985	387	397	434	424	235	185	98	75	233	432	426	406	3,732	2,710	1,022	37.7
1986	260	320	434	446	472	465	330	310	210	302	341	350	4,241	2,705	1,536	56.8
1987	321	250	410	401	351	390	57	49	265	274	282	157	3,207	2,319	888	38.3
1988	191	127	429	442	119	80	90	19	33	34	132	101	1,798	2,747	-949	-34.6
1989	130	165	238	83	109	427	141	49	228	411	412	419	2,812	3,136	-324	-10.3
1990	336	142	266	163	124	152	25	49	33	197	160	113	1,760	3,138	-1,378	-43.9
1991	43	34	72	18	129	434	91	49	52	57	61	170	1,211	1,812	-601	-33.2
1992	209	72	114	14	428	232	87	18	33	47	81	84	1,420	1,612	-192	-11.9
1993	52	70	426	506	437	435	180	131	397	431	435	416	3,916	2,583	1,333	51.6
1994	361	227	365	174	389	43	92	49	160	406	426	205	2,898	2,013	885	44.0
1995	163	228	426	485	450	447	319	365	397	441	441	427	4,590	2,500	2,091	83.6
1996	411	347	434	434	437	420	265	298	228	151	320	427	4,172	2,633	1,539	58.5
1997	266	397	472	479	422	396	151	147	157	88	350	276	3,600	2,496	1,104	44.2
1998	224	347	435	450	419	431	328	351	397	441	441	427	4,693	2,134	2,559	119.9
1999	411	397	438	445	373	427	232	193	240	274	284	427	4,141	2,439	1,702	69.8
2000	326	397	306	458	439	421	149	111	246	380	441	338	4,012	3,692	320	8.7
2001	206	346	440	457	422	361	94	18	25	83	177	222	2,851	2,635	216	8.2
2002	102	253	433	458	223	245	117	69	80	407	287	285	2,959	2,900	59	2.0
2003	144	288	431	443	304	262	185	228	172	361	441	362	3,622	3,458	164	4.8

Monthly Distribution of Simulated No action Banks Pumping Plant Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	No Action Annual	Historical Annual	Annual Change	Percent Change
Min	43	34	72	14	109	43	25	18	25	34	61	84	1,211	1,612	-1,378	-43.9
10%	111	88	246	107	125	162	88	28	33	65	141	126	1,771	1,842	-518	-26.8
25%	184	212	399	404	286	257	94	49	137	186	276	210	2,886	2,134	138	4.1
50%	263	304	430	446	391	424	150	121	228	350	365	344	3,677	2,569	1,063	44.1
75%	342	397	434	460	431	431	260	246	269	416	436	421	4,189	2,719	1,716	69.0
90%	411	397	439	489	446	439	327	341	397	439	441	427	4,662	3,137	2,357	109.0
Max	411	397	472	523	472	465	364	372	397	441	441	427	4,925	3,692	3,013	157.6
Avg	**260**	**277**	**382**	**380**	**345**	**350**	**177**	**154**	**213**	**295**	**328**	**307**	**3,467**	**2,525**	**941**	**41.8**

Table 4.1-33. Simulated No Action Combined CVP and SWP Export Pumping (taf) for Water Years 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total	Change
1980	590	650	694	782	672	541	399	308	390	552	682	664	**6,925**	**2,364**
1981	556	495	674	719	582	690	209	148	386	620	529	478	**6,086**	**1,363**
1982	520	650	694	750	708	662	513	504	576	714	722	694	**7,706**	**3,067**
1983	680	651	712	724	590	549	485	557	576	724	723	694	**7,666**	**3,252**
1984	680	651	621	526	541	588	277	202	430	576	658	559	**6,311**	**2,436**
1985	654	650	693	684	470	370	196	192	410	710	701	651	**6,382**	**882**
1986	510	572	694	706	707	597	446	482	376	581	618	615	**6,904**	**1,581**
1987	587	502	543	497	468	494	105	98	373	493	332	302	**4,794**	**-283**
1988	353	370	688	701	165	129	180	68	161	176	212	271	**3,474**	**-2,168**
1989	274	283	497	342	242	686	283	98	375	685	543	591	**4,899**	**-1,107**
1990	506	390	525	422	256	304	110	131	80	285	210	252	**3,471**	**-2,364**
1991	302	284	275	68	275	623	181	120	100	129	110	283	**2,750**	**-469**
1992	297	107	268	51	671	464	134	68	81	96	118	238	**2,595**	**-359**
1993	172	136	685	765	672	697	332	180	545	710	658	681	**6,234**	**1,542**
1994	627	480	625	417	624	183	184	152	321	667	705	367	**5,351**	**1,315**
1995	341	349	685	745	685	710	529	550	576	724	723	692	**7,309**	**2,228**
1996	680	601	694	694	682	540	440	390	386	419	600	694	**6,819**	**1,560**
1997	534	651	732	739	658	582	280	196	304	368	628	516	**6,188**	**1,182**
1998	491	600	694	710	654	554	491	535	576	724	723	694	**7,447**	**2,838**
1999	680	651	698	705	523	594	383	242	387	488	562	693	**6,606**	**1,905**
2000	593	650	566	718	683	675	298	180	412	478	719	603	**6,575**	**397**
2001	459	599	690	717	658	622	189	92	165	314	327	322	**5,154**	**187**
2002	345	484	693	718	383	475	233	186	258	687	561	543	**5,567**	**162**
2003	334	541	691	703	539	524	337	329	350	410	720	628	**6,106**	**-37**

Monthly Distribution of Simulated No Action Combined Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	No Action Average	No Action Change
Min	172	107	268	51	165	129	105	68	80	96	110	238	**2,595**	**-2,364**
10%	299	283	505	364	262	324	148	94	118	209	210	275	**3,472**	**-916**
25%	344	385	607	519	470	489	188	128	292	400	480	356	**5,090**	**-98**
50%	515	557	689	706	607	568	281	189	381	564	623	597	**6,211**	**1,249**
75%	601	650	694	720	672	633	409	344	417	693	708	684	**6,840**	**1,986**
90%	680	651	697	749	685	689	489	526	576	721	722	694	**7,405**	**2,718**
Max	680	651	732	782	708	710	529	557	576	724	723	694	**7,706**	**3,252**
Avg	**490**	**500**	**626**	**608**	**546**	**535**	**301**	**250**	**358**	**514**	**545**	**530**	**5,805**	**895**

Table 4.1-34. Future No Action Simulated CVP Chinook Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	3090	0	0	193	165	58023	25731	6803	1195	0	0
1981	388	1467	344	98	0	3777	13860	14863	4716	0	0	0
1982	4702	1453	37223	6819	6084	11407	4718	96388	69851	466	245	0
1983	0	18680	17262	6502	4110	3100	35422	119290	32296	1076	0	0
1984	4856	2045	128	233	0	5180	43769	21735	1572	688	0	0
1985	12886	7275	5359	0	7711	3456	19761	38286	1624	102	0	0
1986	8354	4445	5506	1969	430611	30048	47248	176739	43054	10444	0	0
1987	694	86	520	121	263	1781	8923	10406	0	0	0	0
1988	0	0	2501	3860	428	290	8961	5949	146	29	0	0
1989	0	0	306	74	0	6297	8055	5509	2056	0	0	0
1990	0	0	0	94	60	43	692	1370	247	0	0	0
1991	0	0	0	0	201	2086	9607	6297	264	0	0	0
1992	0	812	188	96	6686	16573	8164	1784	0	0	0	0
1993	0	0	83	38	378	376	4768	6111	1271	0	0	0
1994	12	494	1152	446	3056	1680	4247	1326	73	0	0	0
1995	14	0	2710	3928	823	1237	9912	24516	17619	1078	0	0
1996	146	0	130	854	1242	256	23335	11131	1846	0	0	0
1997	25	198	75	503	91	11611	16006	6166	2223	12	12	22
1998	49	49	353	52976	54326	10655	23644	56451	13494	204	0	0
1999	0	168	0	3120	23843	6412	49740	17197	9050	28	37	0
2000	12	97	220	1600	28403	8910	34149	8710	1717	13	0	214
2001	35	50	176	427	1423	6698	15766	3560	406	0	7	0
2002	0	0	193	951	163	1653	8477	3932	782	13	12	0
2003	121	180	704	2957	1792	3391	7457	1912	188	0	0	0

Monthly Distribution of CVP Chinook Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	43	692	1326	0	0	0	0
10%	0	0	0	11	18	266	4733	1822	95	0	0	0
25%	0	0	117	95	186	1549	8137	5114	260	0	0	0
50%	13	133	263	475	1032	3424	11886	9558	1670	12	0	0
75%	207	1456	1489	2998	6235	7251	26271	24820	7365	269	0	0
90%	4810	4038	5462	5730	27035	11550	46205	84407	27893	1078	12	0
Max	12886	18680	37223	52976	430611	30048	58023	176739	69851	10444	245	214
Avg	1346	1691	3131	3653	23829	5712	19363	27723	8804	640	13	10

Table 4.1-35. Future No Action Simulated SWP Chinook Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	2164	7618	6293	8044	845	1228	54116	56162	29597	1403	31	1521
1981	1499	1536	3400	3198	6217	15616	22575	13381	3643	0	71	0
1982	456	6137	19660	15937	40551	26443	28431	192873	170264	0	0	0
1983	0	15196	74287	15274	13719	24673	0	16933	127057	821	0	0
1984	0	1462	0	0	288	4455	19667	34841	71338	4	714	0
1985	35692	14777	15654	438	1031	1494	13841	38003	10114	606	0	29
1986	842	1699	2340	2358	55572	204384	397704	279248	104123	0	0	0
1987	0	213	1178	193	948	8859	15201	34740	21250	584	62	47
1988	4	25	38659	3396	1509	1202	15486	6883	4265	293	160	12
1989	43	546	1366	596	84	9601	18328	10938	1072	0	127	0
1990	34	297	894	1029	390	1815	1379	14169	854	99	0	0
1991	3	0	18	9	128	5666	6684	7156	599	0	0	0
1992	71	1489	14	67	17805	5577	1244	851	0	0	0	3
1993	0	0	403	1765	1446	514	1642	3156	2294	13	94	0
1994	20	114	850	156	767	103	1237	2036	107	0	0	0
1995	0	11	1255	5299	2461	244	496	16194	17503	221	18	0
1996	0	0	0	3725	716	1110	6531	12190	1183	6	0	12
1997	2	128	99	221	155	4196	8427	5249	635	8	0	7
1998	7	26	480	808	3481	0	0	10737	4917	241	0	0
1999	37	31	41	172	6054	4657	29653	45452	1641	34	30	43
2000	6	50	78	727	7050	4130	17032	9667	3724	35	17	459
2001	150	57	225	497	1958	6404	12068	3282	0	0	0	0
2002	0	0	521	1246	220	535	1491	3443	19	0	10	0
2003	0	6	1205	6027	685	2277	7920	6000	139	0	0	0

Monthly Distribution of SWP Chinook Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	84	0	0	851	0	0	0	0
10%	0	0	15	93	175	325	719	3194	45	0	0	0
25%	0	21	93	214	611	1179	1463	5813	626	0	0	0
50%	7	121	872	919	1238	4163	10247	11564	2968	7	0	0
75%	91	1500	2605	3479	6095	7018	18663	34765	18440	226	39	12
90%	1302	7174	18458	7439	16579	21956	29287	52949	94287	599	117	46
Max	35692	15196	74287	15937	55572	204384	397704	279248	170264	1403	714	1521
Avg	1710	2142	7038	2966	6837	13966	28381	34316	24014	182	56	89

Table 4.1-36. Future No Action Simulated CVP Steelhead Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	50	459	65	0	0	0	0
1981	0	0	281	257	1463	2228	81	137	0	0	0	0
1982	0	0	0	0	0	0	0	299	0	0	0	0
1983	0	0	2667	0	0	0	0	0	0	0	0	0
1984	0	62	0	0	0	89	94	19	0	0	0	0
1985	0	0	0	0	87	102	54	65	0	0	0	0
1986	0	0	0	28	562	112	353	222	43	46	0	0
1987	0	0	0	56	59	516	144	73	0	0	0	0
1988	0	0	0	257	0	96	385	441	0	0	0	0
1989	0	0	141	0	147	5171	1868	323	0	0	0	0
1990	0	0	0	0	631	1285	261	0	0	0	0	0
1991	0	0	0	40	111	3641	661	88	0	0	0	0
1992	0	0	0	792	3060	2500	161	0	0	0	0	0
1993	0	0	0	0	3651	3194	608	44	30	0	0	0
1994	0	0	12	52	739	338	126	54	24	0	0	0
1995	0	0	58	12	278	1172	241	108	53	0	0	0
1996	0	0	0	997	997	64	323	60	7	0	0	0
1997	0	0	25	25	0	117	315	27	20	12	0	0
1998	0	0	12	321	259	116	68	62	13	190	0	0
1999	0	24	0	136	203	259	721	75	18	0	0	0
2000	0	24	40	595	1884	484	232	53	0	0	0	0
2001	0	13	13	241	2890	3413	338	17	9	0	0	0
2002	0	0	0	98	322	761	186	0	28	0	0	0
2003	0	0	107	4520	1183	798	323	67	0	0	0	0

Monthly Distribution of CVP Steelhead Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	54	58	0	0	0	0	0
25%	0	0	0	0	44	100	118	25	0	0	0	0
50%	0	0	0	46	269	411	251	63	0	0	0	0
75%	0	0	29	257	1043	1521	361	93	18	0	0	0
90%	0	21	130	733	2588	3348	645	276	29	9	0	0
Max	0	62	2667	4520	3651	5171	1868	441	53	190	0	0
Avg	0	5	140	351	772	1104	333	96	10	10	0	0

Table 4.1-37. Future No Action Simulated SWP Steelhead Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	28	28	514	1842	483	342	436	104	0	0	0
1981	51	0	58	217	2678	7622	2011	0	0	0	0	0
1982	0	0	502	1884	2166	1278	10995	4268	1247	0	0	0
1983	38	0	0	342	96	0	0	3809	0	0	0	0
1984	0	0	0	0	0	110	258	16	0	0	0	0
1985	0	0	35	0	396	807	571	255	0	0	0	0
1986	0	0	0	0	576	584	3948	705	0	0	0	0
1987	0	0	2722	0	161	6952	364	163	0	0	0	0
1988	0	0	248	102	856	253	732	41	5	0	0	0
1989	0	0	0	11	247	5501	779	103	0	0	0	0
1990	0	0	0	0	465	853	82	30	0	0	0	0
1991	0	0	17	2	30	6895	904	53	0	0	0	0
1992	91	568	0	11	11423	2330	236	12	0	0	0	0
1993	0	0	40	1447	12945	2996	390	240	0	0	0	0
1994	0	0	0	17	393	56	101	70	0	57	0	0
1995	2	0	7	378	641	1057	213	397	228	36	0	0
1996	9	0	0	2484	1526	475	476	279	5	0	0	0
1997	0	19	36	0	40	221	141	41	0	0	0	0
1998	24	0	31	119	516	0	0	0	18	0	0	0
1999	54	0	0	66	50	418	737	380	150	4	3	0
2000	6	46	4	842	4550	974	190	29	53	6	0	0
2001	2	59	124	731	4705	4456	235	28	0	0	0	0
2002	0	0	2	704	434	670	148	36	11	13	0	0
2003	0	0	278	4559	979	405	310	236	18	0	0	0

Monthly Distribution of SWP Steelhead Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	43	72	88	13	0	0	0	0
25%	0	0	0	2	226	367	180	30	0	0	0	0
50%	0	0	12	110	546	738	326	86	0	0	0	0
75%	7	0	45	711	1923	2497	734	305	18	0	0	0
90%	47	41	269	1753	4658	6477	1679	625	136	11	0	0
Max	91	568	2722	4559	12945	7622	10995	4268	1247	57	3	0
Avg	12	30	172	601	1988	1891	1007	485	77	5	0	0

Table 4.1-38. Future No Action Simulated CVP Delta Smelt Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	24510	693	0	0	6310	4283	2477	283	880	2521	395	2116
1981	14918	3523	7136	10191	13893	13716	803	46681	39672	51775	53155	3887
1982	2925	14570	0	6591	7662	3500	119	627	2594	0	551	1991
1983	1510	542	0	2022	502	0	53	58	1639	1111	0	103
1984	0	0	1150	0	0	1026	51	4747	4845	0	927	0
1985	183	131	0	177	173	46	87	3677	1711	3825	2226	403
1986	90	0	0	449	449	3	0	0	93	293	1388	0
1987	195	0	0	0	0	391	3446	3532	0	0	0	190
1988	0	45	1456	1897	48	0	0	969	1306	0	0	0
1989	48	0	101	0	0	0	2261	630	244	756	187	169
1990	73	0	0	0	0	0	1767	2372	315	59	0	0
1991	0	0	206	75	0	197	230	464	0	0	0	499
1992	0	0	0	0	130	374	40	73	0	0	0	0
1993	0	0	0	0	38	63	0	463	3214	253	0	0
1994	0	0	0	0	131	109	720	24684	7388	20	0	0
1995	0	0	14	122	24	22	25	0	0	0	0	0
1996	0	0	0	1068	528	64	125	7934	598	70	0	0
1997	0	12	12	0	365	1103	812	7358	967	12	0	0
1998	0	0	25	13	35	566	90	0	38	27	0	0
1999	0	0	0	34	848	289	349	9646	17755	255	12	0
2000	0	24	100	744	2407	1290	1665	12102	8045	97	0	0
2001	0	251	163	241	2672	2268	200	8905	1038	0	0	0
2002	0	0	399	1268	134	76	340	26102	4723	25	0	0
2003	0	0	1004	2120	538	458	662	12746	1045	2	0	0

Monthly Distribution of CVP Delta Smelt Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	8	17	0	0	0	0
25%	0	0	0	0	32	40	52	418	206	0	0	0
50%	0	0	6	99	154	243	215	2952	1042	26	0	0
75%	113	66	174	1118	615	1045	805	9090	3591	264	239	174
90%	2500	648	1106	2090	5219	3130	2113	21103	7848	2098	1250	1543
Max	24510	14570	7136	10191	13893	13716	3446	46681	39672	51775	53155	3887
Avg	1852	825	490	1126	1537	1243	680	7252	4088	2546	2452	390

Table 4.1-39. Future No Action Simulated SWP Delta Smelt Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	444	1748	0	6210	199	1025	664	1425	15788	26509	10415	137
1981	549	550	4698	19200	16166	8241	1596	4319	50808	15652	0	22
1982	99	754	1076	8021	5116	2315	187	87	56	8295	2705	0
1983	27	1164	1132	3061	770	1322	0	1027	10176	4680	0	2790
1984	0	0	0	0	126	13	56	412	3747	3998	0	53
1985	0	0	508	109	573	324	602	577	9312	101	0	998
1986	0	0	530	1337	3532	7116	1552	285	82	137	0	0
1987	0	60	552	147	337	361	195	43	32200	1994	2438	46
1988	101	0	9091	5191	148	52	0	478	8317	596	0	0
1989	133	5	686	233	53	320	54	428	4813	6588	930	195
1990	0	186	0	94	220	138	26	1653	7447	19168	43	0
1991	0	0	3	43	476	1131	330	69	5498	5740	555	0
1992	376	0	0	9	1436	265	0	685	1184	34	0	0
1993	0	0	0	3358	1745	337	0	19110	19740	1313	27	0
1994	0	0	83	13	198	22	998	17482	27504	5768	0	0
1995	0	0	75	2033	810	54	0	0	0	0	0	0
1996	0	0	0	3844	2162	328	22	35836	6313	31	0	0
1997	0	0	13	0	142	366	194	29683	6025	58	0	0
1998	0	0	266	271	0	0	0	25	92	200	0	0
1999	0	0	55	20	789	293	221	73107	176712	13866	25	0
2000	0	0	87	275	5672	2080	232	37762	38033	1318	7	23
2001	18	77	54	47	2667	2732	223	3287	1570	2	0	0
2002	0	0	899	4583	90	144	0	58547	4706	0	0	0
2003	0	0	3381	9251	814	10	0	18312	3897	0	0	0

Monthly Distribution of SWP Delta Smelt Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	10	101	16	0	51	85	1	0	0
25%	0	0	2	46	186	117	0	380	3203	52	0	0
50%	0	0	85	273	672	326	121	1226	6169	1315	0	0
75%	45	64	739	4029	1849	1179	257	18512	16776	5973	31	29
90%	303	693	2706	7478	4641	2607	898	37184	36283	15116	1985	178
Max	549	1748	9091	19200	16166	8241	1596	73107	176712	26509	10415	2790
Avg	73	189	966	2806	1843	1208	298	12693	18084	4835	714	178

Table 4.1-40. Future No Action Simulated CVP Longfin Smelt Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	260	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	58	0	0	0
1984	0	0	0	0	0	0	0	5481	0	1356	0	0
1985	0	0	0	0	0	0	602	870	111	0	0	95
1986	541	0	0	0	0	0	0	20	24	123	0	0
1987	0	0	0	0	0	0	231	823	0	468	65	0
1988	0	0	841	257	19	0	3146	3379	1817	0	0	0
1989	0	0	0	0	0	0	3360	49	168	0	0	0
1990	0	0	0	0	37	0	2030	2423	393	0	2555	1130
1991	1539	0	0	0	0	0	982	137	341	0	0	0
1992	0	0	0	0	0	95	25	350	0	0	0	0
1993	0	0	0	0	0	0	0	69	0	0	0	0
1994	0	0	0	0	0	36	608	3386	194	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	24	14	0	15	52	22	0	0	0
1997	0	0	0	0	91	0	76	132	0	0	0	0
1998	0	0	50	51	17	0	0	0	0	0	0	0
1999	0	0	0	0	8	0	64	30	0	0	12	0
2000	0	0	0	16	0	0	450	85	0	0	0	0
2001	0	0	25	56	29	216	1640	2748	0	0	0	0
2002	0	0	14	85	0	766	24011	35213	156	0	0	0
2003	0	0	46	48	0	0	2163	3248	8	0	0	0

Monthly Distribution of CVP Longfin Smelt Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0
25%	0	0	0	0	0	0	0	15	0	0	0	0
50%	0	0	0	0	0	0	70	108	0	0	0	0
75%	0	0	0	30	9	0	1146	2504	123	0	0	0
90%	0	0	39	76	26	77	2851	3384	297	86	9	0
Max	1539	0	841	260	91	766	24011	35213	1817	1356	2555	1130
Avg	87	0	41	33	9	46	1642	2437	137	81	110	51

Table 4.1-41. Future No Action Simulated SWP Longfin Smelt Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	502	0	181	0	7381	10719	1102	0	0	1065
1981	0	0	0	495	602	1121	55	385	2836	817	0	109
1982	0	0	0	0	42	0	0	0	0	0	0	0
1983	0	60	0	333	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	270	396	0	0	0	0
1985	0	0	0	0	0	0	1397	5690	504	0	53	0
1986	0	0	237	60	62	0	966	1501	0	0	0	0
1987	0	368	1142	43	110	131	9668	6959	0	367	0	0
1988	21	0	7618	8157	250	2083	23368	4643	1994	0	0	0
1989	0	0	93	72	13	304	17128	1802	9471	1269	1420	0
1990	0	0	0	0	0	30	915	17109	5383	85	0	7
1991	0	0	0	4	1	864	1270	713	190	808	0	646
1992	0	0	0	0	0	2	9	295	1114	0	0	0
1993	0	0	10	13	0	0	9	248	38	390	36	0
1994	0	0	6	6	66	0	1564	3308	645	0	0	0
1995	0	0	18	59	21	0	142	55	35	0	0	0
1996	0	0	0	69	41	0	2	44	0	13	7	0
1997	0	0	0	0	0	0	6	1247	16	3	0	0
1998	0	0	6	28	0	0	202048	0	0	0	0	0
1999	0	0	0	0	0	33	424	327	172	38	33	0
2000	0	0	0	45	19	74	790	279	31	25	7	0
2001	22	20	0	0	39	15	200	933	0	0	0	0
2002	0	0	0	93	0	0	10235	68877	910	6	0	0
2003	0	0	20	238	9	0	98	1406	26	0	0	0

Monthly Distribution of SWP Longfin Smelt Savlage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	3	13	0	0	0	0
25%	0	0	0	0	0	0	44	271	0	0	0	0
50%	0	0	0	20	11	0	607	823	36	0	0	0
75%	0	0	18	70	47	43	3018	3642	958	50	2	0
90%	0	14	423	305	160	696	15060	9591	2583	682	35	78
Max	22	368	7618	8157	602	2083	202048	68877	9471	1269	1420	1065
Avg	2	19	402	405	61	194	11581	5289	1019	159	65	76

Table 4.1-42. Future No Action Simulated CVP Splittail Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	301	285	1461	75712	49497	32426	2449	231
1981	198	0	180	310	1528	800	3594	42832	27683	2560	1145	0
1982	0	0	0	0	10489	5252	1609	5321	57165	144997	29282	4057
1983	151	0	2212	1875	11874	4853	2868	47410	188481	63335	30791	5066
1984	1922	62	161	104	2511	4790	1201	2275	29810	10741	2598	0
1985	0	0	0	86	1702	2307	614	2156	8310	9930	3521	480
1986	90	1479	0	61	1441	3503	26506	891085	196547	17858	2825	2696
1987	840	419	47	313	1229	1156	426	904	455	158	34	131
1988	0	0	138	2580	128	318	1122	689	1670	580	0	0
1989	0	0	0	264	404	3289	2273	1343	1619	62	0	0
1990	0	0	0	0	0	1601	518	458	5969	1160	0	0
1991	0	0	0	221	221	2920	1454	787	3236	166	0	0
1992	0	0	54	32	3409	1934	66	343	2563	0	22	0
1993	0	0	0	12015	2933	1916	1477	29794	71098	9892	70	12
1994	0	12	0	0	214	242	36	197	3840	549	0	0
1995	0	0	0	661	109	22	139	200148	1982335	263041	5845	595
1996	719	291	202	297	1127	0	1116	17260	11138	3427	1187	374
1997	561	124	62	0	548	1664	956	2742	5432	852	110	45
1998	24	0	50	897	363	1612	12214	320345	1160299	771143	8787	1373
1999	510	96	0	358	255	463	133	48	3634	8261	383	207
2000	98	109	40	79	1164	708	1870	29808	19370	327	136	38
2001	35	0	13	37	276	569	390	352	3822	404	35	30
2002	13	25	275	817	80	502	802	0	697	264	12	12
2003	0	28	52	960	155	625	129	875	7236	62	38	13

Monthly Distribution of CVP Splittail Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	36	0	455	0	0	0
10%	0	0	0	0	115	255	130	241	1634	91	0	0
25%	0	0	0	36	219	492	417	631	3535	311	20	0
50%	7	0	26	243	476	1378	1119	2215	7773	1860	123	34
75%	162	71	81	700	1571	2460	1674	33064	51414	12520	2655	401
90%	671	241	195	1600	3266	4404	3376	162817	194127	120499	7905	2299
Max	1922	1479	2212	12015	11874	5252	26506	891085	1982335	771143	30791	5066
Avg	215	110	145	915	1769	1722	2624	69704	160080	55925	3720	640

Table 4.1-43. Future No Action Simulated SWP Splittail Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	68	131	1715	91010	416927	1560	3662	110755	164442	21641	7865	1303
1981	62	0	439	1427	10500	1381	1973	12337	29	0	67	0
1982	0	76	1729	18614	24038	8520	6884	175739	193300	30607	110797	296
1983	22	0	935	394	16000	69399	0	4567	386126	23188	126980	471
1984	81	0	0	7	1826	858	3435	4581	16920	40032	17394	682
1985	0	360	4421	67	3884	1310	1629	4710	25475	3720	605	226
1986	164	100	0	489	3179	2524	39810	702107	571111	44499	8272	7124
1987	354	0	3416	498	2406	737	262	8204	40627	4714	401	241
1988	45	12	3716	6476	4490	1312	337	476	1999	2958	90	270
1989	0	94	48	227	675	2458	2712	18432	4084	1885	11635	1445
1990	31	114	72	405	2254	284	2003	1418	351	148	0	0
1991	0	0	0	77	89	990	5000	246	11303	1070	0	0
1992	410	0	0	363	1188	2572	39	16	387	0	3	4
1993	0	0	14	38902	22662	319	267	53081	11630	1805	379	103
1994	180	83	11	48	10	253	0	384	287	35	6	17
1995	0	0	0	4130	6353	142	9	61383	2465471	147365	11986	457
1996	272	1488	0	1178	670	451	65	17475	4394	1003	470	89
1997	53	26	49	67	143	2196	7453	581	805	1144	130	63
1998	14	12	2608	14439	0	9840	75	31204	845716	960663	23796	2762
1999	2669	510	61	179	276	882	1575	935	358	6457	1898	480
2000	91	57	118	175	4121	4602	1716	18147	36694	5836	395	138
2001	419	185	113	173	1943	3556	1564	56	13	131	74	71
2002	0	0	639	1988	870	712	1615	30	190	147	60	54
2003	0	61	150	617	243	495	422	25	3634	105	47	37

Monthly Distribution of SWP Splittail Salvage Density (fish/taf) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	7	0	142	0	16	13	0	0	0
10%	0	0	0	67	105	294	18	38	219	56	4	1
25%	0	0	8	174	572	658	215	453	380	148	65	50
50%	49	41	93	447	2098	1311	1595	4645	7849	2421	398	182
75%	168	103	1130	2523	4956	2536	2893	21625	71581	22028	9113	474
90%	393	307	3174	17361	20663	7345	6319	95943	515616	43159	21876	1403
Max	2669	1488	4421	91010	416927	69399	39810	702107	2465471	960663	126980	7124
Avg	206	138	844	7581	21864	4890	3438	51120	199389	54131	13473	681

Table 4.1-44. Future No Action Simulated CVP Striped Bass Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	78580	103066	0	0	17367	1752	5638	912	165429	659664	128760	81652
1981	84916	154443	76138	26906	35398	22514	10842	725170	5008993	813623	107039	68073
1982	91808	151193	106773	122530	78998	18026	17823	8877	209780	1287444	368759	82525
1983	49187	66821	45078	31079	21203	3561	4115	2749	15097	25690	81465	20724
1984	3035	20436	9693	4525	1746	1049	3864	46755	1404488	1307742	147544	43182
1985	258984	115018	92712	31576	21629	7606	4911	87122	653891	556706	103211	21517
1986	13691	22062	38304	56069	176058	8874	1379	21541	2397602	1410885	258097	98029
1987	50846	74239	16477	14595	12197	7745	2410	325839	496773	61638	3954	10015
1988	3879	5226	22076	28480	8047	3978	2901	3739	285455	86482	13912	11294
1989	4418	2426	27838	28549	19828	15576	4698	49710	731792	246649	13449	10784
1990	8105	3938	4691	8643	8793	13882	1357	83789	129938	164958	20211	17781
1991	8090	4854	24743	6147	21345	21901	13159	23726	627880	663006	36496	16896
1992	5747	1154	6163	2769	286726	46908	1379	1162788	468369	64177	3772	18501
1993	21163	9412	22150	168047	48167	35999	3600	116111	3457709	1436608	47629	49052
1994	24861	20832	14120	17732	17467	10999	4419	44621	2403281	842203	47207	11216
1995	9698	4961	10455	112822	31971	17977	2654	2094	14101	62882	34207	28269
1996	17083	8296	9941	6143	8770	224	1762	1410	33731	36738	14181	8529
1997	16601	13792	14978	15399	2467	1789	3765	44946	196385	43375	12518	8483
1998	9953	9804	12710	18596	11518	1705	791	1019	1693	79758	39085	16329
1999	4084	5328	0	3359	1380	911	793	682	343094	184556	22874	7461
2000	10164	12095	6500	12195	14677	2667	2662	15690	306581	49281	19230	15133
2001	12285	45628	11621	6110	20114	34083	2863	242960	643521	87744	5180	2444
2002	2654	17602	23200	32153	20840	37169	7196	17059	290492	111966	10932	1648
2003	697	5661	17161	16148	10145	17777	4084	8488	33519	4809	12573	6170

Monthly Distribution of CVP Striped Bass Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	697	1154	0	0	1380	224	791	682	1693	4809	3772	1648
10%	3289	4213	5132	3708	4141	1245	1363	1136	20623	38729	6906	6557
25%	5415	5302	9879	6146	9807	2447	2248	3492	156556	62571	13230	9643
50%	11225	12944	15728	16940	18647	9936	3682	22633	324837	138462	28541	16612
75%	30943	50926	25517	31203	24214	18995	4751	84622	673366	700660	86902	31997
90%	83015	111432	66820	95796	69749	35424	9748	300976	2401577	1301653	141908	77578
Max	258984	154443	106773	168047	286726	46908	17823	1162788	5008993	1436608	368759	98029
Avg	32939	36595	25563	32107	37369	13945	4544	126575	846650	428691	64679	27321

Table 4.1-45. Future No Action Simulated SWP Striped Bass Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	67745	169677	175957	44154	18130	2723	780	648	636360	2646786	670711	144717
1981	14387	105012	280234	109355	33626	10613	587	77424	3309143	669269	147709	6647
1982	4714	86216	102530	134600	46875	16613	6769	2515	136923	1853512	611136	72833
1983	51788	71562	239570	16847	7667	2279	0	101794	57334	111181	99380	23741
1984	6654	53505	283083	19099	3974	2269	844	18087	3960686	4392950	135961	31923
1985	284710	216894	189560	53765	11117	2039	642	133168	2794923	1311879	132435	23324
1986	5779	157009	116015	50388	45726	11355	473	54865	8057322	7470716	371147	119786
1987	99366	87929	126920	39659	35533	3633	212	2041889	10995880	1126540	24294	9923
1988	479	38484	288261	26770	17083	1338	87	9932	1688337	613806	201148	2469
1989	5072	156597	136596	5407	5187	7691	498	411691	9199992	2851587	207728	15018
1990	4555	14001	7844	22201	12691	5768	45	331221	279484	1022568	177270	6769
1991	1005	10424	7386	1114	7239	5915	5190	963	1107010	496539	48001	22186
1992	5556	4858	126137	1925	124185	19014	516	166209	813378	161223	7640	636
1993	69	21955	41546	318048	117936	5038	81	526776	11942482	5818305	442819	25470
1994	5095	106596	5189	987	4107	152	23	167095	1213088	444608	18846	14432
1995	239	89854	36544	106403	107867	10782	142	397	163418	943295	212321	19270
1996	7412	16815	11842	6861	2372	1500	50	12757	266097	108918	5506	8230
1997	39363	140742	17106	28138	2568	406	394	8942	603661	32457	6808	2670
1998	18339	2904	171235	13491	6156	0	0	38	10243	193535	250238	61413
1999	51998	52309	8270	2862	904	229	1436	4653	342752	765574	308623	4444
2000	1228	8460	74152	8642	10470	4597	267	97040	1692783	880095	149964	10034
2001	214977	305866	58984	9140	17454	13933	4549	1754	100838	97560	7049	690
2002	133	115128	75773	35722	21460	5337	290	1927	285196	318586	9093	16938
2003	3501	145070	69053	15206	15003	4421	1046	52824	166883	248776	23299	5903

Monthly Distribution of SWP Striped Bass Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	69	2904	5189	987	904	0	0	38	10243	32457	5506	636
10%	311	9049	7972	2206	2989	282	30	742	111663	109597	7226	2529
25%	2933	20670	31684	8197	5914	1904	86	2368	241293	234966	22186	6461
50%	5667	87073	89151	20650	13847	4509	433	35455	724869	717422	141835	14725
75%	42470	141824	172415	45713	34103	8421	796	141428	2923478	1447287	221801	24173
90%	89880	165877	268035	108469	89569	13160	3615	387550	8857191	3930541	421317	69407
Max	284710	305866	288261	318048	124185	19014	6769	2041889	11942482	7470716	670711	144717
Avg	37257	90745	110408	44616	28139	5735	1038	176025	2492675	1440844	177880	27061

Table 4.1-46. Future No Action Simulated CVP Green Sturgeon Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	166	0	0	0	209	0	0
1982	0	0	0	0	0	0	0	0	0	0	172	614
1983	0	0	167	0	0	0	0	0	0	0	1518	0
1984	127	0	0	0	90	56	0	29	0	128	0	0
1985	0	254	0	0	87	0	0	0	0	759	498	0
1986	0	42	0	0	0	0	0	0	0	0	0	0
1987	53	0	0	0	48	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	54	0	0	0	0	0
1993	0	0	0	0	13	0	0	0	0	0	0	0
1994	0	12	0	0	0	0	0	0	0	0	0	0
1995	0	0	58	0	0	0	0	0	0	0	12	0
1996	24	0	0	0	0	0	0	0	0	12	0	0
1997	0	0	0	0	0	0	10	5	13	0	0	11
1998	12	12	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	6	0	0	0	13
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	12	0	13	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Distribution of CVP Green Sturgeon Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0
25%	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	0	0	0	0
90%	21	12	9	0	37	0	0	4	0	93	124	8
Max	127	254	167	0	90	166	54	29	13	759	1518	614
Avg	9	13	10	0	10	9	3	2	1	46	92	27

Table 4.1-47. Future No Action Simulated SWP Green Sturgeon Salvage for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	301	0	0	0	0	0	0	46	33	0
1981	0	0	0	0	0	0	20	0	0	0	302	0
1982	0	0	0	0	0	159	386	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	20	0	0	0	0	0	0	0	0	44	76	0
1985	0	0	0	0	0	0	1	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	76	0	0	0	0	0	0
1988	0	0	0	0	18	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	7	0	40	0	0	0	0	0	0
1991	1	0	0	1	0	37	0	0	0	0	0	0
1992	0	0	0	0	0	30	0	0	0	0	0	0
1993	0	0	3	5	0	0	0	0	0	0	0	4
1994	0	27	0	0	4	1	0	0	0	0	0	0
1995	0	0	0	9	7	0	0	0	0	43	77	0
1996	0	38	0	0	0	20	0	0	12	0	0	20
1997	0	0	0	0	0	0	1	0	0	0	0	14
1998	0	0	0	0	0	0	0	0	0	0	156	26
1999	33	0	0	0	172	0	0	0	0	0	0	12
2000	0	0	0	0	22	0	0	0	0	0	0	0
2001	0	3	9	0	0	6	0	0	0	0	0	0
2002	0	0	55	0	0	12	0	0	0	0	0	0
2003	0	0	0	7	5	0	0	0	0	5	0	0

Monthly Distribution of SWP Green Sturgeon Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	0	0	0	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0
25%	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	1	14	0	0	0	0	0	0
90%	1	2	7	7	15	39	1	0	0	32	77	14
Max	33	38	301	9	172	159	386	0	12	46	302	26
Avg	2	3	15	1	9	16	17	0	0	6	27	3

Table 4.1-48. CALSIM-Simulated Monthly Intertie CVP Pumping for Water Years 1980–2003 with Comparison to Annual No Action CVP Pumping

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Intertie Annual	No Action Annual	Annual Change	Percent Change
1980	283	274	283	283	213	114	141	92	158	283	283	274	2,680	2,613	66	3%
1981	272	274	283	283	255	185	105	99	178	283	279	274	2,769	2,744	26	1%
1982	255	274	283	283	255	149	148	184	179	283	283	274	2,850	2,829	20	1%
1983	283	274	283	283	128	122	162	184	179	283	283	274	2,737	2,741	-4	0%
1984	283	274	151	121	149	161	119	49	147	200	283	274	2,210	2,206	5	0%
1985	283	274	283	283	235	181	98	118	169	283	282	245	2,733	2,650	83	3%
1986	247	266	283	283	249	81	116	172	166	283	283	273	2,703	2,663	39	1%
1987	281	272	83	96	117	104	48	49	105	215	49	143	1,562	1,587	-25	-2%
1988	162	225	283	283	46	49	90	49	139	143	49	171	1,690	1,676	13	1%
1989	145	119	261	259	133	283	141	49	147	283	131	172	2,123	2,087	36	2%
1990	170	216	265	259	145	152	84	82	48	108	49	139	1,718	1,711	8	0%
1991	280	48	206	6	106	283	90	71	56	60	49	122	1,377	1,539	-162	-11%
1992	99	48	155	55	265	232	48	49	61	49	40	159	1,259	1,175	85	7%
1993	165	36	283	283	255	283	152	49	147	283	222	274	2,431	2,318	114	5%
1994	283	274	283	260	216	132	92	103	172	277	283	162	2,536	2,453	83	3%
1995	198	143	283	283	255	273	223	184	179	283	283	274	2,861	2,718	143	5%
1996	283	274	283	281	128	104	175	92	158	268	283	274	2,602	2,647	-45	-2%
1997	283	274	283	283	255	96	129	49	147	283	283	242	2,608	2,587	20	1%
1998	283	274	283	283	191	123	162	184	179	283	283	274	2,801	2,753	47	2%
1999	283	274	283	236	150	167	152	49	147	214	283	274	2,510	2,465	44	2%
2000	283	274	283	283	265	172	149	69	168	104	283	274	2,605	2,563	42	2%
2001	268	274	229	283	255	283	94	74	143	232	150	101	2,386	2,303	83	4%
2002	243	231	283	283	139	163	117	118	179	283	279	258	2,573	2,608	-34	-1%
2003	190	274	283	283	255	262	152	101	179	49	283	274	2,583	2,484	100	4%

Monthly Distribution of Simulated Jones Pumping Plant Pumping (taf) for No Action Alternative for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Intertie Annual	No Action Annual	Annual Change	Percent Change
Min	99	36	83	6	46	49	48	49	48	49	40	101	1,259	1,175	-162	-11%
10%	163	69	171	104	120	99	86	49	75	73	49	140	1,601	1,614	-31	-1%
30%	238	230	281	260	145	123	97	49	147	212	215	172	2,368	2,293	13	1%
50%	276	274	283	283	214	162	124	87	158	280	283	273	2,578	2,524	38	2%
70%	283	274	283	283	255	190	149	104	172	283	283	274	2,682	2,647	68	3%
90%	283	274	283	283	255	283	162	184	179	283	283	274	2,791	2,743	95	5%
Max	283	274	283	283	265	283	223	184	179	283	283	274	2,861	2,829	143	7%
Avg	**242**	**226**	**257**	**242**	**194**	**173**	**124**	**97**	**147**	**221**	**219**	**228**	**2,371**	**2,338**	**33**	**1%**

Table 4.1-49. CALSIM-Simulated Intertie Banks Pumping Plant Pumping (taf) for Water Years 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Intertie Annual	No Action Annual	Annual Change	Percent Change
1980	303	379	434	523	389	429	258	216	229	274	398	397	4,230	4,311	-82	-1.9
1981	288	221	391	456	327	423	105	84	222	355	262	214	3,348	3,342	6	0.2
1982	272	397	434	490	472	442	364	320	397	431	441	427	4,888	4,877	11	0.2
1983	411	397	452	455	381	427	323	372	397	441	441	427	4,926	4,925	1	0.0
1984	411	397	429	405	392	427	158	153	283	377	385	311	4,128	4,106	22	0.5
1985	364	397	434	401	235	181	98	70	241	432	426	409	3,687	3,732	-45	-1.2
1986	273	306	434	447	472	465	330	310	212	290	344	342	4,224	4,241	-17	-0.4
1987	308	234	436	338	346	399	48	49	268	279	287	164	3,155	3,207	-52	-1.6
1988	191	127	429	442	115	80	90	19	33	52	123	94	1,795	1,798	-3	-0.1
1989	129	165	236	83	109	427	141	49	232	414	409	420	2,814	2,812	2	0.1
1990	336	142	299	161	134	152	25	49	33	165	148	113	1,758	1,760	-3	-0.1
1991	22	103	70	0	74	434	91	49	43	71	155	110	1,224	1,211	13	1.1
1992	86	41	114	138	428	232	87	18	33	52	282	74	1,586	1,420	166	11.7
1993	63	56	426	506	423	435	180	181	397	431	438	408	3,943	3,916	27	0.7
1994	362	192	350	163	408	43	92	49	172	436	429	205	2,901	2,898	3	0.1
1995	189	165	426	485	429	456	312	363	397	441	441	427	4,533	4,590	-58	-1.3
1996	411	345	434	405	389	420	265	298	228	151	322	427	4,095	4,172	-77	-1.9
1997	251	397	472	485	403	412	151	147	156	89	342	279	3,583	3,600	-17	-0.5
1998	224	326	435	454	382	428	328	351	397	441	441	427	4,635	4,693	-59	-1.2
1999	411	397	438	403	373	427	232	193	240	265	284	427	4,090	4,141	-51	-1.2
2000	331	397	283	458	437	428	151	160	277	386	435	341	4,086	4,012	74	1.8
2001	220	331	440	436	422	339	94	18	25	85	178	224	2,812	2,851	-39	-1.4
2002	102	253	433	458	232	312	117	72	78	409	287	285	3,040	2,959	81	2.7
2003	144	277	431	443	284	262	185	228	172	362	441	366	3,596	3,622	-26	-0.7

Monthly Distribution of Simulated Intertie Banks Pumping Plant Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Intertie Annual	No Action Annual	Annual Change	Percent Change
Min	22	41	70	0	74	43	25	18	25	52	123	74	1,224	1,211	-82	-1.9
10%	91	111	250	145	121	161	88	28	33	75	162	111	1,769	1,771	-58	-1.5
25%	178	165	381	385	272	300	94	49	137	162	283	211	2,879	2,886	-47	-1.2
50%	272	291	432	442	386	425	151	150	229	359	365	341	3,642	3,677	-3	-0.1
75%	343	397	435	458	422	429	260	246	279	431	436	422	4,152	4,189	12	0.3
90%	411	397	439	489	434	440	327	341	397	440	441	427	4,604	4,662	60	1.6
Max	411	397	472	523	472	465	364	372	397	441	441	427	4,926	4,925	166	11.7
Avg	**254**	**269**	**382**	**376**	**336**	**353**	**176**	**159**	**215**	**297**	**339**	**305**	**3,462**	**3,467**	**-5**	**0.2**

Table 4.1-50. Simulated Intertie Change in Combined CVP and SWP Export Pumping (taf) for Water Years 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual	Percent Change
1980	-4	3	23	23	-70	2	0	0	-3	5	-1	7	-15	-0.2%
1981	4	0	0	20	0	-82	0	34	15	18	11	10	31	0.5%
1982	7	21	23	23	20	-71	0	0	0	0	2	7	31	0.4%
1983	13	20	23	14	-81	0	0	0	0	0	2	7	-3	0.0%
1984	13	20	-41	0	0	0	0	0	0	0	10	25	27	0.4%
1985	-7	21	23	0	0	-8	0	-5	1	4	8	2	38	0.6%
1986	10	0	23	23	14	-50	0	0	2	-8	9	0	23	0.3%
1987	2	4	-25	-63	-6	9	-9	0	0	2	4	5	-76	-1.6%
1988	0	-17	24	24	-4	0	0	0	12	20	-40	-6	11	0.3%
1989	0	1	0	1	0	24	0	0	4	12	-3	0	38	0.8%
1990	0	-32	39	-1	23	0	0	0	0	-12	-13	0	5	0.1%
1991	0	-133	1	-61	-95	94	-1	0	0	2	95	-50	-149	-5.4%
1992	-111	-19	1	142	22	0	0	0	14	5	203	-6	251	9.7%
1993	55	-44	24	24	6	20	0	50	0	4	2	0	140	2.3%
1994	17	-14	8	6	-1	-7	0	0	23	47	7	0	86	1.6%
1995	47	-40	23	23	-1	18	7	-2	0	0	2	9	85	1.2%
1996	13	18	23	-8	-164	-16	0	0	0	0	5	7	-122	-1.8%
1997	0	20	23	29	0	-74	0	0	0	4	-4	4	3	0.1%
1998	15	0	23	26	-81	-3	0	0	0	0	2	7	-11	-0.2%
1999	13	20	23	-66	0	0	0	0	0	-10	5	8	-7	-0.1%
2000	21	21	0	23	18	-75	3	50	33	12	-1	11	116	1.8%
2001	29	6	-21	2	20	0	0	0	3	2	1	2	44	0.9%
2002	0	0	24	23	-13	0	0	3	-1	5	5	0	46	0.8%
2003	0	10	23	23	0	0	0	0	0	1	5	12	74	1.2%

Monthly Distribution of Simulated Intertie Change in Combined Pumping (taf) for Water Years 1980–2008

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Average	Percent Change
Min	-111	-133	-41	-66	-164	-82	-9	-5	-3	-12	-40	-50	-149	-5.4%
10%	-3	-38	-15	-45	-81	-73	0	0	0	-6	-3	-4	-58	-1.2%
25%	0	-15	1	0	-7	-10	0	0	0	0	0	0	-4	-0.1%
Med	6	2	23	21	0	0	0	0	0	2	3	4	29	0.4%
75%	14	20	23	23	8	1	0	0	3	5	7	7	53	0.9%
90%	27	21	24	26	20	20	0	25	14	17	11	11	107	1.7%
Max	55	21	39	142	23	94	7	50	33	47	203	25	251	9.7%
Avg	**6**	**-5**	**12**	**10**	**-16**	**-9**	**0**	**5**	**4**	**5**	**13**	**3**	**28**	**0.6%**

Table 4.1-51. Intertie Simulated CVP Chinook Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	256	0	0	-25	6	0	0	0	0	0	0
1981	4	122	30	9	0	-1120	0	0	0	0	0	0
1982	-73	121	3293	603	490	-3681	0	0	0	0	2	0
1983	0	1471	1527	575	-1708	0	0	0	0	0	0	0
1984	234	161	-27	0	0	0	0	0	0	0	0	0
1985	772	604	474	0	-33	-75	0	0	-73	2	0	0
1986	-100	247	510	174	25653	-11610	0	0	0	150	0	0
1987	39	7	-196	-1	0	-17	0	0	0	0	0	0
1988	0	0	232	358	0	0	0	0	14	0	0	0
1989	0	0	2	0	0	583	0	0	0	0	0	0
1990	0	0	0	0	6	0	0	0	0	0	0	0
1991	0	0	0	0	-56	1037	0	0	44	0	0	0
1992	0	271	0	47	605	0	0	0	0	0	0	0
1993	0	0	8	4	32	30	0	0	0	0	0	0
1994	1	41	107	29	-247	-96	0	0	5	0	0	0
1995	2	0	240	347	66	42	664	0	0	0	0	0
1996	7	0	12	69	-593	-34	0	0	0	0	0	0
1997	1	16	7	45	7	-5618	0	0	0	0	0	0
1998	3	4	31	4686	-10359	0	0	0	0	0	0	0
1999	0	13	0	-288	0	39	0	0	0	0	1	0
2000	1	8	19	142	2445	-2876	0	0	21	1	0	7
2001	2	4	-15	38	115	565	0	0	9	0	0	0
2002	0	0	18	88	-21	-487	0	0	0	0	0	0
2003	0	15	62	262	144	0	0	0	0	0	0	0

Monthly Distribution of CVP Chinook Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-100	0	-196	-288	-10359	-11610	0	0	-73	0	0	0
10%	0	0	-11	0	-489	-3440	0	0	0	0	0	0
25%	0	0	0	0	-27	-194	0	0	0	0	0	0
50%	0	11	15	41	0	0	0	0	0	0	0	0
75%	2	132	138	196	78	12	0	0	0	0	0	0
90%	30	266	499	510	571	408	0	0	12	1	0	0
Max	772	1471	3293	4686	25653	1037	664	0	44	150	2	7
Avg	37	140	264	299	688	-971	28	0	1	6	0	0

Table 4.1-52. Intertie Simulated SWP Chinook Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	-140	-345	0	0	-77	-6	0	0	-383	26	0	0
1981	5	-127	-189	-21	-341	-146	0	9558	264	0	2	0
1982	19	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	-296	370	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	9	0
1985	-2121	0	0	-24	0	-32	0	-2534	347	0	0	0
1986	42	-74	0	5	0	0	0	0	992	0	0	0
1987	0	-14	75	-30	-14	204	-2400	0	241	11	1	2
1988	0	0	0	0	-51	0	0	0	0	155	-11	-1
1989	0	0	-11	0	0	0	0	0	19	0	-1	0
1990	0	0	111	-13	31	0	0	0	0	-16	0	0
1991	-1	0	0	-9	-54	0	0	0	-104	0	0	0
1992	-42	-641	0	590	0	0	0	0	0	0	0	0
1993	0	0	0	0	-46	0	0	1205	0	0	1	0
1994	0	-18	-35	-10	37	0	0	0	8	0	0	0
1995	0	-3	0	0	-115	5	-11	-89	0	0	0	0
1996	0	0	0	-249	-79	0	0	0	0	0	0	0
1997	0	0	0	3	-7	170	0	0	-4	0	0	0
1998	0	-2	0	7	-307	0	0	0	0	0	0	0
1999	0	0	0	-16	0	0	0	0	0	-1	0	0
2000	0	0	-6	0	-32	69	229	4267	469	1	0	4
2001	10	-2	0	-23	0	-390	0	0	0	0	0	0
2002	0	0	0	0	9	146	0	150	0	0	0	0
2003	0	0	0	0	-45	0	0	0	0	0	0	0

Monthly Distribution of SWP Chinook Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-2121	-641	-189	-296	-341	-390	-2400	-2534	-383	-16	-11	-1
10%	-30	-112	-10	-28	-104	-24	0	0	-3	0	0	0
25%	0	-6	0	-17	-52	0	0	0	0	0	0	0
50%	0	0	0	0	-4	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	11	0	0	0
90%	9	0	0	5	25	123	0	888	322	8	1	0
Max	42	0	111	590	370	204	229	9558	992	155	9	4
Avg	-93	-51	-2	-4	-30	1	-91	523	77	7	0	0

Table 4.1-53. Intertie Simulated CVP Steelhead Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	2	0	0	0	0	0	0
1981	0	0	25	23	118	-661	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	236	0	0	0	0	0	0	0	0	0
1984	0	5	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	-2	0	0	0	0	0	0
1986	0	0	0	3	33	-43	0	0	0	1	0	0
1987	0	0	0	-1	0	-5	0	0	0	0	0	0
1988	0	0	0	24	0	0	0	0	0	0	0	0
1989	0	0	1	0	0	479	0	0	0	0	0	0
1990	0	0	0	0	62	0	0	0	0	0	0	0
1991	0	0	0	-35	-31	1811	0	0	0	0	0	0
1992	0	0	0	385	277	0	0	0	0	0	0	0
1993	0	0	0	0	311	256	0	0	0	0	0	0
1994	0	0	1	3	-60	-19	0	0	2	0	0	0
1995	0	0	5	1	22	40	16	0	0	0	0	0
1996	0	0	0	80	-476	-9	0	0	0	0	0	0
1997	0	0	2	2	0	-57	0	0	0	0	0	0
1998	0	0	1	28	-49	0	0	0	0	0	0	0
1999	0	2	0	-13	0	2	0	0	0	0	0	0
2000	0	2	4	53	162	-156	0	0	0	0	0	0
2001	0	1	-1	21	233	288	0	0	0	0	0	0
2002	0	0	0	9	-42	-224	0	0	0	0	0	0
2003	0	0	9	400	95	0	0	0	0	0	0	0

Monthly Distribution of CVP Steelhead Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	-1	-35	-476	-661	0	0	0	0	0	0
10%	0	0	0	0	-47	-126	0	0	0	0	0	0
25%	0	0	0	0	0	-11	0	0	0	0	0	0
50%	0	0	0	2	0	0	0	0	0	0	0	0
75%	0	0	1	23	70	2	0	0	0	0	0	0
90%	0	2	8	72	212	278	0	0	0	0	0	0
Max	0	5	236	400	311	1811	16	0	2	1	0	0
Avg	0	0	12	41	27	71	1	0	0	0	0	0

Table 4.1-54. Intertie Simulated SWP Steelhead Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	-1	0	0	-168	-2	0	0	-1	0	0	0
1981	0	0	-3	-1	-147	-71	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	-7	3	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	-17	0	-17	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	173	0	-2	160	-57	0	0	0	0	0
1988	0	0	0	0	-29	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	38	0	0	0	0	0	0	0
1991	0	0	0	-2	-13	0	0	0	0	0	0	0
1992	-53	-245	0	97	0	0	0	0	0	0	0	0
1993	0	0	0	0	-415	0	0	92	0	0	0	0
1994	0	0	0	-1	19	0	0	0	0	4	0	0
1995	0	0	0	0	-30	21	-5	-2	0	0	0	0
1996	0	0	0	-166	-168	0	0	0	0	0	0	0
1997	0	0	0	0	-2	9	0	0	0	0	0	0
1998	0	0	0	1	-46	0	0	0	0	0	0	0
1999	0	0	0	-6	0	0	0	0	0	0	0	0
2000	0	0	0	0	-21	16	3	13	7	0	0	0
2001	0	-3	0	-34	0	-272	0	0	0	0	0	0
2002	0	0	0	0	18	183	0	2	0	0	0	0
2003	0	0	0	0	-64	0	0	0	0	0	0	0

Monthly Distribution of SWP Steelhead Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-53	-245	-3	-166	-415	-272	-57	-17	-1	0	0	0
10%	0	-1	0	-7	-161	-13	0	0	0	0	0	0
25%	0	0	0	-1	-34	0	0	0	0	0	0	0
50%	0	0	0	0	-1	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	13	20	0	1	0	0	0	0
Max	0	0	173	97	38	183	3	92	7	4	0	0
Avg	-2	-10	7	-5	-43	1	-2	4	0	0	0	0

Table 4.1-55. Intertie Simulated CVP Delta Smelt Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	1566	57	0	0	-802	156	0	0	0	0	4	55
1981	166	292	631	901	1118	-4068	0	0	0	369	970	117
1982	-45	1209	0	583	617	-1130	0	0	0	0	4	52
1983	73	43	0	179	-209	0	0	0	0	0	0	3
1984	0	0	-246	0	0	0	0	0	0	0	17	0
1985	11	11	0	16	-1	-1	0	0	-77	69	57	0
1986	-1	0	0	40	27	-1	0	0	0	4	30	0
1987	11	0	0	0	0	-4	0	0	0	0	0	-3
1988	0	-3	135	176	0	0	0	0	123	0	0	0
1989	0	0	1	0	0	0	0	0	0	25	0	0
1990	0	0	0	0	0	0	0	0	0	14	0	0
1991	0	0	3	-66	0	98	0	0	0	0	0	40
1992	0	0	0	0	12	0	0	0	0	0	0	0
1993	0	0	0	0	3	5	0	0	0	4	0	0
1994	0	0	0	0	-11	-6	0	0	554	1	0	0
1995	0	0	1	11	2	1	2	0	0	0	0	0
1996	0	0	0	86	-252	-9	0	0	0	0	0	0
1997	0	1	1	0	29	-534	0	0	0	0	0	0
1998	0	0	2	1	-7	0	0	0	0	0	0	0
1999	0	0	0	-3	0	2	0	0	0	0	0	0
2000	0	2	9	66	207	-416	0	0	97	6	0	0
2001	0	21	-14	21	215	191	0	0	22	0	0	0
2002	0	0	37	117	-18	-22	0	0	0	0	0	0
2003	0	0	89	188	43	0	0	0	0	0	0	0

Monthly Distribution of CVP Delta Smelt Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-45	-3	-246	-66	-802	-4068	0	0	-77	0	0	-3
10%	0	0	0	0	-151	-499	0	0	0	0	0	0
25%	0	0	0	0	-2	-7	0	0	0	0	0	0
50%	0	0	0	6	0	0	0	0	0	0	0	0
75%	0	4	2	94	27	0	0	0	0	4	1	0
90%	54	53	73	185	213	70	0	0	75	21	26	48
Max	1566	1209	631	901	1118	191	2	0	554	369	970	117
Avg	74	68	27	96	41	-239	0	0	30	20	45	11

Table 4.1-56. Intertie Simulated SWP Delta Smelt Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	-29	-79	0	0	-18	-5	0	0	-204	493	-104	0
1981	2	-46	-261	-125	-888	-77	0	3085	3682	739	0	0
1982	4	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	-59	21	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	3
1985	0	0	0	-6	0	-7	0	-38	320	0	0	7
1986	0	0	0	3	0	0	0	0	1	-5	0	0
1987	0	-4	35	-23	-5	8	-31	0	365	36	43	2
1988	0	0	0	0	-5	0	0	0	0	315	0	0
1989	-1	0	-6	0	0	0	0	0	84	48	-7	0
1990	0	0	0	-1	18	0	0	0	0	-3114	-3	0
1991	0	0	0	-43	-203	0	0	0	-952	1410	855	0
1992	-221	0	0	78	0	0	0	0	0	4	0	0
1993	0	0	0	0	-56	0	0	7294	0	0	0	0
1994	0	0	-3	-1	10	0	0	0	2063	426	0	0
1995	0	0	0	0	-38	1	0	0	0	0	0	0
1996	0	0	0	-257	-237	0	0	0	0	0	0	0
1997	0	0	0	0	-6	15	0	0	-38	1	0	0
1998	0	0	0	2	0	0	0	0	0	0	0	0
1999	0	0	0	-2	0	0	0	0	0	-455	0	0
2000	0	0	-7	0	-26	35	3	16670	4793	21	0	0
2001	1	-3	0	-2	0	-167	0	0	0	0	0	0
2002	0	0	0	0	4	39	0	2546	-118	0	0	0
2003	0	0	0	0	-54	0	0	0	0	0	0	0

Monthly Distribution of SWP Delta Smelt Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-221	-79	-261	-257	-888	-167	-31	-38	-952	-3114	-104	0
10%	-1	-4	-5	-54	-159	-6	0	0	-94	-4	-2	0
25%	0	0	0	-3	-29	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	22	39	0	0
90%	1	0	0	2	8	13	0	2923	1553	473	0	2
Max	4	0	35	78	21	39	3	16670	4793	1410	855	7
Avg	-10	-6	-10	-18	-62	-7	-1	1231	416	-3	33	1

Table 4.1-57. Intertie Simulated CVP Longfin Smelt Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	23	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	-5	0	0	0
1986	-6	0	0	0	0	0	0	0	0	2	0	0
1987	0	0	0	0	0	0	0	0	0	-9	0	0
1988	0	0	78	24	0	0	0	0	172	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	4	0	0	0	0	0	0	0
1991	125	0	0	0	0	0	0	0	57	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	-2	0	0	15	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	2	-7	0	0	0	0	0	0	0
1997	0	0	0	0	7	0	0	0	0	0	0	0
1998	0	0	4	5	-3	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	1	0	0	0	0	0	0	0	0
2001	0	0	-2	5	2	18	0	0	0	0	0	0
2002	0	0	1	8	0	-225	0	0	0	0	0	0
2003	0	0	4	4	0	0	0	0	0	0	0	0

Monthly Distribution of CVP Longfin Smelt Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-6	0	-2	0	-7	-225	0	0	-5	-9	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0
25%	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	2	0	0	0	0	0	0	0	0
90%	0	0	3	7	2	0	0	0	10	0	0	0
Max	125	0	78	24	7	18	0	0	172	2	0	0
Avg	5	0	4	3	0	-9	0	0	10	0	0	0

Table 4.1-58. Intertie Simulated SWP Longfin Smelt Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	-16	0	0	0	-14	0	0	0
1981	0	0	0	-3	-33	-10	0	275	206	39	0	1
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	-6	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	-379	17	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	-24	72	-7	-2	3	-1527	0	0	7	0	0
1988	0	0	0	0	-8	0	0	0	0	0	0	0
1989	0	0	-1	0	0	0	0	0	166	9	-10	0
1990	0	0	0	0	0	0	0	0	0	-14	0	0
1991	0	0	0	-4	-1	0	0	0	-33	198	0	-228
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	94	0	0	0	0
1994	0	0	0	0	3	0	0	0	48	0	0	0
1995	0	0	0	0	-1	0	-3	0	0	0	0	0
1996	0	0	0	-5	-4	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	-1	0	0
2000	0	0	0	0	0	1	11	123	4	0	0	0
2001	1	-1	0	0	0	-1	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	2995	-23	0	0	0
2003	0	0	0	0	-1	0	0	0	0	0	0	0

Monthly Distribution of SWP Longfin Smelt Savlage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	-24	-1	-7	-33	-10	-1527	-379	-33	-14	-10	-228
10%	0	0	0	-5	-7	0	0	0	-10	0	0	0
25%	0	0	0	0	-1	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	115	39	8	0	0
Max	1	0	72	0	3	3	11	2995	206	198	0	1
Avg	0	-1	3	-1	-3	0	-63	129	15	10	0	-9

Table 4.1-59. Intertie Simulated CVP Splittail Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	-38	10	0	0	0	0	26	6
1981	2	0	16	27	123	-237	0	0	0	18	21	0
1982	0	0	0	0	844	-1695	0	0	0	0	208	106
1983	7	0	196	166	-4934	0	0	0	0	0	219	133
1984	93	5	-34	0	0	0	0	0	0	0	47	0
1985	0	0	0	8	-7	-50	0	0	-376	179	90	0
1986	-1	82	0	5	86	-1354	0	0	0	256	61	92
1987	47	33	-18	-3	0	-11	0	0	-13	-3	0	-2
1988	0	0	13	239	0	0	0	0	158	8	0	0
1989	0	0	0	0	0	305	0	0	0	2	0	0
1990	0	0	0	0	0	0	0	0	0	264	0	0
1991	0	0	0	-194	-62	1452	0	0	539	-28	0	0
1992	0	0	0	16	309	0	0	0	694	0	2	0
1993	0	0	0	1113	250	154	0	0	0	142	0	0
1994	0	1	0	0	-17	-14	0	0	288	34	0	0
1995	0	0	0	58	9	1	9	0	0	0	42	23
1996	35	23	18	24	-538	0	0	0	0	0	13	11
1997	31	10	5	0	44	-805	0	0	0	9	2	0
1998	1	0	4	79	-69	0	0	0	0	0	63	36
1999	25	8	0	-33	0	3	0	0	0	0	7	6
2000	6	9	4	7	100	-229	0	0	233	20	2	1
2001	2	0	-1	3	22	48	0	0	82	2	0	0
2002	0	0	25	76	-11	-148	0	0	0	3	0	0
2003	0	2	5	85	13	0	0	0	0	0	1	0

Monthly Distribution of CVP Splittail Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-1	0	-34	-194	-4934	-1695	0	0	-376	-28	0	-2
10%	0	0	-1	-2	-67	-635	0	0	0	0	0	0
25%	0	0	0	0	-12	-74	0	0	0	0	0	0
50%	0	0	0	6	0	0	0	0	0	1	2	0
75%	6	6	5	63	55	1	0	0	20	19	43	7
90%	34	19	17	142	212	122	0	0	272	168	81	75
Max	93	82	196	1113	844	1452	9	0	694	264	219	133
Avg	10	7	10	70	-162	-107	0	0	67	38	33	17

Table 4.1-60. Intertie Simulated SWP Splittail Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	-4	-5	0	0	-37727	-12	0	0	-1834	269	-79	0
1981	0	0	-22	-12	-467	-53	0	2086	1	0	2	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	-10	375	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	296	3
1985	0	0	0	-7	0	-53	0	-101	472	0	0	0
1986	7	-3	0	1	0	0	0	0	3782	-1566	71	-13
1987	-18	0	221	-89	-31	116	-48	0	445	84	13	1
1988	0	0	0	0	-225	0	0	0	0	403	-8	-1
1989	0	0	-1	0	0	0	0	0	40	14	-83	1
1990	0	0	15	-7	148	0	0	0	0	-30	0	0
1991	0	0	0	-11	-11	0	0	0	-1785	246	0	0
1992	-700	0	0	105	0	0	0	0	0	0	7	0
1993	0	0	0	0	-729	0	0	6685	0	0	3	0
1994	1	-8	-1	-1	5	0	0	0	8	2	0	0
1995	0	0	0	0	-298	4	0	-309	0	0	0	0
1996	0	-7	0	-78	-77	0	0	0	0	0	2	0
1997	-2	0	0	1	-7	233	0	0	-9	3	-4	0
1998	0	-1	0	138	0	-90	0	0	0	0	0	0
1999	0	0	0	-20	0	0	0	0	0	-205	0	0
2000	1	0	-6	0	-20	216	31	3615	2993	79	-7	0
2001	17	-6	0	-9	0	-832	0	0	0	1	0	0
2002	0	0	0	0	32	408	0	1	-1	1	0	0
2003	0	-2	0	0	-19	0	0	0	0	0	0	0

Monthly Distribution of SWP Splittail Salvage Density (fish/taf) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-700	-8	-22	-89	-37727	-832	-48	-309	-1834	-1566	-83	-13
10%	-3	-6	-1	-18	-417	-53	0	0	-7	-21	-8	0
25%	0	-1	0	-9	-42	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	3	6	2	0
90%	1	0	0	1	24	186	0	1461	464	197	11	0
Max	17	0	221	138	375	408	31	6685	3782	403	296	3
Avg	-29	-1	9	0	-1627	-3	-1	499	171	-29	9	0

Table 4.1-61. Intertie Simulated CVP Striped Bass Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	5022	8555	0	0	-2206	64	0	0	0	0	1380	2141
1981	947	12819	6735	2380	2850	-6677	0	0	0	5791	1953	2047
1982	-1418	12550	9445	10839	6360	-5818	0	0	0	0	2625	2164
1983	2368	5262	3988	2749	-8810	0	0	0	0	0	580	543
1984	146	1609	-2070	0	0	0	0	0	0	0	2654	1299
1985	15520	9547	8201	2793	-92	-164	0	0	-29554	10013	2627	0
1986	-164	1226	3549	4960	10489	-3429	0	0	0	20228	5591	3342
1987	2867	5892	-6195	-150	0	-74	0	0	-13799	-1126	0	-138
1988	0	-387	2046	2639	0	0	0	0	26972	1227	-5283	0
1989	31	21	215	0	0	1443	0	0	0	8102	0	0
1990	0	-508	109	0	866	0	0	0	0	37490	0	0
1991	656	-3922	366	-5395	-5953	10893	0	0	104647	-110501	0	1346
1992	718	385	0	1347	25959	0	0	0	126850	0	306	601
1993	7696	-4278	2052	15572	4099	2885	0	0	0	20597	-214	1666
1994	1589	1729	1308	1163	-1412	-628	0	0	180246	51629	677	0
1995	1151	902	925	9980	2574	613	178	0	0	0	243	1071
1996	823	653	879	496	-4188	-30	0	0	0	0	152	257
1997	929	1145	1325	1362	199	-866	0	0	0	465	225	71
1998	596	814	1124	1645	-2196	0	0	0	0	0	278	428
1999	197	420	0	-310	0	5	0	0	0	0	411	224
2000	609	1004	575	1079	1263	-861	0	0	3694	3017	346	514
2001	728	3787	-1019	541	1619	2873	0	0	13790	380	0	0
2002	0	0	2150	2979	-2735	-10941	0	0	0	1200	240	-6
2003	0	470	1518	1428	817	0	0	0	0	0	226	186

Monthly Distribution of CVP Striped Bass Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-1418	-4278	-6195	-5395	-8810	-10941	0	0	-29554	-110501	-5283	-138
10%	0	-472	-713	-105	-3752	-5101	0	0	0	0	0	0
25%	23	294	81	0	-1608	-687	0	0	0	0	0	0
50%	687	953	1025	1355	0	0	0	0	0	190	261	342
75%	1260	4156	2077	2760	1858	20	0	0	923	6369	852	1310
90%	4376	9249	5911	8474	5682	2444	0	0	81344	20486	2626	2113
Max	15520	12819	9445	15572	25959	10893	178	0	180246	51629	5591	3342
Avg	1709	2487	1551	2421	1229	-446	7	0	17202	2021	626	740

Table 4.1-62. Intertie Simulated SWP Striped Bass Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	-4391	-7693	0	0	-1652	-13	0	0	-8229	49197	-6674	0
1981	50	-8715	-15569	-715	-1847	-99	0	55303	239793	31588	3462	63
1982	199	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	-327	207	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	1789	1846
1985	-16921	0	0	-2916	0	-44	0	-8878	95963	0	0	172
1986	289	-6869	0	113	0	0	0	0	76736	-296850	3265	-2738
1987	-4024	-5627	8049	-6231	-506	84	-33	0	124482	20557	431	442
1988	0	0	0	0	-574	0	0	0	0	324956	-13715	-171
1989	-39	0	-1148	0	0	0	0	0	161403	20815	-1513	36
1990	0	0	973	-272	1024	0	0	0	0	-166102	-13295	0
1991	-491	21155	-205	-1114	-3087	0	0	0	-191598	121957	73968	-7830
1992	-3270	-2092	0	17048	0	0	0	0	0	17151	18958	-76
1993	15	-4391	0	0	-3778	0	0	201060	0	0	3054	-490
1994	14	-16435	-213	-62	201	0	0	0	90982	32853	133	0
1995	38	-24828	0	0	-5034	217	-3	-2	0	0	0	0
1996	0	-97	0	-458	-260	0	0	0	0	0	34	0
1997	-2220	0	0	352	-116	16	0	0	-3845	369	-156	29
1998	0	-176	0	120	-544	0	0	0	0	0	0	0
1999	0	0	0	-270	0	0	0	0	0	-25147	0	0
2000	19	0	-5574	0	-48	76	4	42838	213318	13896	-2040	89
2001	14610	-13260	0	-420	0	-849	0	0	0	2351	40	6
2002	0	0	0	0	866	1459	0	84	-7130	1566	0	0
2003	0	-5541	0	0	-987	0	0	0	0	689	0	65

Monthly Distribution of SWP Striped Bass Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-16921	-24828	-15569	-6231	-5034	-849	-33	-8878	-191598	-296850	-13715	-7830
10%	-3798	-11896	-867	-994	-2715	-35	0	0	-6144	-17603	-5284	-394
25%	-152	-5938	0	-350	-677	0	0	0	0	0	-39	0
50%	0	-48	0	0	-24	0	0	0	0	529	0	0
75%	16	0	0	0	0	0	0	0	80298	20622	770	43
90%	154	0	0	118	205	82	0	30012	150327	44294	3403	147
Max	14610	21155	8049	17048	1024	1459	4	201060	239793	324956	73968	1846
Avg	-672	-3107	-570	202	-672	35	-1	12100	32995	6244	2823	-357

Table 4.1-63. Intertie Simulated CVP Green Sturgeon Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	-49	0	0	0	1	0	0
1982	0	0	0	0	0	0	0	0	0	0	1	16
1983	0	0	15	0	0	0	0	0	0	0	11	0
1984	6	0	0	0	0	0	0	0	0	0	0	0
1985	0	21	0	0	0	0	0	0	0	14	13	0
1986	0	2	0	0	0	0	0	0	0	0	0	0
1987	3	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	1	0	0	0	0	0	0	0
1994	0	1	0	0	0	0	0	0	0	0	0	0
1995	0	0	5	0	0	0	0	0	0	0	0	0
1996	1	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	1	1	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	1	0	-1	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Distribution of CVP Green Sturgeon Salvage for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	0	0	-1	0	0	-49	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0
25%	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	0	0	0	0
90%	1	1	0	0	0	0	0	0	0	0	1	0
Max	6	21	15	0	1	0	0	0	0	14	13	16
Avg	0	1	1	0	0	-2	0	0	0	1	1	1

Table 4.1-64. Intertie Simulated SWP Green Sturgeon Salvage Impacts for 1980–2003

WY	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1980	0	0	0	0	0	0	0	0	0	1	0	0
1981	0	0	0	0	0	0	0	0	0	0	7	0
1982	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	1	0
1985	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	2	0	0	0	0	0	0
1988	0	0	0	0	-1	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0
1991	-1	0	0	-1	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	-4	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	0	0	0	0	0
2000	0	0	0	0	0	0	0	0	0	0	0	0
2001	0	0	0	0	0	0	0	0	0	0	0	0
2002	0	0	0	0	0	3	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0	0	0	0	0

Monthly Distribution of SWP Green Sturgeon Salvage Density (fish/taf) for Water Years 1980–2003

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Min	-1	-4	0	-1	-1	0	0	0	0	0	0	0
10%	0	0	0	0	0	0	0	0	0	0	0	0
25%	0	0	0	0	0	0	0	0	0	0	0	0
50%	0	0	0	0	0	0	0	0	0	0	0	0
75%	0	0	0	0	0	0	0	0	0	0	0	0
90%	0	0	0	0	0	0	0	0	0	0	0	0
Max	0	0	0	0	0	3	0	0	0	1	7	0
Avg	0	0	0	0	0	0	0	0	0	0	0	0

4.2 Vegetation and Wetlands

4.2.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing the project alternatives on vegetation and wetlands.

4.2.2 Affected Environment

Study Area

The proposed project area (project area) is located near the junction of I-205 and I-580 west of Tracy, California, between the federal DMC and state California Aqueduct along the border in Alameda and San Joaquin Counties (Figure 2-1). The project area is located at the westernmost edge of the San Joaquin Valley subdivision of the California Floristic Province adjacent to San Francisco Bay subdivision (Hickman 1993:45). The topography of the project area is gently sloping, with approximate elevations ranging from 200 to 260 feet msl. For the purposes of this EIS section, the study area encompasses the areas that would be affected by the three project alternatives—Alternative 2 (Proposed Action), Alternative 3 (TANC Intertie Site) and Alternative 4 (Virtual Intertie)—and has an area of approximately 1,020 acres. The study area has been disturbed by past and ongoing human activities, including mowing, excavation operations for soil testing, right-of-way (ROW) maintenance, and canal operation and maintenance. The study area is surrounded by alfalfa fields, commercial development, and rural residences. Vegetated portions of the study area consist primarily of annual grassland habitat.

Sources of Information

The key sources of information pertaining to vegetation and wetlands used to prepare this section are listed below.

- A California Natural Diversity Database (CNDDB) records search for the Clifton Court Forebay, Midway, Brentwood, Woodward Island, Holt, Byron Hot Springs, Union Island, Altamont, Tracy, Mendenhall Springs, Cedar Mountain, Lone Tree Creek USGS 7.5-minute quadrangles (California Natural Diversity Database 2009).
- The California Native Plant Society's (CNPS's) 2009 online Inventory of Rare and Endangered Plants of California (California Native Plant Society 2008).

- A USFWS list (dated July 6, 2009) of endangered, threatened, and candidate plant species for the Midway and Clifton Court Forebay USGS 7.5-minute quadrangles (U.S. Fish and Wildlife Service 2008).
- Delta-Mendota Canal/California Aqueduct Intertie Proposed Finding of No Significant Impact/Negative Declaration and Draft Environmental Assessment/Initial Study (Jones & Stokes 2004:3-89–3-103).
- Wetland delineation report for the Intertie project (ICF Jones & Stokes 2008).
- The San Joaquin County Multi Species Habitat Conservation and Open Space Plan (SJMSCP) (San Joaquin Council of Governments 2000: 2-16–2-32).

Field Surveys

Several types of field surveys were conducted in the study area and are described below.

Reconnaissance-Level Surveys

An ICF Jones & Stokes botanist conducted reconnaissance-level field surveys on August 23, 2003, September 17, 2008, and July 7, 2009. The botanist used a combination of driving along access roads adjacent to the DMC and walking portions of the study area. In general the purpose of the reconnaissance-level field surveys was to characterize habitat types, evaluate the potential for occurrence of special-status plant species, and identify wetlands and other waters in the study area.

On September 19 and 30, 2005, a Western biologist surveyed the portion of the transmission line that would occur on Reclamation's land. A final site visit was made on December 8, 2005 to survey the two parcels of private land. Field surveys consisted of walking meandering transects through the proposed ROW.

Special-Status Plant Surveys

ICF Jones & Stokes botanists conducted botanical surveys on May 2, 2007, October 30, 2007, and July 7, 2009 within the project area. The timing of the surveys coincided with the published blooming period for 15 of the 27 special-status plant species identified as having potential habitat in the study area (California Native Plant Society 2009). One special-status plant, crownscale (*Atriplex coronata* var. *coronata*) was observed during the botanical surveys. Additionally, no special-status plant species were observed during Western's field visits.

Wetland Delineation

ICF Jones & Stokes botanists and a soil scientist conducted a wetland delineation on December 21, 2006, September 16 and 22, 2008, October 22, 2008, and January 13 and 21, 2009 in accordance with the routine on-site determination method described in the Corps 1987 *Wetlands Delineation Manual* (Environmental Laboratory 1987) and the interim (2006 & 2008 fieldwork) and revised (2009 fieldwork) versions of the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (U.S. Army Corps of Engineers 2006 & 2008). The delineation was conducted to identify potential wetlands and other waters in the study area that may be subject to regulation under Clean Water Act (CWA) Section 404.

4.2.3 Existing Conditions

Habitat Types

The following habitat types were observed in the study area: annual grassland, alkali grassland, black willow riparian woodland, alfalfa, developed areas, seasonal wetland, emergent marsh wetland, alkali wetland, perennial drainage, intermittent drainage, ephemeral drainage, open water, orchard/vineyard, and fallow agricultural land. The habitat types are described below, and their locations within the study area are shown in Figure 4.2-1. The list of plant species observed in the study area is provided as Appendix D.

Annual Grassland

The majority of the study area consists of annual grassland that encompasses approximately 347 acres. The annual grassland in the study area is heavily grazed and exhibits signs of disturbance associated with the site's past and ongoing human activities: mowing, excavating for soil testing, maintaining canal ROWs, and operating/maintaining the canals and their associated facilities. Nonnative annual grasses are the dominant species and consisted of soft chess (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), slender wild oat (*Avena barbata*), and Italian ryegrass (*Lolium multiflorum*). Other nonnative annual grasses observed were foxtail barley (*Hordeum murinum* spp. *leporinum*) and rattail fescue (*Vulpia myuros* var. *myuros*). Nonnative forbs that tend to quickly colonize disturbed area were also well-represented, and species observed were yellow star-thistle (*Centaurea solstitialis*), stinkweed (*Dittrichia graveolens*), Russian thistle (*Salsola tragus*), black mustard (*Brassica nigra*), prickly lettuce (*Lactuca serriola*), bristly ox-tongue (*Picris echioides*), and Mediterranean mustard (*Hirschfeldia incana*).

Alkali Grassland

The alkali grassland in the study area is limited to approximately 3 acres abutting the alkali wetland located east of the canal access road. Vegetative cover in the alkali grassland was extremely low (i.e., less than 10%) vegetative cover due to heavy grazing by horses but the area appeared to be much more alkaline than the rest of the grassland in the study area. Plant species observed were gumplant (*Grindelia camporum*), common tarweed (*Centromadia pungens*), and alkali heath (*Frankenia grandiflora*). Crownscale, a CNPS List 4.2 species, was observed observed at the edge of the narrow swath of alkali grassland between the alkali wetland and Mountain House Road (Figure 4.2-1).

Black Willow Riparian Woodland

A small 0.31-acre patch of black willow riparian woodland occurs adjacent to an ephemeral drainage on the western side of the DMC. It is located within the area of ruderal annual grassland bounded on three sides by the large parking lot in the central portion of the study area. As indicated, the overstory is dominated by mature black willows (*Salix gooddingii*). The black willow riparian woodland lacks a well-developed shrub layer, and the herbaceous understory consists of ruderal annual grassland.

Alfalfa

The study area overlaps portions of adjacent alfalfa (*Medicago sativa*) fields and contains approximately 180 acres of this habitat type. The edges of the alfalfa fields contain ruderal species that inhabit disturbed areas, and representative species include bristly ox-tongue, prickly lettuce, English plantain (*Plantago lanceolata*), black mustard, and Russian thistle.

Developed Areas

For the purposes of this section, developed areas within the study area consist of rural residential development, commercial development, and areas that have been graded in preparation for development in the foreseeable future. Developed areas encompass approximately 313 acres in the study area. Vegetation in developed areas consisted primarily of nonnative ornamental species used in landscaping. Representative species observed in developed areas were ornamental pines (*Pinus* spp.), Canary Island date palm (*Phoenix canariensis*), and eucalyptus (*Eucalyptus* sp.).

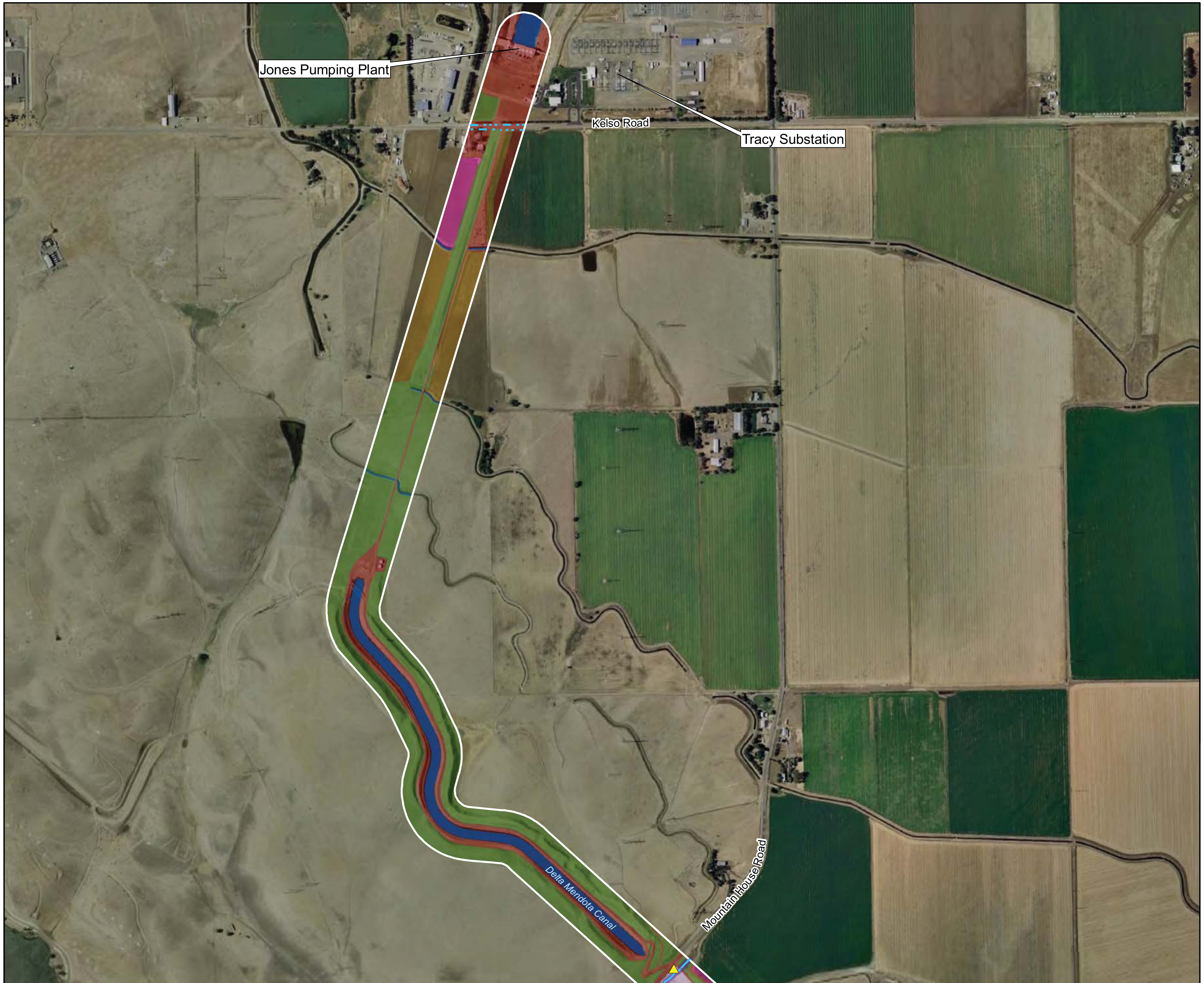


Figure 4.2-1
Map Sheet 1 of 4
Habitat Types in the Study Area

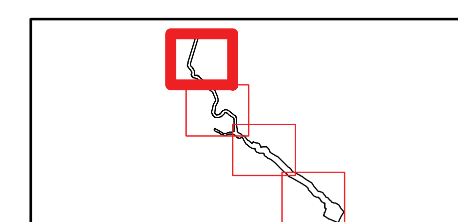
Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
Ephemeral Drainage	0.18
Alfalfa	180.25
Black Willow Riparian Woodland	0.31
Open Water	124.42
(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
Alkali Wetland	0.15
Developed	312.86
Emergent Marsh	1.66
Alkali Grassland	3.21
Annual Grassland	347.05
Seasonal Wetland	5.39
Orchard/Vineyard	14.46
Fallow Agricultural Land	29.20
Total Acreage	1,019.86

Study Area
Crownscale

Feet
1,000 500 0 1,000

N

Aerial Photo Source: Aerials Express, 2007



Prepared by:
ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, California 95814
Office: 916/737-3000

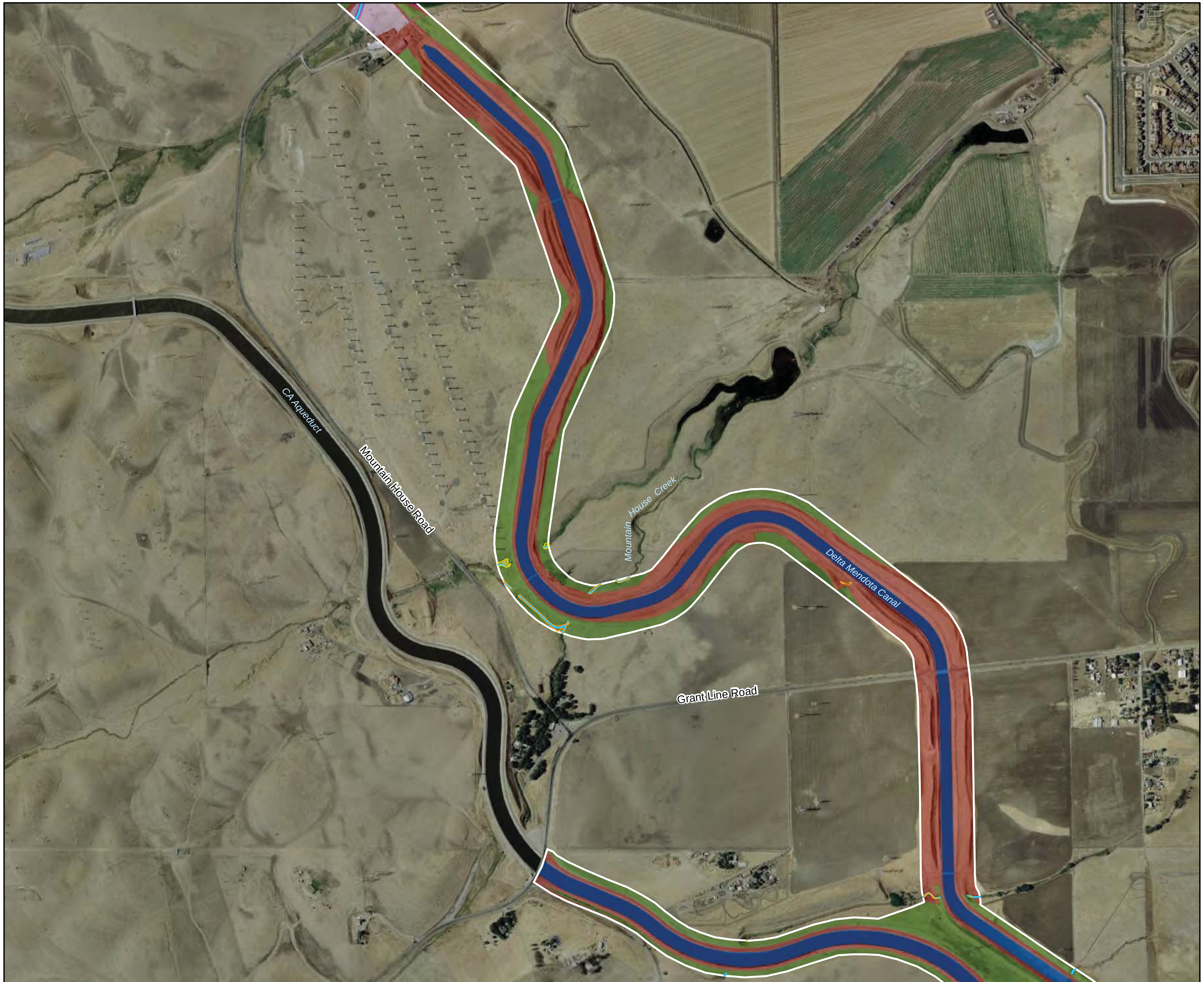


Figure 4.2-1
Map Sheet 2 of 4
Habitat Types in the Study Area

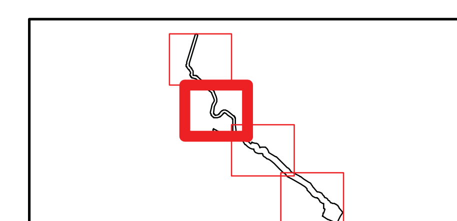
Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
Ephemeral Drainage	0.18
Alfalfa	180.25
Black Willow Riparian Woodland	0.31
Open Water	124.42
(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
Alkali Wetland	0.15
Developed	312.86
Emergent Marsh	1.66
Alkali Grassland	3.21
Annual Grassland	347.05
Seasonal Wetland	5.39
Orchard/Vineyard	14.46
Fallow Agricultural Land	29.20
Total Acreage	1,019.86

Study Area
Crownscale

Feet
1,000 500 0 1,000

N

Aerial Photo Source: Aerials Express, 2007



Prepared by:
ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, California 95814
Office: 916/737-3000

Q:\Projects\CH2MHill\06688_06\mapdoc\Habitat_20090828.mxd BC (09-29-09)

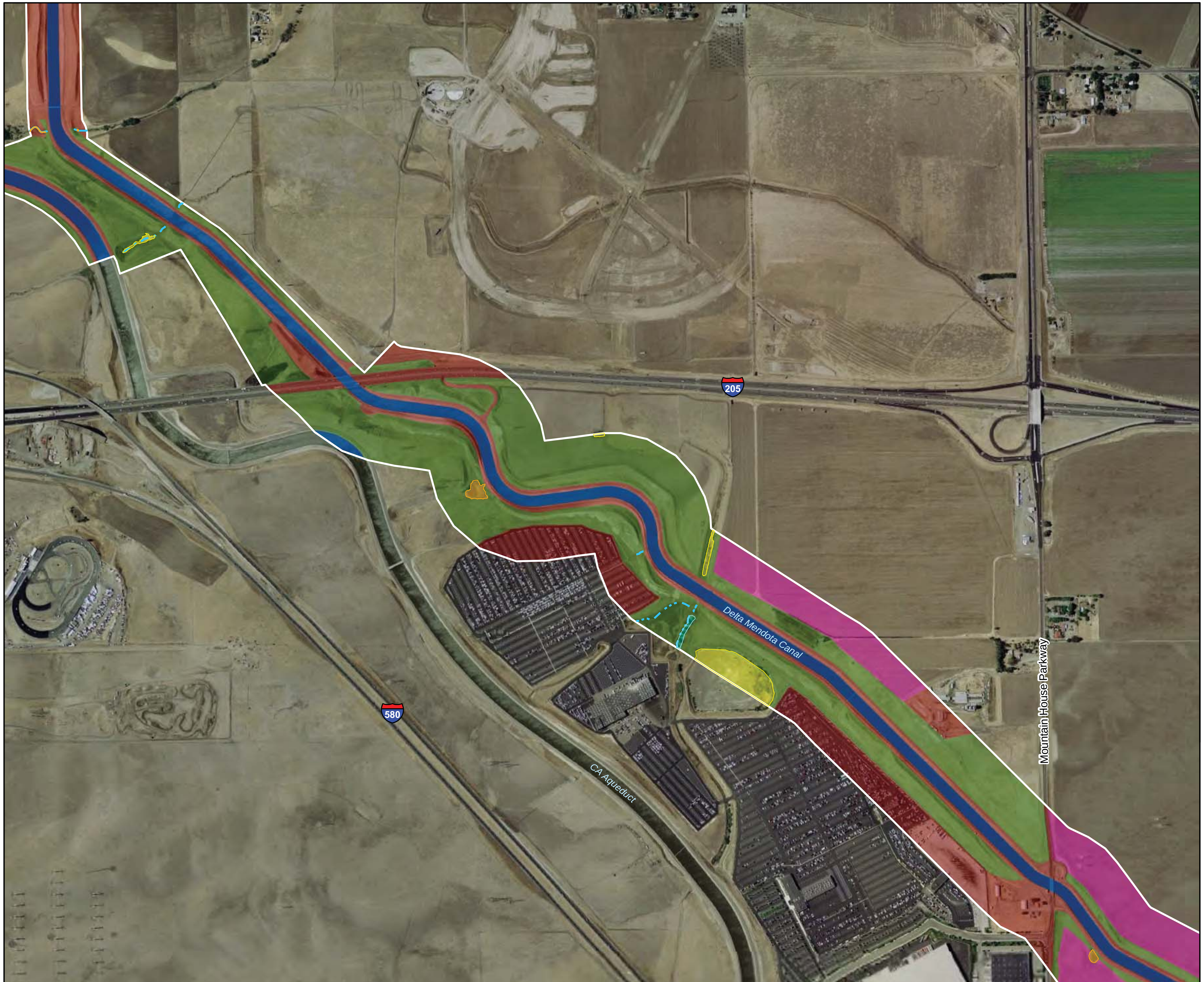


Figure 4.2-1
Map Sheet 3 of 4
Habitat Types in the Study Area

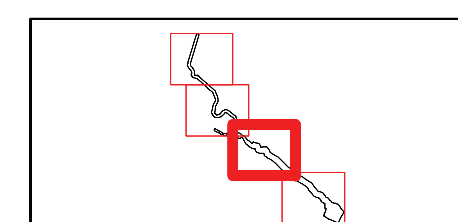
Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
Ephemeral Drainage	0.18
Alfalfa	180.25
Black Willow Riparian Woodland	0.31
Open Water	124.42
(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
Alkali Wetland	0.15
Developed	312.86
Emergent Marsh	1.66
Alkali Grassland	3.21
Annual Grassland	347.05
Seasonal Wetland	5.39
Orchard/Vineyard	14.46
Fallow Agricultural Land	29.20
Total Acreage	1,019.86

Study Area   Crownscale

Feet
1,000 500 0 1,000

N

Aerial Photo Source: Aerials Express, 2007



Prepared by:
ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, California 95814
Office: 916/737-3000

Q:\Projects\CH2MHill\06688_06\mapdoc\Habitat_20090828.mxd BC (09-29-09)

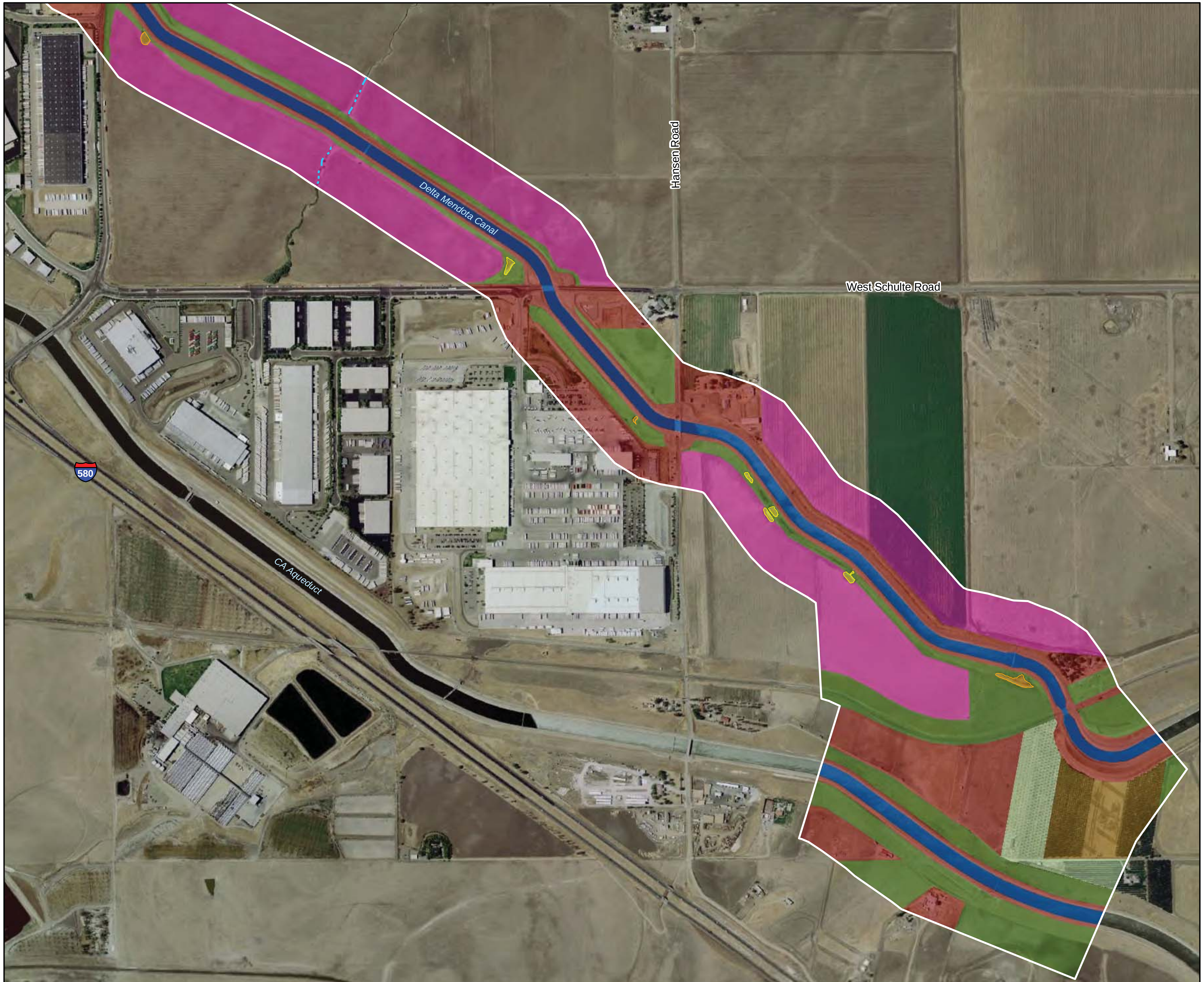


Figure 4.2-1
Map Sheet 4 of 4
Habitat Types in the Study Area

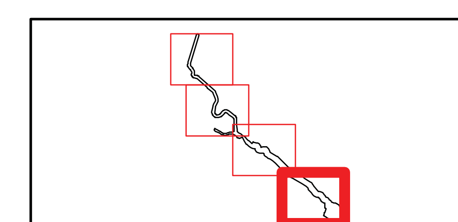
Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
Ephemeral Drainage	0.18
Alfalfa	180.25
Black Willow Riparian Woodland	0.31
Open Water	124.42
(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
Alkali Wetland	0.15
Developed	312.86
Emergent Marsh	1.66
Alkali Grassland	3.21
Annual Grassland	347.05
Seasonal Wetland	5.39
Orchard/Vineyard	14.46
Fallow Agricultural Land	29.20
Total Acreage	1,019.86

Study Area
Crownscale

Feet
1,000 500 0 1,000

N

Aerial Photo Source: Aerials Express, 2007



Prepared by:
ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, California 95814
Office: 916/737-3000

Q:\Projects\CH2MHill\06688_06\mapdoc\Habitat_20090828.mxd BC (09-29-09)

Seasonal Wetland

Eleven seasonal wetlands occur in the study area and encompass a total area of 5.39 acres. The largest seasonal wetland encompasses approximately 4 acres, is located just east of the black willow riparian woodland along the western edge of the DMC, and appears to be a human-made sediment detention basin that receives water from direct precipitation (i.e., rainfall) and runoff from the adjacent parking lot. The majority of the remaining seasonal wetlands appear to be naturally occurring basins that are not perennially inundated and receive water from direct precipitation and one or more of the following supplemental sources: runoff from adjacent alfalfa fields, seepage from the DMC, and flows from adjacent drainages. Three of the seasonal wetlands are associated with intermittent drainages. Representative species observed in seasonal wetlands were tall flatsedge (*Cyperus eragrostis*), Baltic rush (*Juncus balticus*), water smartweed (*Polygonum amphibium*), broadleaf cattail (*Typha latifolia*), rabbitsfoot grass (*Polypogon monspeliensis*), curly dock (*Rumex crispus*), Bermuda grass (*Cynodon dactylon*), and cocklebur (*Xanthium strumarium*).

Emergent Marsh Wetland

Twelve emergent marsh wetlands are scattered throughout the study area and encompass 1.66 acres. Sources of hydrological input vary among the emergent marsh wetlands and consist of direct precipitation supplemented by either seasonal flow from an adjacent intermittent drainage and/or wetland complex located outside of the study area, or runoff from adjacent alfalfa fields. Six of the emergent marsh wetlands are connected to either another emergent marsh or an ephemeral drainage via a culvert. Several of the emergent marsh wetlands are associated with intermittent or perennial drainages. Dominant species observed in emergent marsh wetlands were tall flatsedge and broadleaf cattail. Other species observed in emergent marsh wetlands were perennial pepperweed (*Lepidium latifolium*), rabbitsfoot grass, curly dock, and swamp smartweed (*Polygonum hydropiperoides*).

Alkali Wetland

Two alkali wetlands occur in the portion of the study area located immediately east of Mountain House Road and encompass a total area of 0.15 acre in the study area (Figure 4.2-1). The alkali wetlands are associated with a perennial drainage that was flowing east at the time of the July 7, 2009 site visit. Species observed were saltgrass (*Distichlis spicata*), alkali heath, and sedge (*Carex* sp.). The alkali wetland was accessible during the July 7, 2009 site visit.

Perennial Drainage

Three perennial drainages occur in the study area (Figure 4.2-1). The first perennial drainage is associated with the alkali wetland located just east of Mountain House Road and encompasses approximately 0.01 acre within the study area. At the time of the July 7, 2009 site visit the flowing portion of the drainage was approximately 1 foot wide.

The second perennial drainage in the study area is Mountain House Creek that is located south of Mountain House Road and encompasses approximately 0.47 acre within the study area. The creek crosses underneath the DMC via a culvert, and is associated with emergent marsh wetlands on both sides of the canal.

The third perennial drainage is located south of Grant Line Road and flows through a culvert under the California Aqueduct before continuing downslope to the DMC and entering a second culvert underneath the canal. Emergent marsh wetlands occur within the third perennial drainage on both sides of the DMC and it encompasses approximately 0.04 acre within the study area. An ICF Jones & Stokes wildlife biologist observed flow within the drainage at the California Aqueduct and a wet area on the west side of the DMC during a site visit on February 4, 2009. At the time of the July 7, 2009 site visit the perennial drainage was flowing at the DMC.

Intermittent Drainage

The study area contains two intermittent drainages (Figure 4.2-1). One of the intermittent drainages is a fork of Mountain House Creek and is approximately 40 feet wide. The intermittent drainage appears to flow seasonally (i.e., during wetter times of the year) when there is overflow from Mountain House Creek. The intermittent drainage is associated with a seasonal wetland and encompasses approximately 0.16 acre in the study area.

The second intermittent drainage is located north of I-205 in the southern portion of the study area (Figure 4.2-1) and flows underneath the California Aqueduct through a culvert before continuing downslope to the DMC where it flows through a raised box culvert. A seasonal wetland vegetated with cattails is associated with the portion of the intermittent drainage located between the two canals. The second intermittent drainage encompasses approximately 0.03 acre within the study area.

Ephemeral Drainage

Seven ephemeral drainages are scattered throughout the study area and encompass a total area of approximately 0.18 acre. The drainages were characterized by a relatively straight channel with a substrate of sand, silt, and gravel and an ordinary high water mark (OHWM) that was identified by the presence of shelving, scour, sediment sorting, and sediment deposition.

Open Water

The open water in the study area consists of the DMC, the California Aqueduct, and three smaller irrigation canals. The DMC and California Aqueduct are both concrete-lined, unvegetated, and account for approximately 100 acres and 23 acres in the study area, respectively. The three irrigation canals are located in the northern portion of the study area (i.e., between Mountain House Road and Kelso Road). The three irrigation canals flow east, are essentially unvegetated, and encompass a total area of approximately 0.44 acre within the study area. The northernmost irrigation canal is 20 feet wide, unlined, and has large rocks scattered along its sides. The central irrigation canal is approximately 15 feet wide, concrete-lined, and becomes subterranean to the west of the canal access road. The southernmost irrigation canal is approximately 15 feet wide and contained both lined and unlined segments. An approximately 100-foot-long segment of the irrigation canal on the west side of the canal access road was cement-lined, and the remainder of the irrigation canal was unlined.

Orchard/Vineyard

Orchard/vineyard habitat occurs only in the southernmost portion of the study area and encompasses approximately 14 acres.

Fallow Agricultural Land

Fallow agricultural land is confined to the southernmost and northernmost portions of the study area and consists of disked, open areas. The total area of fallow agricultural land in the study area is approximately 29 acres.

Special-Status Plants

Special-status plant species are those that are legally protected under the ESA, CESA, or other regulations, as well as species considered sufficiently rare by the scientific community to qualify for such listing. For the purposes of this EIS section, special-status plant species are:

- species listed or proposed for listing as threatened or endangered under the ESA (Title 50 CFR Section 17.12 for listed plants and various notices in the FR for proposed species);
- species that are candidates for possible future listing as threatened or endangered under the ESA (73 FR 75178, December 10, 2008);

- species that are listed or proposed for listing by the State of California as threatened or endangered under the CESA (Title 14 CCR Section 670.5);
- plants listed as rare under the California Native Plant Protection Act of 1977 (California Fish and Game Code [CFGC], Section 1900 *et seq.*);
- plants considered by CNPS to be "rare, threatened, or endangered in California" (Lists 1B and 2, California Native Plant Society 2009); and
- species that meet the definitions of rare or endangered under the State CEQA Guidelines, Section 15380.

Records searches of the CNDDB, CNPS's *Inventory of Rare and Endangered Plants of* California, and USFWS lists identified 48 special-status plant species as having the potential to occur in the study area (California Natural Diversity Database 2009; California Native Plant Society 2009; U.S. Fish and Wildlife Service 2009). An additional species, crownscale (*Atriplex coronata* var. *coronata*), was not identified in the records searches but was observed in the study area. The legal status, geographic distribution, habitat requirements, and blooming periods of the 49 species are provided in Table 4.2-1.

Table 4.2-1. Special-Status Plants Identified during Prefield Investigation as Having the Potential to Occur in the Intertie Study Area

Common and Scientific Name	Legal Status[a] Federal/State/CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Sharsmith's onion *Allium sharsmithiae*	–/–/1B.3	Southeastern San Francisco Bay area in the Mount Hamilton Range	Rocky or serpentine soils in chaparral, cismontane woodland; 1,312–3,937 feet (400–1,200 meters)	March–May	No potential habitat present and study area falls outside elevation range of species
Large-flowered fiddleneck *Amsinckia grandiflora*	E/E/1B.1	Historically known from Mt. Diablo foothills in Alameda, Contra Costa, and San Joaquin Counties; currently known from three natural occurrences	Cismontane woodland, valley and foothill grassland; 902–1,804 feet (275–550 meters)	April–May	Study area substantially lower than elevational range of species. Not observed during botanical surveys.
Bent-flowered fiddleneck *Amsinckia lunaris*	–/–/1B.2	Inner North Coast Ranges, San Francisco Bay area, western and central Great Valley	Cismontane woodland, valley and foothill grassland, coastal bluff scrub; 16–1,640 feet (5–500 meters)	March–June	Low potential to occur in annual grassland but habitat conditions of poor quality and not observed during botanical surveys.
Alkali milk-vetch *Astragalus tener* var. *tener*	–/–/1B.2	Southern Sacramento Valley, northern San Joaquin Valley, east San Francisco Bay area	Alkaline soils in playas, vernal pools, adobe clay soils in valley and foothill grassland; 3–197 feet (1–60 meters)	March–June	Low potential to occur in annual grassland but microhabitat requirements (adobe clay) may not be met, and habitat conditions of poor quality, and not observed during botanical surveys.
Heartscale *Atriplex cordulata*	–/–/1B.2	Western Central Valley and valleys of adjacent foothills	Saline or alkaline areas in chenopod scrub, meadows and seeps, sandy soils in valley and foothill grassland; below 1,230 feet (375 meters)	April–October	Low potential to occur in annual grassland but microhabitat requirements (sandy soils) may not be met and not observed during botanical surveys.
Crownscale *Atriplex coronata* var. *coronata*	–/–/4.2	Western Central Valley and valleys of adjacent foothills	Saline or alkaline areas in valley and foothill grassland, chenopod scrub, and vernal pools; below 1,936 feet (590 meters)	March–October	Occurs in alkali grassland in study area.

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Brittlescale *Atriplex depressa*	–/–/1B.2	Western and eastern Central Valley and adjacent foothills on west side of Central Valley	Alkaline or clay soils in chenopod scrub, valley and foothill grassland, vernal pools; below 1,050 feet (320 meters)	May–October	Low potential to occur in clay soils in annual grassland and inaccessible portions of alkali grassland but habitat conditions of poor quality and not observed during botanical surveys.
San Joaquin spearscale *Atriplex joaquiniana*	–/–/1B.2	West edge of the Central Valley from Glenn to Tulare Counties	Alkaline soils in chenopod scrub, valley and foothill grassland, meadows and seeps; below 2,739 feet (835 meters)	April–October	Low potential to occur in inaccessible portions of alkali grassland.
Big-scale balsamroot *Balsamorhiza macrolepis* var. *macrolepis*	–/–/1B.2	Sierra Nevada foothills, Sacramento Valley, San Francisco Bay area	Chaparral, cismontane woodland, valley and foothill grassland, sometimes in serpentine soils; 295–4,593 feet (90–1,400 meters)	March–June	Low potential to occur in annual grassland but no serpentine soils present, habitat conditions of poor quality, and not observed during botanical surveys.
Big tarplant *Blepharizonia plumosa*	–/–/1B.1	San Francisco Bay area with occurrences in Alameda, Contra Costa, San Joaquin*, Stanislaus, and Solano Counties	Valley and foothill grassland; 98–1,657 feet (30–505 meters)	July–October	Moderate potential to occur in clay soils in annual grassland but not observed during botanical surveys.
Round-leaved filaree *California macrophylla* (formerly *Erodium macrophyllum*)	–/–/1B.1	Scattered occurrences in the Great Valley, southern north Coast Ranges, San Francisco Bay area, south Coast Ranges, Channel Islands, Transverse and Peninsular Ranges	Clay soils in cismontane woodland, valley and foothill grassland; 49–3,937 feet (15–1,200 meters)	March–May	Low potential to occur in annual grassland with clay loam soils present but habitat conditions of poor quality and not observed during botanical surveys.
Chaparral harebell *Campanula exigua*	–/–/1B.2	Eastern San Francisco Bay area, northern South Inner Coast Ranges	Rocky, usually serpentine soils in chaparral; 902–4,101 feet (275–1,250 meters)	May–June	No potential habitat present and outside elevation range of species

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Bristly sedge *Carex comosa*	–/–/2.1	Inner North Coast Ranges, High Cascade Range, Central Valley, northern Central Coast, San Francisco Bay, San Bernardino mountains, Modoc Plateau	Coastal prairie, marshes and swamps (lake margins), valley and foothill grassland; below 2,050 feet (625 meters)	May–September	Low potential to occur in annual grassland but habitat conditions of poor quality and not observed during botanical surveys.
Brown fox sedge *Carex vulpinoidea*	–/–/2.2	Scattered occurrences from Siskiyou to Los Angeles Counties	Freshwater marshes and swamps, riparian woodland; 98–3,937 feet (30–1,200 meters)	May–June	Low potential to occur in emergent marsh but habitat conditions of poor quality and not observed during botanical surveys.
Succulent owl's-clover *Castilleja campestris* ssp. *succulenta*	T/E/1B.2	Southern Sierra Nevada foothills, eastern San Joaquin Valley	Vernal pools, often acidic; 164–2,460 feet (50–750 meters)	April–May	No vernal pools present
Lemmon's jewelflower *Caulanthus coulteri* var. *lemmonii*	–/–/1B.2	Southeastern San Francisco Bay area, south through the south Coast Ranges and adjacent San Joaquin Valley to Ventura Counties	Dry, exposed slopes in pinyon-juniper woodland and valley and foothill grassland; 262–4,002 feet (80–1,220 meters)	March–May	Low potential to occur in annual grassland but habitat conditions of poor quality. Study area is outside known elevation range of species. Not observed during botanical surveys.
Congdon's tarplant *Centromadia parryi* ssp. *congdonii* (formerly *Hemizonia parryi* ssp. *parryi*)	–/–/1B.2	Central and southern central western California with scattered occurrences from Solano* to San Luis Obispo Counties	Alkaline soils in valley and foothill grassland; below 754 feet (230 meters)	May–October (uncommonly November)	Low potential to occur in inaccessible portions of alkali grassland.
Mt. Hamilton fountain thistle *Cirsium fontinale* var. *campylon*	–/–/1B.2	Eastern San Francisco Bay area in Alameda, Santa Clara, and Stanislaus Counties	Serpentine seeps in chaparral, cismontane woodland, valley and foothill grassland; 328–2,920 feet (100–890 meters)	April–October (uncommonly February)	No serpentine seeps present and outside elevation range of species
Santa Clara red ribbons *Clarkia concinna* ssp. *automixa*	–/–/4.3	Southern San Francisco Bay area in Alameda and Santa Clara Counties	Chaparral, cismontane woodland; 295–4,921 feet (90-1,500 meters)	May–June (uncommonly April–July)	No potential habitat and outside elevation range of species

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Presidio clarkia *Clarkia franciscana*	E/E/1B.1	Known from fewer than five occurrences in Alameda and San Francisco Counties	Serpentine soils in valley and foothill grassland, coastal scrub; 82–1,099 feet (25–335 meters)	May–July	No serpentine soils present in study area
Hispid bird's-beak *Cordylanthus mollis* ssp. *hispidus*	–/–/1B.1	Central and southern Great Valley with scattered occurrences from Placer to Kern Counties	Alkaline soils in meadows and seeps, playas, valley and foothill grassland; 3–508 feet (1–155 meters)	June–September	Low potential to occur in inaccessible portions of alkali grassland.
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B.1	Scattered occurrences in the Central Valley from Glenn to Fresno Counties	Alkaline soils in chenopod scrub, valley and foothill grassland; 16–508 feet (5–155 meters)	May–October	No characteristic habitat (i.e. valley sink scrub) within alkali grassland in study area.
Mt. Hamilton coreopsis *Coreopsis hamiltonii*	–/–/1B.2	Known from fewer than ten occurrences in the Mt. Hamilton Range	Rocky soils in cismontane woodland; 1,804–4,265 feet (550–1,300 meters)	March–May	No potential habitat and outside elevation range of species
Livermore tarplant *Deinandra bacigalupi*	–/–/1B.2	Known from fewer than ten occurrences in Alameda County near Livermore	Alkaline meadows and seeps; 492–607 feet (150–185 meters)	June–October	Study area is outside elevation range of species and not observed in alkali wetland during blooming period.
Hospital Canyon larkspur *Delphinium californicum* ssp. *interius*	–/–/1B.2	Scattered occurrences from Contra Costa to San Benito Counties	Mesic areas in chaparral openings, cismontane woodland; 754–3,592 feet (230–1,095 meters)	April–June	No potential habitat present and outside elevation range of species
Recurved larkspur *Delphinium recurvatum*	–/–/1B.2	Central Valley from Colusa* to Kern Counties	Alkaline soils in chenopod scrub, cismontane woodland, valley and foothill grassland; 10–2,460 feet (3–750 meters)	May–June	Low potential to occur in inaccessible portions of alkali grassland.
Delta button-celery *Eryngium racemosum*	–/E/1B.1	Northern San Joaquin Valley, adjacent Sierra Nevada foothills	Riparian scrub in vernally mesic clay depressions; 10–98 feet (3–30 meters)	June–September	Low potential to occur in riparian habitat but habitat conditions of poor quality and not observed during botanical surveys.

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Diamond-petaled California poppy *Eschscholzia rhombipetala*	–/–/1B.1	Inner North and South Coast Ranges, eastern San Francisco Bay, eastern Outer South Coast Ranges	Alkaline or clay soils in valley and foothill grassland; below 3,199 feet (975 meters)	March–April	Low potential to occur in annual grassland with clay loam soils and inaccessible portions of alkali grassland but habitat conditions of poor quality. No *Eschscholzia* sp. observed in study area.
Stinkbells *Fritillaria agrestis*	–/–/4.2	Outer North Coast Ranges, Sierra Nevada foothills, Central Valley, Central Western California	Clay, sometimes serpentine soils in chaparral, cismontane woodland, pinyon-juniper woodland, valley and foothill grassland; 33–5,102 feet (10–1,555 meters)	March–June	Low potential to occur in grassland habitat but habitat conditions of poor quality and not observed during botanical surveys.
Talus fritillary *Fritillaria falcata*	–/–/1B.2	San Francisco Bay area, inner South Coast Ranges	Serpentine, often talus slopes in chaparral, cismontane woodland, lower montane coniferous forest; 984–5,003 feet (300–1,525 meters)	March–May	No potential habitat present and outside elevation range of species
Diablo helianthella *Helianthella castanea*	–/–/1B.2	San Francisco Bay area in Alameda, Contra Costa, Marin*, San Francisco*, and San Mateo Counties	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland; 197–4,265 feet (60–1,300 meters)	March–June	Low potential to occur in annual grassland but habitat conditions of poor quality and not observed during botanical surveys.
Napa western flax *Hesperolinon serpentinum*	–/–/1B.1	Known from fewer than 20 occurrences in Alameda, Lake, Napa, and Stanislaus Counties	Serpentine soils in chaparral; 164–2,625 meters (50–800 meters)	May–July	No chaparral or serpentine soils present
Rose-mallow *Hibiscus lasiocarpus*	–/–2.2	Central and southern Sacramento Valley, Deltaic Central Valley, and elsewhere in the U.S.	Freshwater marshes and swamps; below 394 feet (120 meters)	June–September	Low potential to occur in emergent marsh but habitat conditions of poor quality and not observed during botanical surveys.

Common and Scientific Name	Legal Status[a] Federal/State/ CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Contra Costa goldfields *Lasthenia conjugens*	E/–/1B.1	North Coast, southern Sacramento Valley, San Francisco Bay area, South Coast	Mesic areas in cismontane woodland, alkaline playas, valley and foothill grassland, vernal pools; below 1, 542 (470 meters)	March–June	Low potential to occur in seasonal wetlands but habitat conditions of poor quality and not observed during botanical surveys.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	–/–/1B.2	Central Valley, San Francisco Bay area	Freshwater and brackish marshes and swamps; below 13 feet (4 meters)	May–July (uncommonly Sep)	Study area substantially higher than elevation range of species
Legenere *Legenere limosa*	–/–/1B.1	Sacramento Valley, North Coast Ranges, northern San Joaquin Valley and Santa Cruz Mountains	Vernal pools; below 2,887 feet (880 meters)	April–June	No vernal pools present
Mason's lilaeopsis *Lilaeopsis masonii*	–/R/1B.1	Southern Sacramento Valley, Sacramento–San Joaquin River Delta, northeastern San Francisco Bay area in Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, and Solano Counties	Freshwater or brackish marshes and swamps, riparian scrub; below 33 feet (10 meters)	April–November	Study area substantially higher than elevation range of species
Delta mudwort *Limosella subulata*	–/–/2.1	Deltaic Central Valley with occurrences in Contra Costa, Sacramento, San Joaquin, and Solano Counties; Oregon	Marshes and swamps; below 10 feet (3 meters)	May–August	Study area substantially higher than elevation range of species
Showy madia *Madia radiata*	–/–/1B.1	Scattered populations in the interior foothills of the South Coast Ranges; Contra Costa*, Fresno, Kings*, Kern, Monterey*, Santa Barbara*, San Benito, San Joaquin*, Stanislaus, and San Luis Obispo Counties.	Slopes of cismontane woodland, valley and foothill grassland; (25–900 meters)	March–May	Low potential to occur in annual grassland but habitat conditions of poor quality and not observed during botanical surveys.
Hall's bush-mallow *Malacothamnus hallii*	–/–/1B.2	Scattered occurrences from Mendocino to Merced Counties	Chaparral, coastal scrub; 33–2,493 feet (10–760 meters)	May–September (uncommonly October)	No potential habitat present in study area

Common and Scientific Name	Legal Status[a] Federal/State/CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Mt. Diablo cottonweed *Micropus amphibolus*	–/–/3.2	Southern North Coast Ranges, San Francisco Bay area, southern Outer South Coast Ranges	Rocky areas in broadleafed upland forest, chaparral, cismontane woodland, valley and foothill grassland; 148–2,707 feet (45–825 meters)	March–May	Microhabitat requirements (i.e., rocky areas) are not met in study area
Little mousetail *Myosurus minimus* ssp. *apus*	–/–/3.1	Scattered occurrences from Colusa to San Diego Counties	Alkaline soils in valley and foothill grassland, vernal pools; 20–640 meters (66–2,100 feet)	March–June	Low potential to occur in inaccessible portions of alkali grassland
Mt. Diablo phacelia *Phacelia phacelioides*	–/–/1B.2	Eastern San Francisco Bay area, inner South Coast Ranges	Rocky soils in chaparral, cismontane woodland; 1,640–4,495 feet (500–1,370 meters)	April–May	No potential habitat present and outside elevation range of species
Hairless popcorn-flower *Plagiobothrys glaber*	–/–/1A	Historically known from the Central Coast, southern San Francisco Bay area	Alkaline meadows and seeps, coastal salt marshes and swamps; 49–590 feet (15–180 meters)	March–May	Low potential to occur in alkali wetland
Marsh skullcap *Scutellaria galericulata*	–/–/2.2	Northern High Sierra Nevada, Modoc Plateau; Oregon	Lower montane coniferous forest, mesic meadows and seeps, marshes and swamps; below 6,890 feet (2,100 meters)	June–September	Low potential to occur in emergent marsh but habitat conditions of poor quality and no *Scutellaria* sp. observed during botanical surveys.
Rayless ragwort *Senecio aphanactis*	–/–/2.2	Scattered locations in central western and southwestern California from Alameda to San Diego Counties	Chaparral, cismontane woodland, and coastal scrub, sometimes in alkaline soils; 49–2,625 feet (15–800 meters)	January–April	No potential habitat present in study area
Suisun Marsh aster *Symphyotrichum lentum* (formerly *Aster lentus*)	–/–/1B.2	Sacramento Valley, Central Coast, San Francisco Bay	Brackish and freshwater marshes and swamps; below 10 feet (3 meters)	May–November	Study area substantially higher than elevation range of species
Saline clover *Trifolium depauperatum* var. *hydrophilum*	–/–/1B.2	Sacramento Valley, Central Western California from Sonoma to San Luis Obispo Counties	Marshes and swamps, vernal pools, mesic or alkaline areas in valley and foothill grassland; below 984 feet (300 meters)	March–April	Low potential to occur in inaccessible portions of alkali grassland.

Common and Scientific Name	Legal Status[a] Federal/State/CNPS	Geographic Distribution/Floristic Province	Habitat Requirements	Blooming Period	Potential to Occur in Study Area
Caper-fruited tropidocarpum *Tropidocarpum capparideum*	–/–/1B.1	Historically known from the northwest San Joaquin Valley and adjacent Coast Range foothills; currently known from Fresno, Monterey, and San Luis Obispo Counties.	Valley and foothill grasslands on alkaline hills below 1,493 feet (455 meters)	March–April	Low potential to occur in inaccessible portions of alkali grassland.

Notes:

[a] Status explanations:

Federal

E = listed as endangered under the federal Endangered Species Act.

T = listed as threatened under the federal Endangered Species Act.

SC = species of concern; species for which existing information indicates it may warrant listing but for which substantial biological information to support a proposed rule is lacking

– = no listing.

State

E = listed as endangered under the California Endangered Species Act.

R = listed as rare under the California Native Plant Protection Act (this category is no longer used for newly listed plants, but some plants previously listed as rare retain this designation)

– = no listing.

California Native Plant Society (CNPS)

1A = List 1A species: presumed extinct in California.

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.

2 = List 2 species: rare, threatened, or endangered in California but more common elsewhere.

4 = List 4 species: plants with limited distribution that are on a watch list.

– = no listing.

Threat Code Extentions

.1 = seriously endangered in California (over 80% of occurrences threatened-high degree and immediacy of threat).

.2 = fairly endangered in California (20-80% occurrences threatened).

.3 = not very endangered in California (<20% of occurrences threatened or no current threats known).

Twenty-two of the 49 special-status plant species have specific habitat (e.g., chaparral, vernal pools, cismontane woodland) or microhabitat (e.g., serpentine soils, rocky areas) requirements that are not present in the study area or the elevational range of the species is considerably outside the elevational range of the study area. Clay loam soils have been mapped in the study area but no serpentine soils have been documented in soil surveys of the study area (Welch et al. 1966; McElhiney 1992). Therefore, 27 special-status plant species were identified as potentially occurring in the study area. One of the 27 special-status species, crownscale, was not identified during the initial record searches but was observed in the study area. Crownscale is not federally or state listed but is a CNPS List 4.2 species that has been identified by CNPS as having limited distribution and is on a watch list. The crownscale was observed at the edge of the narrow swath of alkali grassland between the alkali wetland and Mountain House Road (Figure 4.2-1).

Two of the 27 species are federally listed (Contra Costa goldfields [*Lasthenia conjugens*], palmate-bracted bird's-beak [*Cordylanthus palmatus*]) and the remainder of the species are exclusively on CNPS lists. Contra Costa goldfields was initially identified as having low potential in occur in the seasonal wetlands but was not observed during the May 2007 botanical surveys that coincided with its blooming period and the seasonal wetlands will not be affected by any of the proposed project alternatives (see environmental commitments in Chapter 2). Palmate-bracted bird's-beak was not observed in the accessible portion of the alkali grassland during the July 2009 survey that coincided with its blooming period and there was no characteristic habitat (i.e., valley sink scrub) or any of the typical associates (i.e., iodine bush (*Allenrolfea occidentalis*), bush seepweed (*Suaeda moquinii*), alkali heath (*Frankenia salina*), and alkali sacaton (*Sporobolus airoides*) in the alkali grassland in the study area.

Crownscale, San Joaquin spearscale (*Atriplex joaquiniana*), Congdon's tarplant (*Centromadia parryi* ssp. *congdonii*), hispid bird's-beak (*Cordylanthus mollis* ssp. *hispidus*), recurved larkspur (*Delphinium recurvatum*), diamond-petaled California poppy (*Eschscholzia rhombipetala*), little mousetail (*Myosurus minimus* ssp. *apus*), saline clover (*Trifolium depauperatum* var. *hydrophilum*), and caper-fruited tropidocarpum (*Tropidocarpum capparideum*) also have low potential to occur in the inaccessible portions of the alkali grassland. The timing of botanical surveys coincided with the blooming periods for all but 4 of the special-status species: hairless popcorn-flower, saline clover, caper-fruited tropidocarpum, and diamond-petaled poppy. Hairless popcorn-flower, saline clover, and caper-fruited tropidocarpum are restricted to alkaline areas, and the only habitats within the study area with strongly alkaline soils were the alkali wetland and the alkali grassland. Hairless popcorn-flower could potentially occur in the alkali wetland that would not be affected by any of the proposed project alternatives (see environmental commitments in Chapter 2). Saline clover, caper-fruited tropidocarpum, and diamond-petaled poppy have low potential to occur in the alkali grassland. Diamond-petaled California poppy can also occur in clay soils that occur within the majority of the study area and would have been recognizable to the genus level at the time of the May 2007 survey but no *Eschscholzia* spp. were observed.

, *Invasive Plants*

Plant species that have been identified by the California Invasive Plant Council (Cal-IPC) and California Department of Food and Agriculture (CDFA) as invasive are well-represented in the study area (California Invasive Plant Council 2006; California Department of Food and Agriculture 2008). Representative invasive species observed were yellow star-thistle, perennial pepperweed, Italian thistle (*Carduus pycnocephalus*), ripgut brome, Russian thistle, stinkweed, and Italian ryegrass.

Regulatory Setting

Federal Endangered Species Act

The USFWS is responsible for implementation of the ESA (16 USC § 1531 *et seq.*). The act protects fish, wildlife, and plant species that are listed as threatened or endangered, and their habitats. Endangered species, subspecies, or distinct population segments are those that are in danger of extinction through all or a significant portion of their range, and “threatened” species, subspecies, or distinct population segments are likely to become endangered in the near future.

Section 7 of the ESA mandates that all federal agencies consult with USFWS if they determine that a proposed project may affect a listed plant species or its habitat. The purpose of consultation with USFWS is to ensure that the federal agencies’ actions do not jeopardize the continued existence of a listed species or destroy or adversely modify critical habitat for listed species.

For plants listed as endangered under the ESA, Section 9(a)(2) prohibits their import or export from the United States. Section 9(a)(2) also prohibits acts to remove, cut, dig up, damage, or destroy an endangered plant species in nonfederal areas in knowing violation of any state law or in the course of criminal trespass. Candidate species and species that are proposed or under petition for listing receive no protection under Section 9.

Clean Water Act

The CWA was enacted as an amendment to the federal Water Pollution Control Act of 1972, which outlined the basic structure for regulating discharges of pollutants to waters of the United States. The CWA serves as the primary federal law protecting the quality of the nation’s surface waters, including lakes, rivers, and coastal wetlands. The CWA empowers the EPA to set national water quality standards and effluent limitations and includes programs addressing both *point-source* and *nonpoint-source* pollution. Point-source pollution is pollution that originates or enters surface waters at a single, discrete location, such as an outfall structure or an excavation or construction site. Nonpoint-source pollution originates over a broader area and includes urban contaminants in stormwater runoff and sediment loading from upstream areas. The CWA operates on the principle that all discharges into the nation's waters are unlawful unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool. The following sections provide additional details on specific sections of the CWA.

Permits for Fill Placement in Waters and Wetlands (Section 404)

CWA Section 404 regulates the discharge of dredged and fill materials into waters of the United States. Waters of the United States refers to oceans, bays, rivers, streams, lakes, ponds, and wetlands, including any or all of the following:

- areas within the OHWM of a stream, including nonperennial streams with a defined bed and bank and any streamchannel that conveys natural runoff, even if it has been realigned; and
- seasonal and perennial wetlands, including coastal wetlands.

None of the project alternatives would result in the discharge of dredged or fill material into any wetland or water. Therefore, no CWA Section 404 permit is needed.

Permits for Stormwater Discharge (Section 402)

CWA Section 402 regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program, administered by EPA. In California, the State Water Resources Control Board is authorized by EPA to oversee the NPDES program through the RWQCBs. The project area is under the jurisdiction of the Central Valley RWQCB.

NPDES permits are required for projects that disturb more than 1 acre of land. The NPDES permitting process requires the applicant to file a public notice of intent (NOI) to discharge stormwater and to prepare and implement a SWPPP. The SWPPP includes a site map and a description of proposed construction activities. In addition, it describes the BMPs that would be implemented to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) that could contaminate nearby water resources. Permittees are required to conduct annual monitoring and reporting to ensure that BMPs are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

Executive Order 13112: Prevention and Control of Invasive Species

Executive Order (EO) 13112, signed February 3, 1999, directs all federal agencies to prevent and control introductions of invasive species in a cost-effective and environmentally sound manner. The EO established the National Invasive Species Council (NICS), which is composed of federal agencies and departments and a supporting Invasive Species Advisory Committee (ISAC) composed of state, local, and private entities. The NISC and ISAC prepared a national invasive species management plan (National Invasive Species Council 2008) that recommends objectives and measures to implement the EO and to prevent the introduction and spread of invasive species. The EO requires consideration of invasive species in NEPA analyses, including their identification and distribution, their potential impacts, and measures to prevent or eradicate them.

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.

4.2.4 Environmental Consequences

Assessment Methods

Effects on vegetation and wetlands would be considered adverse if the implementation of Alternative 2, 3, or 4 would result in:

- temporary or permanent removal, filling, grading, or disturbance of waters of the United States (including wetlands) and/or waters of the state and woody riparian vegetation;
- loss of habitat that is sensitive or rare in the project region, such as native riparian woodland and wetlands;
- substantial loss of natural vegetation that is slow to recover;
- loss of populations or habitat of a special-status plant species that is federally or state-listed or designated by CNPS as a List 1B or List 2 species;
- substantial loss of diversity of species or natural communities; or
- incompatibility with an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan.

Impact Mechanisms

Vegetation resources could be directly or indirectly affected by Alternatives 2, 3, and 4. The following types of activities could cause impacts on vegetation resources. These impact mechanisms were used to assess project related effects on vegetation resources in the study area:

- grading and paving activities during construction and building activities;
- potentially removing habitat and individuals of special-status species;
- temporary stockpiling and sidecasting of soil, construction materials, or other construction wastes;
- soil compaction, dust, and water runoff from the construction and development site;
- development of soil stockpiling areas to contain material from excavation; and
- degradation of water quality in the two drainages, resulting from construction runoff containing petroleum products.

Impact Assumptions

Construction activities associated with Alternatives 2, 3, and 4 could result in temporary or permanent effects on vegetation resources located in the study area. All wetland resources would be avoided, and there would be no temporary or permanent impacts associated with construction or operation of any of the project alternatives. In assessing the magnitude of possible effects, the following assumptions were made regarding construction-related impacts on vegetation and wetland resources.

- No fill or dredged material will be directly placed within any waters of the United States (including wetlands).
- No woody riparian species would be removed.
- All equipment and vehicle staging would occur within the study area.
- Construction of the transmission line for Alternatives 2 and 3 would not adversely affect any wetlands and other waters or riparian habitat. This analysis assumes that locations of the transmission towers would avoid all placement of fill or dredged materials into all waters of the United States (including wetlands).
- Reclamation will implement all measures identified in the project description and environmental commitments to avoid or minimize adverse effects on special-status species, wetlands/other waters, and riparian habitat.

- If any staging areas, laydown areas, office sites, or spoils areas are identified outside the study area, they will be located within previously graded, paved, or disturbed areas that do not support any special-status plants, wetlands/other waters, or sensitive natural communities (e.g., riparian habitat).
- These staging areas will be evaluated and approved by Reclamation prior to the contractor's use of the area.

4.2.5 Environmental Effects

Alternative 1 (No Action)

This alternative would consist of the continuation of the existing conditions. Reclamation would continue to operate and maintain the DMC as it currently is. There would be no effects on vegetation or wetland resources under the No Action Alternative.

Alternative 2 (Proposed Action)

Construction Impacts

Impact VEG-1: Direct and Indirect Effects on Sensitive Biological Resources within and Adjacent to the Construction Zone

Sensitive biological resources (e.g., wetlands, other waters, and riparian habitat) are known to occur within and adjacent to the project area for the Proposed Action. The environmental commitments in Chapter 2 include avoidance of all wetlands, mandatory training for construction personnel to ensure the recognition and avoidance of sensitive biological resources, protective fencing around sensitive biological resources that will be installed prior to the initiation of construction and maintained for the duration of construction, and an on-site biological monitor to assist construction personnel with implementing environmental commitments. Therefore, there would be no adverse effects on sensitive biological resources within and adjacent to the construction zone under implementation of the Proposed Action.

Impact VEG-2: Introduction or Spread of Invasive Plant Species

Invasive plants already occur in the study area; however, construction activities associated with implementation of Alternative 2 (e.g., ground disturbance, movement of construction equipment) potentially could introduce new invasive plants or contribute to the spread of existing invasive plants within the study area or to undeveloped lands adjacent to the study area. EO 13112 directs federal agencies to prevent and control introductions of invasive species. The environmental commitments in Chapter 2 include measures to avoid and minimize the introduction and spread of invasive plants into and from the project area for the Proposed Action, including washing construction equipment and vehicles prior to entering and exiting the construction zone, using weed-free erosion control materials, coordinating with local agricultural commissioners and land management agencies, and educating construction personnel about invasive plant species. Therefore, implementation of the Proposed Action would not contribute to a substantial increase in the distribution of invasive plant species, and there would be no adverse effect.

Operation Impacts

There would be no operational effects on riparian habitat or wetlands/other waters. The increase in pumping would not result in substantial changes in stage (refer to Section 3.2, Delta Tidal Hydraulics) that could affect special-status plants, wetlands/other waters, or riparian habitat.

Alternative 3 (TANC Intertie Site)

Alternative 3 is similar in design to Alternative 2 and differs only in the location of the Intertie and accompanying structures. Alternative 3 also includes the construction of a new transmission line along the west side of the DMC in the vicinity of the riparian habitat. Therefore, impacts VEG-1 and VEG-2 associated with Alternative 2 and the applicable environmental commitments in Chapter 2 would be the same under the implementation of Alternative 3.

Impact VEG-3: Potential Impacts on Special-Status Plants

Although a botanical survey of the entire project area for Alternative 3 was not conducted, the majority of the areas that would be affected were surveyed and the timing of the surveys coincided with the blooming periods of most of the species (discussed above). In addition, 6 of the special-status plants are associated with habitat types that would be avoided under the environmental commitments in Chapter 2 (i.e., wetlands, black willow riparian woodland). The inaccessible portion of the alkali grassland located in the study area has low potential to contain special-status plants listed by CNPS. For the remainder of the study area, occurrence of special-status species was interpreted to be unlikely based on the negative results of the botanical surveys in adjacent areas, and the degradation of the habitat quality as a result of past and ongoing human activities (e.g., grazing, mowing, excavation operations for soil testing, ROW maintenance, canal operation and maintenance). Additionally, it is unlikely that the special-status (i.e., CNPS listed) annual grassland species not restricted to alkaline soils would occur within the relatively limited portions of the Alternative 3 project area that were not surveyed where direct impacts would occur, and if any of the special-status plant species were present in those areas, it is also unlikely that implementation of Alternatives 3 would have an adverse effect on those species.

Alternative 4 (Virtual Intertie)

The implementation of Alternative 4 would result in ground disturbance (including re-grading if necessary) within a much smaller area than would be disturbed under Alternatives 2 and 3. Therefore, although the types of impacts (and applicable environmental commitments in Chapter 2) associated with Alternative 2 (VEG-1 and VEG-2) and Alternative 3 (VEG-3) would be the same under Alternative 4, they would be lessened because less ground disturbance would occur.

4.3 Wildlife

4.3.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on wildlife resources.

4.3.2 Affected Environment

Study Area

The proposed project area is located near the junction of I-205 and I-580 west of Tracy, California, between the federal DMC and state California Aqueduct along the border in Alameda and San Joaquin Counties (Figure 2-1). For the purposes of this EIS section, the study area encompasses approximately 1,020 acres and consists of the areas that would be affected by the three project alternatives: Alternative 2 (Proposed Action), Alternative 3 (TANC Intertie Site) and Alternative 4 (Virtual Intertie) (Figure 4.2-1). The study area includes the proposed alternative sites, and an area along each side of the DMC and California Aqueduct where the transmission line between the alternatives and the Tracy substation may be placed.

The study area has been disturbed by past and ongoing human activities such as construction, operation, and maintenance of the DMC and California Aqueduct, ROW maintenance, agricultural practices, and commercial development. The study area is surrounded by annual grassland, agricultural land, commercial development, and rural residences. Vegetated portions of the study area consist primarily of annual grassland habitat. Other land cover types in the study area are black willow riparian woodland, seasonal wetland, emergent marsh wetland, ephemeral drainages, open water, and agricultural lands. Additional information pertaining to vegetation and wetland resources in the study area are provided in Section 4.2, Vegetation and Wetlands.

4.3.3 Methods

The methods used to identify potential special-status wildlife that may occur in the study area consisted of a prefield investigation, coordination with resource agencies, and habitat-based field surveys. Each of these elements is described in this section.

Prefield Investigation

The following key sources of information were used in the preparation of this section:

- A California Natural Diversity Database (CNDDB) records search for the Tracy, Midway, Clifton Court Forebay, Union Island, Byron Hot Springs, and Altamont USGS 7.5-minute quadrangles (California Natural Diversity Database 2009) (Appendix E).
- A USFWS list of endangered, threatened, and candidate animal species for the Tracy, Midway, and Clifton Court Forebay USGS 7.5-minute quadrangles (U.S. Fish and Wildlife Service 2009) (Appendix F).
- *Delta-Mendota Canal/California Aqueduct Intertie Proposed Finding of No Significant Impact/Negative (FONSI) Declaration and Draft Environmental Assessment/Initial Study (EA/IS)* (Jones & Stokes 2004).

Field Surveys

ICF Jones & Stokes biologists conducted a habitat-based field assessment on August 23, 2003, to gather information for the *Delta-Mendota Canal/California Aqueduct Intertie FONSI and EA/IS*. During the field survey, the biologists walked throughout the Alternative 2 study area, noted each habitat type present, and evaluated it for potential to support special-status species. Additionally, Western staff conducted habitat-based field surveys of the transmission line area from Alternative 2 to the Tracy substation on September 19 and 30, 2005 to survey the portion of the transmission line that would occur on Reclamation's land. A final site visit was made on December 8, 2005 to survey the two parcels of private land. Field surveys were used to verify information from the sources listed above and consisted of walking meandering transects through the proposed ROW.

Additional habitat-based wildlife surveys were conducted on May 4, 2007; October 30, 2007; September 17, 2008; January 15, 2009; February 4, 2009; and July 7, 2009 by ICF Jones & Stokes wildlife biologists. The purpose of the additional surveys was to determine the presence of habitat capable of supporting special-status wildlife species identified as having the potential to occur in the study area (as defined above and including the other project alternatives that were not surveyed in 2003) (Table 4.3-1).

Table 4.3-1. Special-Status Wildlife Identified during the Prefield Investigation as Having the Potential to Occur in the Intertie Study Area

Species Name	Status[1] Fed/State	Distribution	Habitat	Potential to Occur in Study Area
Invertebrates				
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.	Would not occur—no elderberry shrubs in study area.
Conservancy fairy shrimp *Branchinecta conservatio*	E/–	Disjunct occurrences in Solano, Merced, Tehama, Ventura, Butte, and Glenn Counties.	Large, deep vernal pools in annual grasslands.	Unlikely to occur—not known to occur in the project vicinity; seasonal pool in study area likely too small to provide suitable habitat.
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.	May occur—suitable habitat in the study area; unidentified fairy shrimp observed in one seasonal pool in study area.
Vernal pool fairy shrimp *Branchinecta lynchi*	E/–	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.	May occur—suitable habitat in the study area; unidentified fairy shrimp observed in one seasonal pool in study area.
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–	Shasta County south to Merced County.	Vernal pools and ephemeral stock ponds.	May occur—suitable habitat in the study area.
Amphibians				
California tiger salamander *Ambystoma californiense*	T/C	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.	May occur—suitable habitat in the study area.

Species Name	Status[1] Fed/State	Distribution	Habitat	Potential to Occur in Study Area
California red-legged frog *Rana draytonii*	T/SSC	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.	Known to occur in study area; observed during July 2009 survey; suitable habitat present.
Foothill yellow-legged frog *Rana boylii*	–/SSC	Occurs in the Klamath, Cascade, north Coast, south Coast, Transverse, and Sierra Nevada Ranges up to approximately 6,000 feet	Creeks or rivers in woodland, forest, mixed chaparral, and wet meadow habitats with rock and gravel substrate and low overhanging vegetation along the edge. Usually found near riffles with rocks and sunny banks nearby.	Would not occur—no suitable habitat in study area
Western spadefoot *Scaphiopus hammondii*	–/SSC	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.	May occur—suitable habitat in the study area.
Reptiles				
Western pond turtle *Actinemys marmorata*	–/SSC	Occurs throughout California west of the Sierra-Cascade crest. Found from sea level to 6,000 feet. Does not occur in desert regions except for along the Mojave River and its tributaries.	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	Unlikely to occur—waterways in study area are narrow with low flows
Coast (California) horned lizard *Phrynosoma coronatum* (*frontale* population)	–/SSC	Sacramento Valley, including foothills, south to southern California; Coast Ranges south of Sonoma County; below 4,000 feet in northern California	Grasslands, brushlands, woodlands, and open coniferous forest with sandy or loose soil; requires abundant ant colonies for foraging	Unlikely to occur—grassland in study area is low quality.
Silvery legless lizard *Anniella pulchra pulchra*	–/SSC	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.	Would not occur—no suitable habitat in the study area.

Species Name	Status[1] Fed/State	Distribution	Habitat	Potential to Occur in Study Area
Giant garter snake *Thamnophis gigas*	T/T	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.	Would not occur—no suitable habitat in the study area (canals in the action area are fast flowing and are either concrete lined and/or do not provide emergent, herbaceous wetland vegetation required for cover).
Alameda whipsnake *Masticophis lateralis euryxanthus*	T/T	Restricted to Alameda and Contra Costa Counties; fragmented into five 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.	Would not occur—no scrub or chaparral habitat in or near the study area.
San Joaquin whipsnake *Masticophia flagellum ruddocki*	–/SSC	From Colusa County in the Sacramento Valley southward to the Grapevine in the San Joaquin Valley and westward into the inner coast ranges; isolated population occurs at Sutter Buttes; known elevation range from 66 to 2,953 feet (20 to 900 meters)	Occurs in open, dry, vegetative association with little or no tree cover; occurs in valley grassland and saltbush scrub associations; often occurs in association with mammal burrows.	Unlikely to occur—grassland in study area is low quality.
Birds				
Northern harrier *Circus cyaneus*	–/SSC	Occurs throughout lowland California. Has been recorded in fall at high elevations.	Grasslands, meadows, marshes, and seasonal and agricultural wetlands.	Known to occur in study area; observed during January 2009 survey; suitable habitat present.
Golden eagle *Aquila chrysaetos*	PR/FP	Foothills and mountains throughout California; uncommon nonbreeding visitor to lowlands such as Central Valley	Nests on cliffs and escarpments or in tall trees overlooking open country; forages in annual grasslands, chaparral, and oak woodlands with plentiful medium and large-sized mammals.	May occur—no suitable nesting habitat in study area but suitable foraging habitat is present.
Swainson's hawk *Buteo swainsoni*	–/T	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.	May occur—no suitable nesting habitat in study area but suitable foraging habitat is present.

Species Name	Status[1] Fed/State	Distribution	Habitat	Potential to Occur in Study Area
White-tailed kite *Elanus leucurus*	–/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.	Known to occur in study area; no suitable nesting habitat but suitable foraging habitat is present in study area.
Western burrowing owl *Athene cunicularia hypugea*	–/SSC	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.	Known to occur in study area; suitable habitat present.
Loggerhead shrike *Lanius ludovicianus*	–/SSC	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.	May occur—suitable nesting and foraging habitat in the study area.
Tricolored blackbird *Agelaius tricolor*	–/SSC	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 grain fields. Habitat must be large enough to support 50 pairs. Probably requires water at or near the nesting colony.	May occur—no suitable nesting habitat in study area but suitable foraging habitat is present.
Mammals				
Pallid bat *Antrozous pallidus*	–/SSC	Occurs throughout California except the high Sierra from Shasta to Kern County and the northwest coast, primarily at lower and mid elevations.	Occurs in a variety of habitats from desert to coniferous forest. Most closely associated with oak, yellow pine, redwood, and giant sequoia habitats in northern California and oak woodland, grassland, and desert scrub in southern California. Relies heavily on trees for roosts but also uses caves, mines, bridges, and buildings.	May occur—suitable crevices for roosting may be present in overcrossings along canals; may forage in study area.

Species Name	Status[1] Fed/State	Distribution	Habitat	Potential to Occur in Study Area
Western mastiff bat *Eumops perotis californicus*	–/SSC	Occurs along the western Sierra primarily at low to mid elevations and widely distributed throughout the southern coast ranges. Recent 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 also may use crevices in trees, buildings, and tunnels	Unlikely to occur—no suitable roosting habitat (crevices in cliff faces, cracks in boulders, buildings, trees, and tunnels).
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	Occurs principally 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.	May occur—suitable habitat present in the study area.
American badger *Taxidea taxus*	–/SSC	Found throughout most of California except in northern North Coast area.	Suitable habitat is characterized by herbaceous, shrub, and open stages of most habitats with dry, friable soils. Dig burrows in friable soils for cover.	May occur—suitable habitat present in the study area.

Notes:

Species listed in table are generated from the U.S. Fish and Wildlife Service project species list (U.S. Fish and Wildlife Service 2009) and California Natural Diversity Database records (California Natural Diversity Database 2009).

[1] Status:

Federal

E = Listed as endangered under the federal Endangered Species Act (ESA).
T = Listed as threatened under ESA.
PR = Protected under the Bald and Golden Eagle Protection Act.
– = No federal status.

State

T = Listed as threatened under CESA.
C = Candidate for listing under CESA
SSC = California species of special concern.
FP = Fully protected under California Fish and Game Code.
– = No state status.

4.3.4 Wildlife Resources in the Study Area

This section describes the land cover types in the study area and identifies common and special-status wildlife species that have the potential to occur in each land cover type. This section also provides natural history information for the special-status wildlife species that are known to occur or that have the potential to occur in the study area.

Land Cover Types in the Study Area

Annual Grassland

The majority of the study area consists of annual grassland that encompasses approximately 347.05 acres (Figure 4.2-1). Annual grasslands provide breeding and foraging habitat for small mammals, birds, amphibians, and reptiles. Annual grasslands also provide foraging habitat for coyote (*Canus latrans*) and many birds, including red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), great horned owl (*Bubo virginianus*), and western meadowlark (*Sternella neglecta*). Grasslands near open water also may be used by a wide variety of waterfowl and wading birds that require resting, breeding, and foraging areas close to water. Annual grassland provides habitat for special-status wildlife, including northern harrier (*Circus cyanus*), San Joaquin kit fox (*Vulpes macrotis mutica*), and American badger (*Taxidea taxus*).

Alkali Grassland

Approximately 3.21 acres of alkali grassland are located southwest of the canal access road near Grant Line Road (Figure 4.2-1). Wildlife use of alkali grassland would be similar to that discussed above for annual grassland.

Black Willow Riparian Woodland

A small patch of black willow riparian woodland (0.31 acre) occurs adjacent to an ephemeral drainage on the western side of the DMC in the small area of ruderal annual grassland bounded on three sides by the large parking lot in the central portion of the study area (Figure 4.2-1). Riparian woodland provides potential nesting, foraging, and roosting habitat for several common bird species and may provide potential nesting and roosting habitat for raptors.

Emergent Marsh Wetlands

Twelve emergent marsh wetlands are scattered throughout the study area and encompass approximately 1.66 acres (Figure 4.2-1). Several of the emergent marsh wetlands are associated with perennial and intermittent drainages (see below). Emergent marsh wetlands are located on the north and south side of the canals and are supported by direct precipitation supplemented by flows from adjacent drainages and/or wetland complexes , or runoff from adjacent alfalfa fields. Emergent marsh wetlands provide potential breeding habitat for Pacific tree frog (*Hyla regilla*) and other amphibians. Emergent marsh wetlands also provide foraging habitat for passerine and wading birds, and small mammals. Emergent marsh provides habitat for special-status wildlife, including California red-legged frog (*Rana draytonii*) and California tiger salamander (*Ambystoma californiense*).

Seasonal Wetlands

Eleven seasonal wetlands occur in the study area and encompass a total area of approximately 5.39 acres (Figure 4.2-1). Three of the seasonal wetlands area associated with intermittent drainages (see below). The largest seasonal wetland encompasses approximately 4.0 acres and is located just east of the black willow riparian woodland. This wetland appears to be a human-made sediment detention basin that receives water from direct precipitation (i.e., rainfall) and runoff from the adjacent parking lot. The remaining 10 seasonal wetlands appear to be naturally occurring and receive water from direct precipitation and runoff. Seasonal wetlands provide unique habitat for a variety of aquatic invertebrates that in turn provide food for other wildlife species, including great blue heron (*Ardea herodias*), killdeer (*Charadrius vociferus*), American avocet (*Recurvirostra americana*) black-necked stilt (*Recurvirostra americana*), and greater yellowlegs (*Tringa melanoleuca*) (Zeiner et al. 1990a: 32, 192, 200, 202). In addition, amphibians such as Pacific tree frog and western toad (*Bufo boreas*) use seasonal wetlands for breeding and feeding (Zeiner et al. 1988: 64, 78). Seasonal wetlands provide suitable habitat for special-status wildlife, including vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*), California tiger salamander, and western spadefoot (*Spea hammondii*).

Basins

There are eight small (4 feet by 5 feet to 15 feet by 30 feet) basins along the west side of the DMC. These basins were not mapped separate from the annual grassland, and therefore the acreage of basins in the study area was not calculated. These basins were not categorized as seasonal wetlands but may pond water long enough to support vernal pool branchiopods and other aquatic invertebrates. These basins collect water from precipitation and run-off from adjacent hillsides.

Drainage

Perennial Drainage

There are three perennial drainages in the study area. The first perennial drainage is located just east of Mountain House Road and encompasses 0.10 acre (Figure 4.2-1; sheet 1). This drainage is approximately 10 feet wide and up to a foot deep with low slopes and a silt substrate. The flowing portion of the creek in July 2009 was an average of 1 foot wide. Several pooled areas are located within the drainage.

The second perennial drainage is Mountain House Creek, which is located north of Grant Line Road in the study area (Figure 4.2-1; sheet 2). Approximately 0.47 acre of this creek is within the study area. The creek crosses underneath the DMC via a culvert, and is associated with emergent marsh wetlands on both sides of the canal. A ponded area is present on the northeast side of the canal, where water backs up before flowing through the culvert. The creek has low to moderately sloped banks. Vegetation within the creek channel consisted mostly of cattails with a few sedges.

The third perennial drainage is located south of Grant Line Road and north of the California Aqueduct (Figure 4.2-1; sheet 2). Approximately 0.04 acre of this creek is within the study area. The drainage is narrow (1–2 feet wide) but passes through a large willow scrub area (outside of the study area) before reaching the DMC. This drainage contains cattail marsh just downstream of the California Aqueduct and at the DMC crossing. During the February 4, 2009 site visit, the drainage was flowing at the California Aqueduct, and there was a wet area on the west side of the DMC. During the July 7, 2009 site visit, the creek was flowing at the DMC. It appears that flow in this drainage is from precipitation and seepage from the California Aqueduct.

Intermittent Drainage

There are two intermittent drainages in the study area. One of the intermittent drainages is a fork of Mountain House Creek (Figure 4.2-1; sheet 2). Approximately 0.16 acre of this creek is within the study area. This drainage is wide (40 feet) with moderately sloped banks, and was dry during the February 4, 2009 survey. Vegetation within the drainage consisted of grasses, rushes, and patches of cattails. Areas of seasonal wetland are located within the channel.

The second intermittent drainage is located north of I-205 in the study area. Approximately 0.03 acre of this creek is within the study area. This drainage flows between and underneath the California Aqueduct and the DMC. The portion of the creek between the two canals has dense cattails. The drainage is wider (about 10 feet) on the east side of the California Aqueduct and becomes narrow (1-3 feet) as it reaches the DMC. On the east side of the DMC, the creek becomes even narrower (1 foot). It appears that flow in this drainage is from precipitation and seepage from the California Aqueduct and DMC.

Ephemeral Drainage

The remaining seven drainages are ephemeral and encompass a total area of approximately 0.18 acre. The drainages are characterized by relatively straight channels with sand, silt, and gravel substrates. Vegetation along the drainages consists of grasses and sparse shrubby vegetation.

Creek channels with well-vegetated areas provide food, water, and migration and dispersal corridors, as well as escape, nesting and thermal cover for many wildlife species (Mayer and Laudenslayer 1988). Wildlife species associated with stream and riparian habitats include western toad (*Bufo boreas*), California newt (*Taricha torosa*), black phoebe (*Sayornis nigricans*), Anna's hummingbird (*Calypte anna*), great egrets (*Ardea alba*), belted kingfishers, raccoon, and striped skunk. (Zeiner et. al 1990a, 1990b). In less-vegetated areas, aquatic species (e.g., fish, invertebrates, and amphibians), are found in the creek channel, and the banks of the channel are often used by species that require less cover, such as California ground squirrel (*Spermophilus beecheyi*), western fence lizard (*Sceloporus occidentalis*), gopher snake (*Pituophis melanoleucus*), and their predators (e.g., coyotes [*Canis latrans*], raptors). The perennial and intermittent drainages provide suitable habitat for California red-legged frog.

Open Water

Open water in the study area consists of the DMC and the California Aqueduct, and three smaller irrigation canals, which in total encompass an area of 124.42 acres. The three smaller irrigation canals are located between Mountain House Road and Kelso Road in the northern portion of the study area (Figure 4.2-1 sheet 1). The DMC, California Aqueduct, and one of the smaller irrigation canals are cement-lined and unvegetated. The other two irrigation canals have dirt bottoms with rip rap and very small amounts of vegetation (grasses and sedges) along the canal banks. The smaller irrigation canals vary from 15–20 feet in width. Open water habitat provides foraging habitat for aquatic bird species such as double-crested cormorant (*Phalacrocorax auritus*) and grebes (Podicepedidae), and waterfowl. Open water habitat may also provide foraging habitat for other bird species, including belted kingfisher (*Ceryle alcyon*), swallows (Hirundinidae), and black phoebe (*Sayornis nigricans*).

Agricultural Land

The study area includes approximately 180.25 acres of alfalfa fields, 14.46 acres of orchards and vineyards, and 29.20 acres of fallow agricultural fields. Agricultural lands are established on fertile soils that historically supported abundant wildlife. The quality of habitat for wildlife is greatly diminished when the land is converted to agricultural uses and is intensively managed. Many species of rodents and birds have adapted to agricultural lands, but they are often controlled by fencing, trapping, and poisoning to prevent excessive crop losses. However, certain agricultural lands have become important habitats for wintering waterfowl and breeding and wintering raptors. Wildlife species associated with agricultural lands include mourning dove (*Zenaida macroura*), American crow (*Corvus brachyrhynchos*), Brewer's blackbird (*Euphagus cyanocephalus*), sandhill crane (*Grus canadensis*), various raptor species, egrets, and many species of rodents. (Mayer and Laudenslayer 1988.) Special-status wildlife that may forage in alfalfa fields in the study area include northern harrier (*Circus cyaneus*), Swainson's hawk (*Buteo swainsoni*) and San Joaquin kit fox.

Developed Areas

Developed areas in the study area consist of rural residential, commercial development, and areas that are bare/disked or have been graded in preparation for development in the foreseeable future. Developed areas encompass approximately 312.86 acres in the study area. Vegetation in developed areas consist primarily of nonnative ornamental species used in landscaping. Developed areas have marginal value for wildlife because of human disturbance and a lack of vegetation. Wildlife species that use these areas typically are adapted to human disturbance. Wildlife species associated with developed areas include western scrub-jay (*Aphelocoma californica)*, northern mockingbird (*Mimus polyglottos*), house finch (*Carpodacus mexicanus*), rock dove (*Columba livia*), raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), and striped skunk (*Mephitis mephitis*) (Mayer and Laudenslayer 1988).

Special-Status Species

Special-status wildlife species are wildlife that are legally protected under the federal Endangered Species Act (ESA), California Endangered Species Act (CESA), or other regulations, and considered sufficiently rare by the scientific community to qualify for such listing. Because NEPA requires that both the context (that being its location within the State of California) and intensity of a project be analyzed, wildlife species that are protected or considered sensitive by the State of California are considered in this EIS. For the purpose of this document, special-status wildlife species are defined as:

- species listed or proposed for listing as threatened or endangered under the ESA (50 CFR 17.12 [listed plants], 50 CFR 17.11 [listed animals], various notices in the FR [proposed species]);
- species that are candidates for possible future listing as threatened or endangered under the federal ESA (73 FR 75176, December 10, 2008);

- 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);
- animal species of special concern to the DFG (California Department of Fish and Game 2009); and
- animals fully protected in California (California Fish and Game Code Sections 3511 [birds], 4700 [mammals], and 5050 [amphibians and reptiles]).

Based on information from the CNDDB records search (2009), the USFWS list (U.S. Fish and Wildlife Service 2009), and the *Delta-Mendota Canal/California Aqueduct Intertie FONSI and EA/IS* (Jones & Stokes 2004), 26 special-status wildlife species are known or have the potential to occur in the project vicinity. The status, distribution, habitat, and potential for occurrence in the study area for each of these species are listed in Table 4.3-1. Ten of the 26 species identified (valley elderberry longhorn beetle [*Desmocerus californicus dimorphus*], Conservancy fairy shrimp [*Branchinecta conservatio*], foothill yellow-legged frog (*Rana boylii*), western pond turtle [*Actinemys marmorata*], Coast [California] horned lizard [*Phrynosoma coronatum*], silvery legless lizard [*Anniella pulchra pulchra*], giant garter snake [*Thamnophis gigas*], Alameda whipsnake [*Masticophis lateralis euryxanthus*], San Joaquin whipsnake [*Masticophia flagellum ruddocki*], and western mastiff bat [*Eumops perotis*]) are unlikely to occur or would not occur in the study area because of the presence of low-quality habitat or lack of suitable habitat. These ten species will not be discussed further. The remaining 16 species have the potential to occur in the study area and are discussed briefly below.

Additionally, non-special-status migratory birds could nest in the study area. Although these species are not considered special-status wildlife, their occupied nests and eggs are protected by California Fish and Game Code 3503 and 3503.5 and the federal Migratory Bird Treaty Act (MBTA).

Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp

Longhorn fairy shrimp (*Branchinecta longiantenna*), vernal pool fairy shrimp and vernal pool tadpole shrimp (vernal pool branchiopods) live in ephemeral freshwater habitats, including vernal pools. These federally listed vernal pool branchiopods are dependent on seasonal fluctuations in their habitat such as presence or absence of water during specific times of the year, the duration of inundation, and other environmental characteristics such as salinity, conductivity, dissolved solids, and pH (59 FR 48136; September 16, 1994.).

Final critical habitat for longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp was designated on August 6, 2003 (68 FR 46684–46809). The study area does not fall within critical habitat for any of these species.

There are records for longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpoles shrimp in the vicinity of the project (California Natural Diversity Database 2009). Several of the seasonal wetlands and small basins in the study area provide suitable habitat for listed vernal pool branchiopods. Unidentified fairy shrimp were observed in a seasonal wetland within the study area near Schulte Road during the January 15, 2009, field visit.

California Tiger Salamander

California tiger salamander is a lowland species restricted to grasslands and low foothill regions where its breeding habitat occurs. Breeding habitat consists of temporary ponds or pools, slower portions of streams, and some permanent waters (Stebbins 2003). Permanent aquatic sites are unlikely to be used for breeding unless they lack fish predators (Jennings and Hayes 1994). Adult California tiger salamanders move from subterranean burrow sites to breeding pools during November–February after warm winter and spring rains (Jennings and Hayes 1994). Eggs are probably laid in January–February at the height of the rainy season (Storer 1925). California tiger salamanders also require dry-season refuge sites in the vicinity of breeding sites (within 1 mile) (Jennings and Hayes 1994). California ground squirrel (*Spermophilus beecheyi*) burrows are important dry-season refuge sites for adults and juveniles (Loredo et al. 1996).

Final critical habitat for California tiger salamander was designated on August 23, 2005 (70 FR 49380–49458). The study area does not fall within critical habitat for California tiger salamander.

California tiger salamander has been recorded in the vicinity of the project (California Natural Diversity Database 2009). Several of the seasonal wetlands in the study area may provide suitable breeding habitat for California tiger salamander if they maintain water long enough for metamorphosis to occur. In addition, grassland and ephemeral drainages in the study area may be used for upland aestivation habitat and dispersal, respectively. Access by salamanders to the portion of the study area located between the DMC and California Aqueduct is limited to drainages that cross under the canals roadway crossings, and portions of the canal that are underground. Because the area between the canals has limited accessibility, the potential for California tiger salamanders to occur in this area is decreased.

California Red-Legged Frog

California red-legged frogs use various aquatic systems as well as riparian and upland habitats (U.S. Fish and Wildlife Service 2002: 12). However, they may complete their entire life cycle in a pond or other aquatic site that is suitable for all life stages (66 FR 14626). California red-legged frogs inhabit marshes; streams; lakes; ponds; and other, usually permanent, sources of water that have dense riparian vegetation (Stebbins 2003: 225). California red-legged frogs are highly aquatic and spend the majority of their lives in the riparian zone (Brode and Bury 1984). Adults may take refuge during dry periods in rodent holes or leaf litter in riparian habitats (U.S. Fish and Wildlife Service 2002). California red-legged frogs breed from November through April and typically lay their eggs in clusters around aquatic vegetation (U.S. Fish and Wildlife Service 2002: 16). Larvae undergo metamorphosis between July and September, 3.5–7 months after hatching (66 FR 14626; March 13, 2001).

Final critical habitat for California red-legged frog was designated on April 13, 2006 (71 FR 19244–19346). Revised critical habitat for California red-legged frog was proposed on September 16, 2008 (71 FR 53492–53680). The study area does not fall within current or proposed critical habitat for California red-legged frog. The northern extent of the study area on the west side of the DMC is immediately adjacent to proposed revised critical habitat, but is not located within it.

Two California red-legged frogs were observed in one of the perennial drainages during the July 2009 field survey. In addition, there are two CNDDB records of observations of California red-legged frog along the California Aqueduct in the study area (California Natural Diversity Database 2009). One of the records is for an adult red-legged frog that was observed in the study area between the DMC and aqueduct and north of I-205 in 2003. The other record is for a breeding population in Mountain House Creek, in and adjacent to the study area. The perennial and intermittent drainages and emergent marsh wetlands provide suitable aquatic habitat (both breeding and nonbreeding habitat) for California red-legged frog. The dirt-bottom irrigation canals could also be occasionally used by California red-legged frog. In addition, grassland in the study area may be used for upland aestivation habitat. Access by frogs to the portion of the study area located between the DMC and California Aqueduct is limited to drainages that cross under the canals roadway crossings, and portions of the canal that are underground. However, as noted above, California red-legged frogs have been observed in this area.

Western Spadefoot

Western spadefoot is a lowland toad that occurs in washes, river floodplains, alluvial fans, playas, and alkali flats in valley and foothill grasslands, open chaparral, and pine-oak woodlands. It breeds in quiet streams and temporary rain pools. This toad prefers habitats with open vegetation and short grasses where the soil is sandy or gravelly (Stebbins 2003: 203). Western spadefoot toads spend a considerable portion of the year underground in burrows (Zeiner et al. 1988: 56). Western spadefoot has been recorded in the vicinity of the project (California Natural Diversity Database 2009). Several of the seasonal wetlands in the study area provide suitable habitat for western spadefoot. Access by toads to the portion of the study area located between the DMC and California Aqueduct is limited to drainages that cross under the canals. Because the area between the canals has limited accessibility, the potential for western spadefoot toads to occur in this area is decreased.

Northern Harrier

Northern harrier is a year-round resident throughout the Central Valley and often is associated with open grassland habitats and agricultural fields. Nests are found on the ground in tall, dense herbaceous vegetation (MacWhirter and Bildstein 1996). Northern harrier nests from April to September, with peak activity in June and July (Zeiner et al. 1990a). The breeding population has been reduced, particularly along the southern coast, because of the destruction of wetland habitat, native grassland, and moist meadows and from the burning and plowing of nesting areas during early stages of breeding (Zeiner et al. 1990a). Northern harrier has been recorded in the vicinity of the project (California Natural Diversity Database 2009). Grasslands and agricultural fields in the study area provide suitable nesting and foraging habitat for northern harrier.

Golden Eagle

Golden eagles (*Aquila chrysaetos*) typically occur in rolling foothills, mountain areas, sage-juniper flats, and deserts (Zeiner et al. 1990a: 142–143). In California, this species nests primarily in open grasslands and oak (*Quercus* spp.) savanna but also will nest in oak woodland and open shrublands. Golden eagles forage in open grassland habitats (Kochert et al. 2002: 6). Preferred territory sites are those that have a favorable nest site, a dependable food supply (medium to large mammals and birds), and broad expanses of open country for foraging. Hilly or mountainous country where takeoff and soaring are supported by updrafts generally is preferred to flat habitats. (Johnsgard 1990: 262.) Golden eagles breed from late January through August, with peak activity from March through July. Eggs are laid from early February to mid-May (Zeiner et al. 1990a: 142). Golden eagle has been recorded in the vicinity of the project (California Natural Diversity Database 2009). There are no suitable nest trees in or immediately adjacent to the study area, but grassland in the study area provides suitable foraging habitat for golden eagles.

Swainson's Hawk

Swainson's hawks forage in grasslands, grazed pastures, alfalfa and other hay crops, and certain grain and row croplands. Vineyards, orchards, rice, cotton, and cotton crops are generally unsuitable for foraging because of the density of the vegetation (California Department of Fish and Game 1992: 41). Swainson's hawks usually nest in large, mature trees. Most nest sites (87%) in the Central Valley are found in riparian habitats (Estep 1989: 35), primarily because trees are more available there. Swainson's hawks also nest in mature roadside trees and in isolated trees in agricultural fields or pastures. The breeding season is from March through August (Estep 1989: 12 and 35). Swainson's hawk has been recorded in the vicinity of the project (California Natural Diversity Database 2009). There are no suitable nest trees in or immediately adjacent to the study area, but suitable nest trees may be present within 0.5 mile of the project, and Swainson's hawks nesting within this distance could be disturbed by the proposed project. In addition, grassland and alfalfa fields in the study area provide suitable foraging habitat for Swainson's hawks.

White-Tailed Kite

White-tailed kite (*Elanus leucurus*) occurs in coastal and valley lowlands in California (Zeiner et al. 1990a: 120). White-tailed kites generally inhabit low-elevation grassland, savannah, oak woodland, wetland, agricultural, and riparian habitats. Some large shrubs or trees are required for nesting and for communal roosting sites. Vegetation structure and prey populations appear to be more important than plant associations in determining suitability. Nest trees range from small, isolated shrubs and trees to trees in relatively large stands (Dunk 1995: 6, 8). White-tailed kites make nests of loosely piled sticks and twigs, lined with grass and straw, near the top of dense oaks, willows, and other tree stands. The breeding season lasts from February through October and peaks between May and August. They forage in undisturbed, open grassland, meadows, farmland, and emergent wetlands (Zeiner et al. 1990a: 120). White-tailed kite has been recorded in the vicinity of the project (California Natural Diversity Database 2009). There are no suitable nest trees in or immediately adjacent to the study area, but grassland and alfalfa fields in the study area provide suitable foraging habitat for white-tailed kites.

Western Burrowing Owl

Western burrowing owls (*Athene cunicularia hypugea*) prefer open grasslands and shrublands with perches and burrows. They usually live and nest in the old burrows of California ground squirrels or other small mammals (Zeiner et al. 1990a: 332) but also can nest in piles of wood or other debris. Burrows can be found on the sides of hills, along roadside embankments, on levees, along irrigation canals, near fence lines, and on or near other raised areas of land. The breeding season for burrowing owls extends from March through August (Zeiner et al. 1990a: 332). There are numerous records of observations of western burrowing owl in the vicinity of the project (California Natural Diversity Database 2009). One record is of an occurrence in the study area along the DMC maintenance road. Grassland along the access/maintenance roads and other areas with sparse vegetation, as well as grazed grassland in and adjacent to the study area, provide suitable breeding and wintering habitat for burrowing owl.

Loggerhead Shrike

Loggerhead shrikes (*Lanius ludovicianus*) occur in open habitats with scattered trees, shrubs, posts, fences, utility lines, or other types of perches. Nests are built in trees or shrubs with dense foliage and usually are hidden well. Loggerhead shrikes search for prey from perches and frequently impale their prey on thorns, sharp twigs, or barbed wire. The nesting period for loggerhead shrikes is March through June (Zeiner et al. 1990b: 46). Loggerhead shrike has been recorded in the vicinity of the project (California Natural Diversity Database 2009). The patch of black willow riparian woodland and scattered coyote brush in the study area provide suitable nesting habitat for loggerhead shrike.

Tricolored Blackbird

Tricolored blackbird (*Agelaius tricolor*) breeding colony sites require open accessible water; a protected nesting substrate including either flooded, thorny, or spiny vegetation; and a suitable foraging space providing adequate insect prey within a few miles of the nesting colony. Historically, tricolored blackbird breeding colonies were nearly all located in freshwater marshes dominated by tules (*Scirpus* sp.) and cattails (*Typha* sp.). More recently, an increasing percentage of breeding colonies has been documented in Himalaya blackberries (*Rubus discolor*) and in silage and grain fields. Tricolored blackbird foraging habitats in all seasons include annual grasslands, dry seasonal pools, agricultural fields (such as large tracts of alfalfa with continuous mowing schedules and recently tilled fields), cattle feedlots, and dairies. Tricolored blackbirds also forage occasionally in riparian scrub habitats and along marsh borders. Weed-free row crops and intensively managed vineyards and orchards do not serve as regular foraging sites. Most tricolored blackbirds forage within 3 miles of their colony sites, but commute distances of up to 8 miles have been reported. (Beedy and Hamilton 1997.) Tricolored blackbird has been recorded in the vicinity of the project (California Natural Diversity Database 2009). There is no suitable nesting habitat in or immediately adjacent to the study area, but grassland and agricultural fields in the study area provide suitable foraging habitat for tricolored blackbirds.

Pallid Bat

Pallid bat (*Antrozous pallidus*) is found throughout most of California at low to middle elevations (6,000 feet). Pallid bats are found in a variety of habitats, including desert, brushy terrain, coniferous forest, and non-coniferous woodlands. Daytime roost sites include rock outcrops, mines, caves, hollow trees, buildings, and bridges. Night roosts are commonly under bridges but are also in cave and mines (Brown and Pierson 1996). Hibernation may occur during late November through March. Pallid bats breed from late October through February (Zeiner et al. 1990b: 70), and one or two young are born in May or June (Brown and Pierson 1996). Pallid bat has been recorded in the vicinity of the project (California Natural Diversity Database 2009). The bridges and other overcrossings over the canals may have cracks that provide suitable roosting habitat for pallid bats. In addition, pallid bats could forage or drink in the study area.

San Joaquin Kit Fox

Because agriculture has replaced much of the native Central Valley habitat, San Joaquin kit foxes appear to have adapted to living in marginal areas such as grazed, nonirrigated grasslands; peripheral lands adjacent to tilled and fallow fields; irrigated row crops, orchards, and vineyards; and petroleum fields and urban areas (U.S. Fish and Wildlife Service 1998: 129). San Joaquin kit foxes usually prefer areas with loose-textured soils suitable for den excavation (Orloff et al. 1986: 62) but are found on virtually every soil type (U.S. Fish and Wildlife Service 1998: 129). Where soils make digging difficult, kit foxes may enlarge or modify burrows built by other animals, particularly those of California ground squirrels (Orloff et al. 1986: 63; U.S. Fish and Wildlife Service 1998: 127). Structures such as culverts, abandoned pipelines, and well casings also may be used as den sites (U.S. Fish and Wildlife Service 1998: 127). The breeding season begins during September and October when adult females begin to clean and enlarge natal or pupping dens. Mating and conception occur between late December and March, and litters of two to six pups are born between late February and late March. (U.S. Fish and Wildlife Service 1998: 126.) San Joaquin kit fox has been recorded in the vicinity of the project (California Natural Diversity Database 2009). Grassland in and adjacent to the study area provides denning and foraging habitat for San Joaquin kit foxes. Numerous California ground squirrels and their burrows were observed during the field surveys.

American Badger

American badgers occur in a wide variety of open, arid habitats but most commonly are associated with grasslands, savannas, and mountain meadows. They require sufficient food (burrowing rodents), friable soils, and relatively open, uncultivated ground (Williams 1986: 67). Badgers dig burrows, which are used for cover and reproduction. The species mates in summer and early autumn, and young are born in March and early April (Zeiner et al. 1990b: 312). American badger has been recorded in the vicinity of the project (California Natural Diversity Database 2009). Grassland in and adjacent to the study area provides denning and foraging habitat for American badgers.

Non-Special-Status Migratory Birds

Non-special-status migratory birds could nest on the ground, in emergent marsh habitat, or in shrubs or trees in and adjacent to the study area. The breeding season for most birds is generally from March 1 to August 30. The occupied nests and eggs of these birds are protected by federal and state laws, including the MBTA and California Fish and Game Code Sections 3503 and 3503.5. The DFG is responsible for overseeing compliance with the codes and makes recommendations on nesting bird and raptor protection.

A focused nest survey was not conducted during any of the field surveys that were conducted. Several migratory birds, including killdeer, western meadowlark, yellow-rumped warbler (*Dendroica coronata*), and red-winged blackbird (*Agelaius phoeniceus*), were observed during 2009 surveys and could nest in or adjacent to the study area. These generally common species are locally and regionally abundant.

4.3.5 Environmental Consequences

Assessment Methods

Effects on wildlife and wildlife habitat would be considered adverse if the implementation of Alternatives 2, 3, or 4 would result in temporary or permanent disturbance of habitat for special-status species and other wildlife attributable to construction-related activities or disturbance of special-status wildlife from ongoing operational activities (maintenance) that result in increased human presence/activity and ground disturbance.

Impact Mechanisms

Wildlife resources could be directly or indirectly affected by Alternatives 2, 3, and 4. The following types of activities could cause impacts on wildlife resources. These impact mechanisms were used to assess project-related effects on wildlife resources in the study area:

- grading and paving activities during construction and building activities;
- removal of habitat or injury or mortality of special-status species;
- temporary stockpiling and sidecasting of soil, construction materials, or other construction wastes;
- soil compaction, dust, and water runoff from the construction and development site;
- changes in hydrology of seasonal wetlands, emergent marshes, and/or drainages; and
- degradation of water quality in seasonal wetlands, emergent marshes, and drainages resulting from construction runoff containing petroleum products or sediment from erosion.

Impact Assumptions

Construction activities associated with Alternatives 2, 3, and 4 could result in temporary or permanent effects on special-status wildlife and their habitats in the study area. In assessing the magnitude of possible effects, the following assumptions were made regarding construction-related impacts on special-status wildlife and their habitats.

- Direct effects on all seasonal wetlands, emergent marshes, and drainages will be avoided, and there would be no temporary or permanent loss of these features from construction or operation of any of the project alternatives.
- No fill material will be directly placed in any seasonal wetland, emergent marsh, or drainage.
- No woody riparian species will be removed.
- All equipment and vehicle staging will occur in the study area.
- Permanent effects would result from the footprint of the pump station facilities, transmission line, and associated features. Temporary impacts would result from pipeline installation, staging areas, and permanent and temporary storage areas for spoils.
- Construction of the transmission line for Alternatives 2 and 3 would not adversely affect any seasonal wetland, emergent marsh, drainage, or riparian habitat (i.e., no transmission towers would be placed in these habitats).
- Reclamation will implement all environmental commitments identified in the project description and mitigation measures identified in this chapter to avoid or minimize adverse affects on special-status and common wildlife species.
- If any staging areas, laydown areas, office sites, or spoils areas are identified outside the study area, they will be located in previously graded, paved, or disturbed areas that do not support any habitat for special-status wildlife. These staging areas will be evaluated and approved by Reclamation prior to the contractor's use of the area.
- Construction access will be along existing roads and would not affect habitat for special-status wildlife.

Regulatory Setting

Federal Regulations

Endangered Species Act

The ESA protects fish and wildlife species and their habitats that have been identified by the USFWS as threatened or endangered. *Endangered* refers to species, subspecies, or distinct population segments (DPSs) that are in danger of extinction through all or a significant portion of their range. *Threatened* refers to those likely to become endangered in the near future.

The ESA is administered by USFWS and the National Marine Fisheries Service (NMFS). In general, NMFS is responsible for protection of ESA-listed marine species and anadromous fishes, whereas other listed species are under USFWS jurisdiction. Provisions of Sections 7 and 9 of ESA are relevant to this project and are summarized below.

Section 7: Endangered Species Act Authorization Process for Federal Actions

Section 7 provides a means for authorizing take of threatened and endangered species by federal agencies. It applies to actions that are conducted, permitted, or funded by a federal agency. Under Section 7, the federal agency conducting, funding, or permitting an action (the federal lead agency) must consult with USFWS, as appropriate, to ensure that the proposed action will not jeopardize endangered or threatened species or destroy or adversely modify designated critical habitat. If a proposed action "may affect" a listed species or designated critical habitat, the lead agency is required to prepare a biological assessment evaluating the nature and severity of the expected effect. In response, USFWS issues a biological opinion, with a determination that the proposed action either:

- may jeopardize the continued existence of one or more listed species (jeopardy finding) or result in the destruction or adverse modification of critical habitat (adverse modification finding), or
- will not jeopardize the continued existence of any listed species (no jeopardy finding) or result in adverse modification of critical habitat (no adverse modification finding).

The biological opinion may stipulate discretionary "reasonable and prudent" alternatives. If the proposed action would not jeopardize a listed species, USFWS issues an incidental take statement to authorize the proposed project.

Concurrent with the preparation of the EA/IS (Jones & Stokes 2004) for the project, Reclamation prepared a BA and consulted with USFWS on California red-legged frog and San Joaquin kit fox. Because the project has changed since this consultation, and California tiger salamander became listed as threatened, Reclamation will prepare a revised BA that will address potential effects on longhorn fairy shrimp, vernal pool fairy shrimp, California tiger salamander, California red-legged frog, and San Joaquin kit fox.

Section 9: Endangered Species Act Prohibitions

Section 9 prohibits the take of any wildlife species federally listed as endangered. Take of threatened species also is prohibited under Section 9, unless otherwise authorized by federal regulations.[1] *Take*, as defined by ESA, means "to harass,

[1] In some cases, exceptions may be made for threatened species under Section 4[d]. In such cases, USFWS or NMFS issues a "4[d] rule" describing protections for the threatened species and specifying the circumstances under which take is allowed.

harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." *Harm* is defined as "any act that kills or injures the species, including significant habitat modification." In addition, Section 9 prohibits removing, digging up, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction.

Migratory Bird Treaty Act

The MBTA (16 USC 703) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and the Soviet Union and authorizes the U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. It establishes seasons and bag limits for hunted species and protects migratory birds, their occupied nests, and their eggs (16 USC 703; 50 CFR 21; 50 CFR 10). Most actions that result in taking or in permanent or temporary possession of a protected species constitute violations of MBTA. USFWS is responsible for overseeing compliance with MBTA.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires coordination with USFWS, NMFS, and DFG when the waters of any stream or other body of water are proposed, authorized, permitted, or licensed to be impounded, diverted, or otherwise controlled or modified under a federal permit or license (16 USC 661–667[e]). USFWS typically prepares a Coordination Act Report (CAR) with recommendations to address impacts to fish and wildlife resources. The recommendations in the CAR are advisory only. USFWS provided a CAR for the project in November 2004 and the recommendations in the report were incorporated into the final EA/IS (Jones & Stokes 2005). Additionally, USFWS prepared a CAR in April 2009 for the updated project (as described in this EIS). Several of the recommendations were incorporated into the mitigation measures in this EIS. The 2004 and 2009 CARs are included in Appendix H.

4.3.6 Environmental Effects

Alternative 1 (No Action)

Under this alternative, the proposed action would not be constructed. Reclamation would continue to operate and maintain the DMC as it currently is. There would be no construction or change in operations and therefore no effects on wildlife resources.

Alternative 2 (Proposed Action)

Construction Effects

Alternative 2 consists of constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct, a 69-kV transmission line connecting to the Tracy substation, and associated construction-related activities.

Impact WILD-1: Potential Degradation or Changes in Hydrology of Habitat for Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp

Although direct disturbance of seasonal wetlands that provide suitable habitat for longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp would not occur, these wetlands could be degraded if petroleum-based pollutants or sediment enters pools from construction runoff. Implementation of Environmental Commitments described in Chapter 2 (i.e., construction only during the dry season, the SWPPP, and implementation of County requirements for grading and erosion control) would minimize the potential for degradation of habitat for these vernal pool branchiopods. Because the proposed location of the Intertie, access road, associated facilities, and staging areas would not be located within 250 feet of habitat for vernal pool branchiopods, construction of these project components would not result in changes in hydrology of vernal pool branchiopod habitat. Some of the transmission line poles could be located within 250 feet of suitable habitat, but the poles would be installed within the existing spoils mounds along the DMC, and augering for the poles would be above the base of the pools. Therefore, augering near the pools would not cut, crack, or otherwise affect the substrata supporting the pool, leading to hydrologic changes. With implementation of Environmental Commitments identified in Chapter 2, there would be no adverse effects on listed vernal pool branchiopods and their habitat from construction of the Proposed Action

Impact WILD-2: Potential Injury or Mortality of California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad

The proposed project would not remove or disturb suitable aquatic habitat for California tiger salamander, California red-legged frog, and western spadefoot but would directly affect upland habitat where salamanders, frogs, and toads may be present. Mortality or injury of California tiger salamanders, California red-legged frogs, and western spadefoot toads in upland habitat could occur if burrows containing individuals are crushed by construction equipment or are buried under spoils; individuals are displaced from burrows exposing them to predators and desiccation; or individuals encounter construction equipment while migrating through the work area. In addition, project construction could temporarily impede the movement of juvenile and adult tiger salamanders, red-legged frogs, and spadefoot toads dispersing between breeding areas and upland refuge sites. The potential effects on California tiger salamander, California red-legged frog, and western spadefoot are considered adverse. However, with implementation of the following mitigation measures, the project would have no adverse effect on these three species.

Mitigation Measure WILD-MM-1: Conduct Preconstruction Surveys for California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot

To avoid and minimize injury and mortality of California tiger salamanders, California red-legged frogs, and western spadefoot toads, Reclamation will retain a qualified wildlife biologist to conduct preconstruction clearance surveys no more than 24 hours before ground disturbance in upland habitat and conduct ongoing monitoring of construction in upland habitats. The biologist also will survey suitable adjacent aquatic habitat to determine whether California tiger salamanders, California red-legged frogs, and western spadefoot toads are in the vicinity of project activities.

In upland habitat, the biologist will search the construction area for burrows that provide suitable aestivation habitat. As feasible, aestivation areas identified within the project boundaries will be temporarily fenced and avoided. At locations where potential aestivation burrows are identified and cannot be avoided, the aestivation burrows will be examined with a burrow probe and if unoccupied, they will be excavated by hand prior to construction. If a burrow is occupied, the individual animal will be moved to a natural burrow or artificial burrow constructed of PVC pipe within 0.25 mile of the project area. Excavation and relocation will be conducted only by USFWS-approved biologists and only in accordance with authorization by USFWS in a biological opinion.

Mitigation Measure WILD-MM-2: Implement Measures during Construction to Avoid and Minimize Potential Injury or Mortality of California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot

The following measures will be implemented to avoid and minimize potential injury or mortality of California tiger salamanders, California red-legged frogs, and western spadefoot toads during construction:

- To minimize disturbance and mortality of California tiger salamanders, California red-legged frogs, and western spadefoot toads in suitable habitat, the project proponent will minimize the extent of ground-disturbing activities by confining the project footprint and limiting the work area to the minimum area necessary for construction. In addition, the boundaries of the work area(s) will be fenced with orange barrier fencing to limit the work area(s).
- A qualified biologist will train all construction personnel regarding habitat sensitivity; identification of California tiger salamanders, California red-legged frogs, and western spadefoot toads; and required practices before

the start of construction. The training will include the measures to be implemented to protect the species, any requirements of the USFWS biological opinion, the penalties for noncompliance, and the location of boundaries of the construction area. A fact sheet or other supporting materials containing this information will be prepared and distributed. Upon completion of training, employees will sign a form stating that they attended the training and understand all the conservation and protection measures.

- All ground-disturbing activities in suitable upland habitat will be conducted during the dry season, between May 1 and October 15, or before the onset of the rainy season, whichever occurs first unless exclusion fencing is used. Construction that commences in the dry season may continue into the rainy season if exclusion fencing is placed between the construction area and the suitable habitat to keep salamanders and frogs from entering the construction area.
- A USFWS-approved biological monitor will remain on site during initial ground-disturbing activities in upland habitat. If a California tiger salamander, California red-legged frog, or western spadefoot toad is found, it will be captured and placed in suitable habitat outside the construction area. In order to move California tiger salamanders or California red-legged frogs, a biological opinion authorizing incidental take, as described above under ESA, must be obtained from the USFWS prior to the start of construction activities.
- All food and food-related trash will be stored away from sensitive areas and enclosed in sealed trash containers at the end of each workday. Food-related trash removal will occur no less frequently than every 3 days.
- No pets will be allowed on the construction site.
- Speed limits of 10 mph will be maintained on all access roads in and leading to the construction area.
- All equipment will be maintained so that there will be no leakage of automotive fluids such as fuels, oils, and solvents. Any fuel or oil leaks will be cleaned up immediately and disposed of properly.
- All hazardous materials such as fuels, oils, solvents, etc., will be stored in sealable containers in a designated location that is at least 200 feet from the drainages or other aquatic habitats. All fueling and maintenance of vehicles and other equipment will be done at least 200 feet these areas.
- If a California tiger salamander or California red-legged frog is encountered during any project activities, activities will cease until the salamander or frog is removed by a USFWS-approved biologist and relocated to nearby suitable aquatic habitat. USFWS and DFG will be notified within 1 working day of any California tiger salamander or California red-legged frog relocation.

Impact WILD-3: Potential Degradation of Aquatic Habitat and Temporary and Permanent Loss of Upland Habitat for California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad

The proposed project would not remove or disturb suitable aquatic habitat for California tiger salamanders, California red-legged frogs, and western spadefoot toads but it could degrade suitable aquatic habitat for California tiger salamander and California red-legged frog. One of the intermittent drainages is located approximately 100 feet southeast of the proposed Intertie construction area and within the 2,600-foot area that permanent spoilsbanks could be located. Activities at the Intertie construction area or placement of spoilsbanks could result in erosion or sedimentation from disturbed surfaces and result in degradation of suitable aquatic habitat. Environmental commitments that are part of the proposed project that would minimize and avoid degradation of suitable aquatic habitat include environmental education, locating spoils sites as far from aquatic habitat as possible, installing barrier fencing and erosion control measures, and biological monitoring. With these measures in place, potential degradation of suitable habitat would not be considered an adverse affect.

Approximately 1.2 acres of upland habitat for California tiger salamander and California red-legged frog would be permanently removed from construction of the Intertie and from the pole footprints along the transmission line. Approximately 13.0 acres of upland habitat would be temporarily removed from activities associated with construction of the Intertie (10.3 acres from staging areas, temporary soil stockpiling areas, the temporary access route at the Intertie, permanent spoils banks, and installation of pipelines) and from activities associated with the transmission line (2.7 acres from laydown/staging areas and pulling/tension stations). The amount of habitat affected is a very small portion (0.04%) of the total amount of annual grassland in the study area (347 acres). The 13.0 acres of habitat that would be temporarily affected will be restored through implementation of the environmental commitment to revegetate temporarily disturbed areas (see Chapter 2). The permanent loss of 1.2 acres of suitable upland habitat would not adversely affect California tiger salamander, California red-legged frog, and western spadefoot toad because upland habitat surrounding the proposed action would continue to provide aestivation and dispersal habitat for these species, such that they could continue to inhabit the area around the proposed project. Therefore, the temporary and permanent loss of upland habitat would not be considered an adverse effect.

Impact WILD-4: Potential Disturbance of Nesting Northern Harrier, Swainson’s Hawk, White-Tailed Kite, Loggerhead Shrike, and Non-Special-Status Migratory Birds

There are no suitable nest trees for Swainson’s hawk or white-tailed kite in the study area; however, suitable nest trees may be present within 0.5 mile of the study area. Suitable nesting habitat for northern harrier and loggerhead shrike are present in the study area. Raptors (e.g., eagles, kites, hawks, owls) could nest within 0.5 mile of the study area, and other birds may nest in the study area. Migratory birds and their nests are protected under both California Fish and Game Code Section 3503 (active bird nests) and the MBTA. Removal of nests or suitable nesting habitat and construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Loss of raptor and other migratory bird eggs or nests, or any activities resulting in nest abandonment, would be considered an adverse effect. However, with implementation of the following mitigation measure, the project would have no adverse effect on special-status or other migratory birds.

Mitigation Measure WILD-MM-3: Avoid Construction during the Nesting Season of Migratory Birds or Conduct Preconstruction Survey for Nesting Birds

To avoid disturbing any active ground-, tree-, or shrub-nesting migratory birds, including northern harrier, Swainson's hawk, white-tailed kite, and loggerhead shrike, construction activities will be conducted during the non-breeding season (generally between September 1 and February 28). If construction activities cannot be avoided during the nesting season (generally between March 1 and August 30), a minimum of two preconstruction surveys will be conducted by a qualified biologist to determine whether there are active nests in the construction area or any raptor nests within 0.5 mile of the construction area. The construction area is defined as any area where work will occur and includes gravel and dirt access roads and staging areas. The surveys will include a search of all trees and shrubs, as well as annual grassland areas, for ground-nesting birds. One of the surveys will be conducted no more than 14 days prior to construction. Nest sites will be marked on an aerial photograph, and the locations will be recorded using global positioning system (GPS). If the biologist determines that the areas surveyed do not contain any active nests, construction activities can commence without any further mitigation. If construction activities cease and begin again during a 12-month period, they should be reinitiated before the next breeding season begins or another set of preconstruction surveys will be conducted.

If an active Swainson's hawk nest is found, construction activities that would result in the greatest disturbance to the active nest site will be deferred until as late in the breeding season as possible.

If active raptor nests or other migratory bird nests are located on or adjacent to the project site during the preconstruction survey, and construction must occur during the breeding season, construction will not occur within 500 feet of an active nest until the young have fledged, as determined by a qualified biologist, or until Reclamation receives written authorization from USFWS and/or DFG to proceed.

Bald and golden eagles are not expected to nest in or adjacent to the study area because of a lack of suitable nesting habitat/nest trees. In the unlikely event that bald or golden eagles are found (during preconstruction surveys) to be nesting in proximity to the construction area such that they may be adversely affected by construction activities, Reclamation will consult with USFWS under the Bald and Golden Eagle Protection Act to avoid or minimize effects.

Impact WILD-5: Loss of Suitable Foraging Habitat for Swainson's Hawk

Construction of the proposed action would permanently remove approximately 1.2 acres and temporarily remove approximately 13.0 acres of annual grassland that provides suitable Swainson's hawk foraging habitat. The amount of habitat affected is a very small portion (0.04%) of the total amount of annual grassland that will be available for foraging in the study area (347 acres). Because these losses are very small and would not substantially reduce available foraging habitat for Swainson's hawk in the study area, the loss of this habitat would not to be an adverse effect.

Impact WILD-6: Potential Mortality or Disturbance of Western Burrowing Owl

The annual grassland in the study area is suitable breeding and wintering habitat for burrowing owl. This species has been observed in the study area in the past, and there are known records in the project vicinity. Construction in and adjacent to occupied burrows could result in mortality of or disturbance to nesting or wintering western burrowing owls. Construction of the proposed action would permanently remove approximately 1.2 acres and temporarily remove approximately 13.0 acres of suitable foraging or burrow habitat for this species. Nesting burrowing owls are protected under the MBTA and California Fish and Game Code Sections 3503 and 3503.5. Loss of active breeding or wintering burrows or disturbance of breeding burrows resulting in mortality of young and displacement of adults is considered an adverse effect. However, with implemention of the following mitigation measures, the project would have no adverse effect on this species.

Mitigation Measure WILD-MM-4a: Conduct Preconstruction Surveys for Western Burrowing Owl

The DFG's *Staff Report on Burrowing Owl Mitigation* (California Department of Fish and Game 1995) recommends that preconstruction surveys be conducted to locate active burrowing owl burrows in the construction work area and within a 500-foot-wide buffer zone around the construction area. The work area includes all areas where ground disturbance would occur, access roads, staging areas, and spoils storage areas. Reclamation will retain a qualified biologist to conduct preconstruction surveys for active burrows according to the DFG's guidelines. The preconstruction surveys will include a breeding season survey (between April 15 and July 15) and wintering season survey (between December 1 and January 31). 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. If no burrowing owls or sign (e.g., feathers, white wash, prey remains) is detected, no further mitigation is required. If burrowing owls or their sign are found, Mitigation Measure WILD-MM-4b will also be implemented.

Mitigation Measure WILD-MM-4b: Avoid and Minimize Effects on Western Burrowing Owl

Reclamation will avoid loss or disturbance of western burrowing owls and their burrows to the maximum extent possible. No burrowing owls will be disturbed during the nesting season (February 1 through August 31). A 250-foot buffer, within which no construction would be permissible, will be maintained between construction activities and nesting burrowing owls. The nesting owls will be monitored periodically by a qualified biologist to ensure that nesting activities are not being disrupted. This protected area will remain in effect until August 31 or, at the DFG's discretion and based on monitoring evidence, until the young owls are foraging independently. If accidental take (disturbance, injury, or death of owls) occurs, the DFG will be notified immediately.

During the wintering season (September 1 through January 31), if avoidance is not possible in the work area or within 160 feet of the work area, eviction of owls may be permitted pending an evaluation of eviction plans by DFG. The guidelines require that one-way doors be installed at least 48 hours before construction at all active burrows in the construction area so that the burrows are not occupied during construction activities. The one-way doors will be installed at that time to ensure that the owls can get out of the burrows and cannot get back in. The guidelines also require the enhancement of unsuitable burrows (enlarging or clearing of debris), or the installation of two artificial burrows for each occupied burrow that is removed, and compensation for loss of habitat. Artificial burrows will be constructed prior to the installation of one-way doors.

Impact WILD-7: Potential Disturbance, Injury, or Mortality of San Joaquin Kit Fox and American Badger

Construction in suitable denning and foraging habitat for San Joaquin kit fox and American badger could result in disturbance, injury, or mortality of these species. Potential direct effects include damage to or destruction of dens, direct mortality from construction vehicles or heavy equipment, direct mortality from den collapse and subsequent suffocation, temporary disturbance from noise and human presence associated with construction activities, and harassment by construction personnel. In addition, exposed pipes or large excavated holes that are left open after construction has finished for the day could entrap San Joaquin kit foxes and American badgers moving through the construction area. The injury or mortality of San Joaquin kit fox (a federally listed endangered and state-listed threatened species) and American badger (a species whose populations have declined drastically during the last century [Williams 1986]) from construction activities is considered an adverse effect. However, with implementation of the following mitigation measures, the project would have no adverse effect on these species.

Mitigation Measure WILD-MM-5: Conduct Preconstruction Den Surveys for San Joaquin Kit Fox and American Badger and Avoid or Protect Dens

Reclamation will retain a qualified biologist (as determined by USFWS [U.S. Fish and Wildlife Service 1999a, 1999b]) to conduct a preconstruction survey no more than 30 days before the beginning of ground disturbance or any activity that may affect San Joaquin kit fox or American badger. The biologist will survey the proposed construction area and a 200-foot buffer area around the construction area to identify suitable dens (U.S. Fish and Wildlife Service 1999a). The work area includes all areas where ground disturbance would occur, access roads, staging areas, and spoils storage areas. The biologist will conduct den searches and classify dens according to USFWS protocol (U.S. Fish and Wildlife Service 1999a). Written results of the surveys will be submitted to USFWS and DFG within 1 week of the completion of surveys and prior to the beginning of ground disturbance and/or construction activities that could affect San Joaquin kit fox or American badger.

After preconstruction den searches and before the commencement of construction activities, a qualified biologist will establish and maintain the following exclusion zones measured in a radius outward from the entrance or cluster of entrances of each den.

- Potential and atypical dens: A total of 4–5 flagged stakes will be placed 50 feet from the den entrance(s) to identify the den location.
- Known den: Orange construction barrier fencing will be installed between the construction work area and the known den site at a minimum distance of 100 feet from the den. The fencing will be maintained until all construction-related disturbances have been terminated. At that time, all fencing will be removed to avoid attracting subsequent attention to the den.
- Natal/pupping den: USFWS will be contacted immediately if a natal or pupping den is discovered at or within 200 feet of the boundary of the construction area.

Construction and other project activities will be prohibited or greatly restricted within these exclusion zones. Only essential vehicle operation on existing roads and foot traffic will be permitted. All other construction activities, vehicle operation, material and equipment storage, and other surface-disturbing activities will be prohibited in the exclusion zones.

In cases where avoidance is not a reasonable alternative, limited destruction of potential kit fox or badger dens will be allowed. Potential dens can be removed by careful hand excavation by, or under the supervision of, a USFWS- and DFG-approved biologist, after the dens have been monitored for 3 days with tracking medium or a remote sensor camera and determined to be vacant. If, during excavation or monitoring, a potential den is determined to be currently or previously used (e.g., kit fox or badger sign found inside) by kit fox or badger, destruction of the den or construction in that area will cease and USFWS and DFG will be notified immediately. Excavation and collapse of burrows will be conducted only by USFWS- and DFG-approved biologists and only in accordance with authorization by USFWS in a biological opinion for San Joaquin kit fox and if authorized by DFG for American badger.

Mitigation Measure WILD-MM-6: Provide Escape Ramps or Cover Open Trenches at the End of Each Day to Avoid Entrapment of San Joaquin Kit Fox and American Badger

To avoid entrapment of San Joaquin kit fox and American badger, all excavated steep-walled holes or trenches more than 1 foot deep will be provided with one or more escape ramps constructed of earth fill or wooden planks at the end of each workday. If escape ramps cannot be provided, holes or trenches will be covered with plywood or similar materials. Providing escape ramps or covering open trenches would prevent injury or mortality of foxes and badgers resulting from falling into trenches and becoming trapped. The biological monitor will thoroughly inspect trenches for the presence of federally listed species at the beginning of each workday.

Impact WILD-8: Temporary Disturbance and Permanent Loss of Suitable Habitat for San Joaquin Kit Fox and American Badger

The proposed action would permanently remove approximately 1.2 acres and temporarily remove approximately 13.0 acres of suitable foraging and denning (grassland) habitat for San Joaquin kit fox and American badger. The amount of habitat affected is a very small portion (0.04%) of the total amount of annual grassland in the study area (347 acres). Areas that are temporarily affected will be restored through implementation of the environmental commitment to revegetate temporarily disturbed areas (see Chapter 2). The permanent loss of a small amount of suitable foraging and denning habitat would not adversely affect San Joaquin kit fox and American badger because grassland surrounding the proposed action would continue to provide foraging and denning opportunities for these species, such that they could continue to inhabit the area around the proposed project. Therefore, the temporary and permanent loss of suitable foraging and denning habitat would not be considered an adverse effect.

Operation Impacts

Operation of the Intertie Pumping Plant and the associated increased operation of Jones Pumping Plant would not result in any operational effects on special-status wildlife or their habitats. Periodic maintenance and inspection of the pumping plant would require vehicle travel along the O&M roads along the DMC and California Aqueduct. Inspection and maintenance of the transmission line also would occur once per year and would require vehicle travel along the O&M road along the DMC. Because maintenance and inspections are expected to be done at most a few times a year, it is expected that injury or mortality of special-status wildlife from vehicle strikes would not occur or would be rare. In addition, access roads are gravel and this limits the speed that vehicles can travel on the roads. The increase in pumping would not result in changes in stage (refer to Section 3.2, Delta Tidal Hydraulics) that could affect special-status wildlife.

Impact WILD-9: Potential Injury or Mortality of Migratory Birds from Electrocution or Collisions with the New Transmission Line

The proposed action includes the construction of a 69-kV transmission line between the proposed action and the Tracy substation. After the transmission line is constructed, it would be an electrocution hazard and an obstruction to migratory birds flying through the area. Birds that fly into the transmission lines could be injured or die from electrocution or impact with the wires. Because of the proximity of the transmission line to water in the adjacent canals and to grassland and agricultural lands in the vicinity, waterfowl, waterbirds, raptors and passerines would utilize the general area surrounding the project site and are at risk of electrocution and collision with the transmission line. If a substantial number of birds were killed from collision from the transmission line such that the local populations were affected, this would be considered an adverse effect. However, with implementation of the following mitigation measures, operation of the transmission line would have no adverse effect on migratory birds.

Mitigation Measure WILD-MM-7: Prepare and Implement an Avian Protection Plan

To avoid injury and mortality of migratory birds from electrocution or collisions with the new transmission line, Reclamation will prepare and implement an Avian Protection Plan (APP). The APP will follow the Avian Protection Plan Guidelines (Guidelines) established by the Edison Electric Institute’s Avian Power Line Interaction Committee (APLIC) and USFWS (2005). At a minimum, the APP will contain the following measures from the Guidelines and the 2009 CAR to avoid and minimize injury and mortality of migratory birds:

- Provide Training on Avian Issues to Personnel. All appropriate personnel, including managers, supervisors, line crews, engineering, dispatch, and design personnel, will be properly trained in avian issues. This training will encompass the reasons, need, and method by which employees will report an avian mortality, follow nest management protocols, dispose of carcasses, and comply with applicable regulations, including the consequences of non-compliance. Supplemental training also may be appropriate where there are material changes in regulations, permit conditions, or internal policies. Personnel may also attend APLIC-sponsored “short courses” on avian electrocution, collision, and nest issues, which are conducted annually throughout the U.S, or view a 2 hour overview presentation of avian issues that is available from APLIC (see <http://aplic.org>).

- Design and Construct Transmission Line to Reduce Mortality of Birds. The new transmission line will be designed and constructed with the following specifications:
  - Use a horizontal and vertical separation between energized and/or grounded parts that allows sufficient clearance for wrist-to-wrist (flesh-to-flesh) and head-to-foot (flesh-to-flesh) clearance for the largest migratory birds in the project area. The standard 60 inches of horizontal separation and 40-48 inches of vertical separation between energized and/or grounded parts are generally recommended for eagles, and should be sufficient for the migratory birds occurring in the project area.
  - Cover exposed grounded or energized parts to prevent avian contact.
  - Minimize the risk of collision by removing the overhead ground wire, or marking the line to increase visibility with marker balls, swinger markers, or bird flight diverters.
- Report Avian Mortalities. Reclamation will develop a system to monitor and report avian mortalities associated with the transmission line. All injured or dead birds along the transmission line will be reported to DFG and USFWS. Data collected should include the location of the injury or mortality (mapped on a topographic map or aerial photo), identification of the species if possible, problematic poles or line configurations, and any remedial actions taken. All data should be regularly entered into a searchable database (Bird Mortality Tracking System software developed by APLIC is available for free upon request at <http://aplic.org>).

Mitigation Measure WILD-MM-8: Consult with USWS under the Bald and Golden Eagle Protection Act

Because there is potential for bald or golden eagles to fly through the project area and be injured or killed from electrocution or collision with the transmission line, Reclamation will consult with USFWS under the Bald and Golden Eagle Protection Act.

Alternative 3 (TANC Intertie Site)

Construction Effects

Alternative 3 is similar in design to the Proposed Action. Alternative 3 consists of constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct, a 69-kV transmission line connecting to the Tracy substation, and associated construction-related activities. The only differences between the Proposed Action and Alternative 3 are the location of the

Intertie and appurtenant structures, and the length of the proposed new transmission line, which would be longer because the TANC Intertie site is located at the southeast end of the study area and the Tracy substation is located at the northwest end of the study area.

Impact WILD-1: Potential Degradation or Changes in Hydrology of Habitat for Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp

Although direct disturbance of seasonal wetlands that provide suitable habitat for longhorn fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp would not occur, these wetlands could be degraded if petroleum-based pollutants or sediment enters pools from construction runoff. Implementation of Environmental Commitments described in Chapter 2 (i.e., the SWPPP and implementation of County requirements for grading and erosion control) would minimize the potential for degradation of habitat for these vernal pool branchiopods. Because the proposed location of the Intertie, access road, associated facilities, and staging areas would not be located within 250 feet of habitat for vernal pool branchiopods, these project components would not result in changes in hydrology of vernal pool branchiopod habitat. Some of the transmission line poles could be located within 250 feet of suitable habitat, but the poles would be installed within the existing spoils mounds along the DMC, and augering for the poles would be above the base of the pools. Therefore, augering near the pools would not cut, crack, or otherwise affect the substrata supporting the pool, leading to hydrologic changes. With implementation of Environmental Commitments identified in Chapter 2, there would be no adverse effects on listed vernal pool branchiopods and their habitat from construction of the Proposed Action.

Impact WILD-2: Potential Injury or Mortality of California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad

Implementation of Alternative 3 would not remove or disturb suitable aquatic habitat for California tiger salamander, California red-legged frog, and western spadefoot toad but would affect upland habitat where salamanders, frogs, and toads may be present. Mortality or injury of California tiger salamanders, California red-legged frogs, and western spadefoot toads in upland habitat could occur if burrows containing individuals are crushed by construction equipment or are buried under spoils; individuals are displaced from burrows exposing them to predators and desiccation; or they encounter construction equipment while migrating through the work area. In addition, project construction temporarily could impede the movement of juvenile and adult tiger salamanders, red-legged frogs, and spadefoot toads dispersing between breeding areas and upland refuge sites. Potential injury or mortality of California tiger salamander and California red-legged frog, which are federally listed threatened species, is considered a significant adverse effect. The potential effects on California tiger salamander, California red-legged frog, and western spadefoot are considered adverse.

However, with implementation of the following mitigation measures, the project would result in no adverse effect on these species.

Mitigation Measure WILD-MM-1: Conduct Preconstruction Surveys for California Tiger Salamander, California Red-legged Frog, and Western Spadefoot

This measure is described above for the proposed action.

Mitigation Measure WILD-MM-2: Implement Measures during Construction to Avoid and Minimize Potential Injury or Mortality of California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot

This measure is described above for the proposed action.

Impact WILD-3: Temporary and Permanent Loss of Upland Habitat for California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad

Alternative 3 would not remove or disturb suitable aquatic habitat for California tiger salamanders, California red-legged frogs, and western spadefoot toads. This alternative would result in the permanent and temporary removal of slightly larger acreages of suitable upland habitat than the proposed action due to additional poles, staging/laydown areas, and tension/pulling stations that would be required for the extended length of the transmission line. Areas that are temporarily affected will be restored through implementation of the environmental commitment to revegetate temporarily disturbed areas (see Chapter 2). The permanent loss of a small amount (slightly more than 1.2 acres) of suitable upland habitat would not adversely affect California tiger salamander, California red-legged frog, and western spadefoot toad because upland habitat surrounding the proposed action would continue to provide aestivation and dispersal habitat for these species, such that they could continue to inhabit the area around the proposed project. Therefore, the temporary and permanent loss of upland habitat is not considered an adverse effect.

Impact WILD-4: Potential Disturbance of Nesting Northern Harrier, Swainson's Hawk, White-Tailed Kite, Loggerhead Shrike, and Non-Special-Status Migratory Birds

There are no suitable nest trees for Swainson's hawk or white-tailed kite in the study area; however, suitable nest trees may be present within 0.5 mile of the study area. Suitable nesting habitat for northern harrier and loggerhead shrike are present in the study area. Raptors (e.g., eagles, kites, hawks, owls) could nest within 0.5 mile of the study area, and other birds may nest in the study area. Migratory birds and their nests are protected under both California Fish and Game Code Section 3503 (active bird nests) and the MBTA. Removal of nests or suitable nesting habitat and construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings or otherwise lead to nest abandonment. Loss of raptor and other migratory bird eggs or nests, or any activities resulting in nest abandonment, would be considered an adverse effect. However, with implementation of the following mitigation measure, there would be no adverse effect on special-status and other migratory birds.

Mitigation Measure WILD-MM-3: Avoid Construction during the Nesting Season of Migratory Birds or Conduct Preconstruction Survey for Nesting Birds

This measure was described above for the proposed action.

Impact WILD-5: Loss of Suitable Foraging Habitat for Swainson's Hawk

This alternative would result in the permanent and temporary removal of slightly larger acreages of suitable Swainson's hawk foraging habitat (grassland) than the proposed action due to additional poles, staging/laydown areas, and tension/pulling stations that would be required for the extended length of the transmission line. Because these losses are small (slightly more than 1.2 acres permanently affected and 13.0 acres temporarily affected) and would not substantially reduce available foraging habitat for Swainson's hawk in the study area, the loss of this habitat would not be an adverse effect.

Impact WILD-6: Potential Mortality or Disturbance of Western Burrowing Owl

The annual grassland in the study area is suitable breeding and wintering habitat for burrowing owl. This species has been observed in the study area in the past, and there are known records in the project vicinity. Construction in and adjacent to occupied burrows could result in mortality or disturbance of nesting or wintering western burrowing owls. Construction of Alternative 3 would result in the permanent and temporary removal of slightly larger acreages of suitable foraging or burrow habitat for this species than the proposed action due to additional poles, staging/laydown areas, and tension/pulling stations that would be required for the extended length of the transmission line. Nesting burrowing owls are protected under the federal MBTA and California Fish and Game Code Sections 3503 and 3503.5. Loss of active breeding or wintering burrows or disturbance of breeding burrows resulting in mortality of young and displacement of adults is considered an adverse effect. However, with implementation of the following mitigation measures, there would be no adverse effect on this species.

Mitigation Measure WILD-MM-4a: Conduct Preconstruction Surveys for Western Burrowing Owl

This measure was described above for the proposed action. If burrowing owls or their sign is found, Mitigation Measure WILD-MM-4b will also be implemented.

Mitigation Measure WILD-NN-4b: Avoid and Minimize Effects on Western Burrowing Owl

This measure was described above for the proposed action.

Impact WILD-7: Potential Disturbance, Injury, or Mortality of San Joaquin Kit Fox and American Badger

Construction in suitable denning and foraging habitat for San Joaquin kit fox and American badger could result in disturbance, injury, or mortality of these species. Potential direct effects include damage to or destruction of dens, direct mortality from construction vehicles or heavy equipment, direct mortality from den collapse and subsequent suffocation, temporary disturbance from noise and human presence associated with construction activities, and harassment by construction personnel. In addition, exposed pipes or large excavated holes that are left open after construction has finished for the day could entrap San Joaquin kit foxes and American badgers moving through the construction area. The injury or mortality of San Joaquin kit fox (a federally listed endangered and state-listed threatened species) and American badger (a species whose populations have declined drastically during the last century [Williams 1986]) from construction activities is considered an adverse effect. However, with implementation of the following mitigation measures, the project would have no adverse effect on these species.

Mitigation Measure WILD-MM-5: Conduct Preconstruction Den Surveys for San Joaquin Kit Fox and American Badger and Avoid or Protect Dens

This measure was described above for the proposed action.

Mitigation Measure WILD-MM-6: Provide Escape Ramps or Cover Open Trenches at the End of Each Day to Avoid Entrapment of San Joaquin Kit Fox and American Badger

This measure was described above for the proposed action.

Impact WILD-8: Temporary Disturbance and Permanent Loss of Suitable Habitat for San Joaquin Kit Fox and American Badger

Implementation of Alternative 3 would result in the permanent and temporary removal of slightly larger acreages of suitable foraging and denning (grassland) habitat for San Joaquin kit fox and American badger than the proposed action due to additional poles, staging/laydown areas, and tension/pulling stations that would be required for the extended length of the transmission line. Areas that are temporarily affected will be restored through implementation of the environmental commitment to revegetate temporarily disturbed areas (see Chapter 2). The permanent loss of a small amount (slightly more than 1.2 acres) of suitable foraging and denning habitat would not adversely affect San Joaquin kit fox and American badger because grassland surrounding the proposed action would continue to provide foraging and denning opportunities for these species, such that they could continue to inhabit the area around the proposed project. Therefore, the temporary and permanent loss of suitable foraging and denning habitat is not considered an adverse effect.

Operation Impacts

Operation of the Intertie Pumping Plant and the associated increased operation of Jones Pumping Plant would not result in any operational effects on special-status wildlife or their habitats. Periodic maintenance and inspection of the pumping plant would require vehicle travel along the O&M roads along the DMC and California Aqueduct. Inspection and maintenance of the transmission line would also occur once per year and would require vehicle travel along the O&M road along the DMC. Because maintenance and inspections are expected to be done at most a few times a year, it is expected that injury or mortality of special-status wildlife from vehicle strikes would not occur or would be rare. In addition, access roads are gravel and this limits the speed that vehicles can travel on the roads. The increase in pumping would not result in changes in stage (refer to Section 3.2, Delta Tidal Hydraulics) that could affect special-status wildlife.

Impact WILD-9: Potential Injury or Mortality of Migratory Birds from Electrocution or Collisions with the New Transmission Line

Alternative 3 includes the construction of a 69-kV transmission line between the TANC intertie site and the Tracy substation. After the transmission line is constructed, it would be an electrocution hazard and an obstruction to migratory birds flying through the area. Birds that fly into the transmission lines could be injured or die from electrocution or impact with the wires. The transmission line for Alternative 3 would be a longer distance than that for the proposed action, and therefore, the number of birds that could be injured or killed by electrocution or collision with the transmission line could be greater than that for the proposed action. Because of the proximity of the transmission line to water in the adjacent canals and to grassland and agricultural lands in the vicinity, waterfowl, waterbirds, raptors and passerines would utilize the general area surrounding the project site and are at risk of electrocution and collision with the transmission line. If a substantial number of birds were killed from collision from the transmission line such that the local populations were affected, this would be considered an adverse effect. However, with implementation of the following mitigation measures, operation of the transmission line would have no adverse effect on migratory birds.

Mitigation Measure WILD-MM-7: Prepare and Implement an Avian Protection Plan

This measure was described above for the proposed action.

Mitigation Measure WILD-MM-8: Consult with USWS under the Bald and Golden Eagle Protection Act

This measure was described above for the proposed action.

Alternative 4 (Virtual Intertie)

Construction Effects

Alternative 4 involves the temporary installation and operation of portable pumps to transfer water from the DMC to the California Aqueduct during emergencies. When needed, the temporary pumping facilities would be located approximately 0.5 mile southeast of the proposed action location. This alternative involves creating a level pad on which to assemble rented portable pumping equipment and use of a temporary pipeline and portable pumps. After water is transferred, the equipment would be removed, but the level pumping pad would remain in place. The transmission line would not be required for Alternative 4.

Because there would be no permanent facilities, transmission line, pipeline installation, and therefore no need for staging areas or storage areas for spoils, there would be very few effects on special-status wildlife habitat. However, implementation of this alternative has the potential to disturb, injure, or kill all of the special-status wildlife species discussed above for the proposed action and Alternative 3. This alternative would be implemented under emergency situations only, and therefore potential effects would occur very infrequently and, because of the emergency nature of the ground-disturbing activities associated with the temporary pipeline component of this alternative, could not be avoided with preconstruction surveys and other avoidance measures. Effects on habitat under Alternative 4 are discussed below.

Impact WILD-3: Temporary and Permanent Loss of Upland Habitat for California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad

Alternative 4 would not remove or disturb suitable aquatic habitat for California tiger salamanders, California red-legged frogs, and western spadefoot toads but would permanently remove approximately 0.4 acre of suitable upland (grassland) habitat. Because the grassland habitat where the pumping pad and temporary pipeline would be located would be disturbed repeatedly, this effect is considered permanent. The permanent loss of a very small amount of suitable upland habitat would not adversely affect California tiger salamander, California red-legged frog, and western spadefoot toad because upland habitat surrounding the proposed action would continue to provide aestivation and dispersal habitat for these species, such that they could continue to inhabit the area around the proposed project. Therefore, the temporary and permanent loss of upland habitat is not considered an adverse effect.

Impact WILD-5: Loss of Suitable Foraging Habitat for Swainson's Hawk

Construction of Alternative 4 would permanently remove approximately 0.4 acre of suitable Swainson's hawk foraging habitat (annual grassland). The grassland habitat where the pumping pad would be located would be disturbed repeatedly, and therefore this effect is considered permanent. Because this loss is so small and would not substantially reduce available foraging habitat for Swainson's hawk in the study area, this effect is not adverse.

Impact WILD-8: Temporary Disturbance and Permanent Loss of Suitable Habitat for San Joaquin Kit Fox and American Badger

Implementation of Alternative 4 would permanently remove approximately 0.4 acre of suitable foraging and denning (grassland) habitat for San Joaquin kit fox and American badger. The grassland habitat where the pumping pad and temporary pipeline would be located would be repeatedly disturbed and therefore this effect is considered permanent. The permanent loss of a very small amount of suitable foraging and denning habitat would not adversely affect San Joaquin kit fox and American badger because grassland surrounding the proposed action would continue to provide foraging and denning opportunities for these species, such that they could continue to inhabit the area around the proposed project. Therefore, the temporary and permanent loss of suitable foraging and denning habitat is not considered an adverse effect.

Operation Impacts

The increased pumping at Banks associated with the Virtual Intertie would not result in any effects on special-status wildlife species. The temporary Intertie would be operated only during emergency situations and would be removed when the emergency situation ended. As such, there would be no ongoing operational effects on special-status wildlife or their habitats.