Delta-Mendota Canal/ California Aqueduct Intertie

Central Valley Project, California

Final Environmental Impact Statement

Volume I: Main Report

U.S. Department of the Interior
Bureau of Reclamation

Western Area Power Administration (DOE/EIS-0398)

November 2009

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Final Environmental Impact Statement
Delta-Mendota Canal/California Aqueduct Intertie Project

United States Department of the Interior
Bureau of Reclamation, Mid-Pacific Region
2800 Cottage Way, MP-700
Sacramento, CA 95825

This Final Environmental Impact Statement (FEIS) has been prepared by the, U.S. Department of the Interior, Bureau of Reclamation, Mid-Pacific Region (Reclamation) in accordance with the requirements of the National Environmental Policy Act (NEPA) for the Delta-Mendota Canal (DMC)/California Aqueduct Intertie (Intertie). The Western Area Power Administration (Western) and the San Luis & Delta-Mendota Water Authority (SLDMWA) are cooperating agencies under NEPA. The Intertie would be located in Alameda or San Joaquin County and involves constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct at Mile 7.2 of the DMC and Mile 9 of the California Aqueduct, which would be used primarily in winter months to fill the San Luis Reservoir earlier each year. The project also includes an interconnection and the construction and operation of a new transmission line, and a new point of delivery on Western's system for delivery of power for the Intertie. The project purpose is to improve the DMC conveyance conditions that restrict the Central Valley Project (CVP) Jones Pumping Plant to less than its authorized pumping capacity of 4,600 cubic feet per second (cfs) and to improve operational flexibility for operations and maintenance and emergency activities.

The FEIS considers three action alternatives and the No Action Alternative:

- Alternative 1—No Action Alternative
- Alternative 2—constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct at Mile 7.2 of the DMC and Mile 9 of the California Aqueduct
- Alternative 3—constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct at Mile 11.5 of the DMC and Mile 13.8 of the California Aqueduct
- Alternative 4—use State Water Project (SWP) Harvey O. Banks Pumping Plant capacity not used by SWP for Table A deliveries (existing long-term SWP water supply contract amount) to pump the increment of CVP water that cannot be conveyed in the DMC without the Intertie and install a temporary intertie during emergencies and maintenance activities

This FEIS describes and evaluates the potential environmental, social and economic effects of the Intertie project. It analyzes the direct, indirect, and cumulative environmental effects of the following resources: water supply and Delta water management, Delta tidal hydraulics, Delta water quality, geology and soils, transportation, air quality, noise, climate change, fish, vegetation and wetlands, wildlife, power production and energy, aesthetic and visual resources, cultural resources, hazards and hazardous materials, socioeconomics, Indian trust assets, utilities and public services, and environmental justice. The alternatives would not result in significant adverse environmental impacts after mitigation. The proposed project would result in beneficial effects on Delta fishery and aquatic resources under Alternatives 2, 3, and 4 due to a shift in the timing of Jones Pumping.

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Executive Summary

ES.1 Introduction

This document is a final environmental impact statement (EIS) that is intended to satisfy the requirements of the National Environmental Policy Act (NEPA). This final EIS has been prepared by the U.S. Department of the Interior, Bureau of Reclamation, which is serving as the lead agency, to identify and analyze the anticipated environmental effects of constructing and operating a proposed intertie between the federal Delta-Mendota Canal (DMC) and the state California Aqueduct (Proposed Action). The Proposed Action will provide operational flexibility for the CVP and State Water Project (SWP) and improve conveyance capacity of the CVP.

This final EIS is a public information document prepared to disclose environmental effects and to inform decision makers about these effects in compliance with NEPA. The document describes the existing conditions and the potential environmental effects of the Proposed Action and alternatives and discloses the direct, indirect, and cumulative impacts. This document also identifies measures that have been incorporated into the design of the project to ensure that there are no adverse effects. Volume III of this final EIS includes all of the public an agency comments received during the draft EIS review period and Reclamation's responses to those comments.

ES.2 Purpose and Need for Proposed Action

The Delta-Mendota Canal/California Aqueduct Intertie (Intertie) is being considered by Reclamation and the San Luis Delta Mendota Water Authority (Authority) to improve the water supply reliability of the Central Valley Project (CVP). The purpose of the Proposed Action is to improve the DMC conveyance conditions that restrict the CVP C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant) to less than its original design pumping capacity of 4,600 cubic feet per second (cfs) and to improve operational flexibility for operations and maintenance and emergency activities.

The need for this action results from the following conditions:

- A lack of operational flexibility compromises the ability of the CVP and SWP to respond to emergencies, conduct necessary system maintenance, and provide capacity to respond to environmental opportunities in the Sacramento–San Joaquin River Delta (Delta).

- The amount, timing, and location of water deliveries from the DMC, apparent canal subsidence, siltation, the facility design, and other factors have resulted in a mismatch between designed Jones Pumping Plant export capacity and DMC conveyance capacity.
- There are unmet CVP water supply demands south of the Delta, and conditions along the DMC constrain CVP operations, reducing the water supplies reliably delivered to CVP water service contractors south of the Delta.

ES.3 Related Environmental Documentation

In December 2004, Reclamation and the Authority issued an Environmental Assessment/Initial Study (EA/IS) for the Intertie project. The Authority signed a Mitigated Negative Declaration on April 20, 2005, and Reclamation signed a Finding of No Significant Impact (FONSI) in May, 2005. On August 31, 2005, the Planning and Conservation League brought suit against Reclamation under NEPA. The Court found and granted a temporary restraining order based upon its determination that there was reasonable likelihood that the plaintiffs would prevail on their contention that an EIS is required because: the Project would have a potential significant impact to delta smelt habitat; the sensitivity of the Delta and conflicting expert evidence; the limitations of the CALSIM model had not been disclosed; and the failure of the cumulative effects analysis to consider certain projects which were reasonably likely to be implemented even though the environmental reviews had not been completed. Reclamation withdrew the FONSI and committed to preparing this EIS, and the suit has been dropped.

The Intertie project also was included in the 2008 Operating Criteria and Plan (OCAP) Biological Assessment (BA), hereafter referred to as the CVP/SWP Longterm Operations Plan, which addresses system-wide operations for CVP and SWP facilities. To ensure consistency between NEPA and ESA analysis for the Intertie, modeling assumptions for the Intertie analysis in the EIS were based on modeling assumptions used in the CVP/SWP Longterm Operations Plan. The subsequent OCAP biological opinions (BO), hereafter referred to as the Operations BOs, issued by U.S. Fish and Wildlife Service (USFWS) in December 2008 and the National Marine Fisheries Service (NMFS) in June 2009 include operational constraints that affect how and when the Intertie is operated. This EIS describes the maximum effects of operating the Intertie (i.e., no restrictions related to the Operations BOs). The actual effects of the Intertie will be avoided or substantially minimized because of the Operations BOs operational constraints that will be in place.

ES.4 Overview of Proposed Action, Alternatives, and Alternatives Development

The Jones Pumping Plant and the DMC were originally designed to pump and convey 4,600 cfs, and these facilities have routinely been operated at 4,600 cfs for many years. The operations of the Jones Pumping Plant are dictated not only by the design capacity, but also by tidal fluctuations at the Jones Pumping Plant and the capacity of the DMC south of Tracy. Because the DMC capacity upstream of Santa Nella and the pumping capacity at O'Neill Pumping Plant is about 4,200 cfs, additional Jones Pumping Plant pumping can presently be accommodated only if deliveries are made to contractors upstream of the O'Neill Pumping Plant. These factors reduce the opportunities for Reclamation to maximize its full design monthly average pumping rate of 4,600 cfs at Jones Pumping Plant during the fall and winter months.

As such, alternatives to allow Reclamation to maximize pumping were evaluated. Ultimately, the construction and operation of an intertie between the California Aqueduct and the DMC was proposed. Locations were evaluated based on their ease of access, distance between the California Aqueduct and the DMC, geological conditions, distance from Jones Pumping Plant, and other physical factors.

This EIS evaluates a no action alternative; the Proposed Action (the Intertie as described in the EA/IS); an Intertie that is operationally identical to the proposed project but is in a different location (Transmission Agency of Northern California [TANC] Site); and an alternative that would use SWP Harvey O. Banks Pumping Plant (Banks Pumping Plant) to achieve the objective related to improving conveyance capacity and a temporary intertie structure to address emergencies (Virtual Intertie).

ES.4.1 Alternative 1 (No Action)

The No Action Alternative is required under NEPA and assumes that the current operation of Jones and Banks Pumping Plants would continue.

ES.4.2 Alternative 2 (Proposed Action)

The Proposed Action is the Intertie (as originally proposed in the 2005 EA/IS). The site of the Proposed Action is in an unincorporated area of the San Joaquin Valley in Alameda County, west of the city of Tracy (Figure ES-1). The site is in a rural area zoned for general agriculture and is under federal and state ownership. Alternative 2 consists of constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct at Mile 7.2 of the DMC and Mile 9 of the California Aqueduct, where the DMC and California Aqueduct are approximately 500 feet apart (Figure ES-2).

The Intertie would allow the DMC and California Aqueduct to share conveyance capacity and could be used to convey water in either direction. To convey water from the DMC to the California Aqueduct, the Intertie would use a pumping plant at the DMC that would allow up to 467 cfs to be pumped from the DMC to the California Aqueduct via an underground pipeline. This additional 467 cfs would allow the Jones Pumping Plant to pump at its designed maximum monthly average of about 4,600 cfs throughout the year. As modeled and analyzed for this EIS, the Intertie would be operated for this purpose primarily in September through March. Additionally, water could be conveyed from the California Aqueduct to the DMC. Because the California Aqueduct is approximately 50 feet higher in elevation than the DMC, up to 900 cfs flow could be conveyed from the California Aqueduct to the DMC through the Intertie using gravity flow. The operations of the Intertie would be subject to all applicable export pumping restrictions for water quality and fisheries protection.

The Intertie would be owned by the federal government and operated by the Authority. Prior to any operations, Reclamation will seek approval from DWR for the introduction of water into the California Aqueduct. An agreement among Reclamation, California Department of Water Resources (DWR), and the Authority would identify the responsibilities and procedures for operating the Intertie. A permanent easement would be obtained by Reclamation where the Intertie alignment crosses state property.

ES.4.3 Alternative 3 (TANC Site)

Alternative 3 is similar in design and the same in operation to the Proposed Action. The only difference is the location of the Intertie and appurtenant structures. The TANC Intertie Site alternative was developed in response to scoping comments submitted by TANC, which requested that the Intertie site be relocated to avoid high-voltage transmission lines. TANC identified two options for alternative sites. Option 1 is evaluated in this EIS because it is most similar in length and distance from the Jones Pumping Plant. Alternative 3 would be located at Milepost 11.5 of the DMC and Milepost 13.8 of the California Aqueduct, where these facilities are approximately ¼ mile apart (Figure ES-2).

ES.4.4 Alternative 4 (Virtual Intertie)

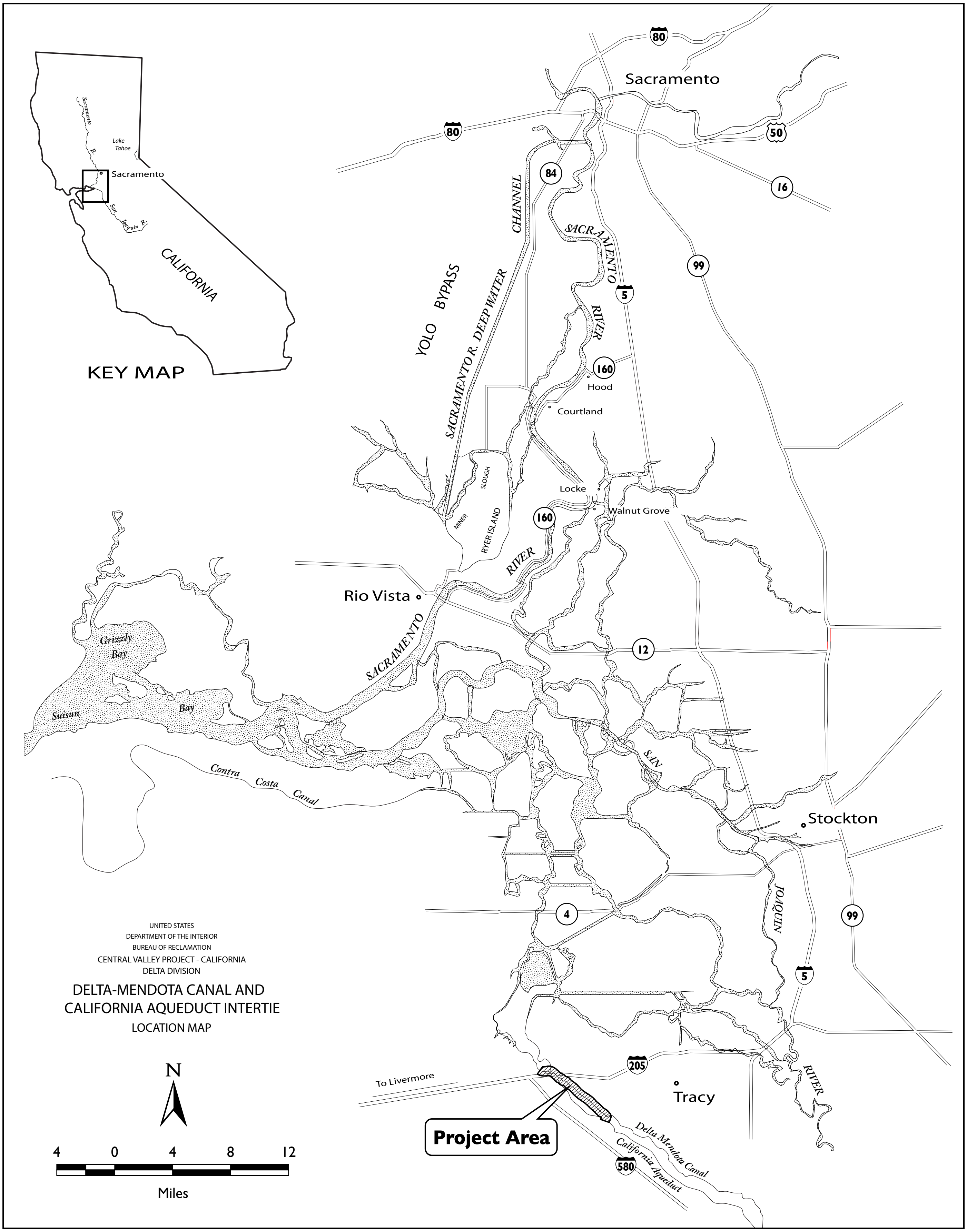
Alternative 4 (Virtual Intertie) would use Banks Pumping Plant capacity not used by SWP for Table A deliveries (existing long-term SWP water supply contract amount) to pump the increment of CVP water that cannot be conveyed in the DMC without the Intertie. This would use some of the available pumping and conveyance capacity of the SWP. CVP operations at Jones Pumping Plant therefore would not change. Under the Virtual Intertie alternative, the CVP would use the Banks Pumping Plant to convey CVP water to O'Neill Forebay and San Luis Reservoir (CVP share).

The permitted pumping capacity at Banks Pumping Plant would not change from the No Action Alternative. Under the No Action Alternative, available CVP water for export that cannot be pumped at Jones because of the DMC conveyance limitations is treated as unused federal share under the Coordinated Operations Agreement (COA) and can be exported by the SWP at Banks Pumping Plant. This water, released from upstream CVP reservoirs for instream or temperature-control flows, is often more than is required for Delta outflow and the maximum pumping capacity at Jones Pumping Plant.

During emergencies, a temporary intertie-like structure would be installed to connect the DMC with the California Aqueduct. This structure would be similar to the structure installed in 2001.

ES.5 Cooperating Agencies

The Western Area Power Administration (Western) has participated in the preparation of this EIS in regards to the interconnection and the construction and operation of the new transmission line associated with Alternatives 2 and 3. They will use this EIS as their NEPA compliance



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ICF Jones & Stokes
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Figure ES-1
Regional Location Map

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Figure ES-2
Project Study Area

document for construction and operation of the new transmission line and a new point of delivery on Western's system for delivery of power for the Intertie.

The Authority is the local project proponent for the Intertie, and will be responsible for its operation and maintenance. They have participated in the preparation of this EIS.

ES.6 Overview of Potential Environmental Effects

The EIS evaluates the potential direct, indirect, and cumulative environmental changes and/or effects on the following resources:

- water supply and Delta water management,
- Delta tidal hydraulics,
- Delta water quality,
- geology and soils,
- transportation,
- air quality,
- noise,
- climate change,
- fish,
- vegetation and wetlands,
- wildlife,
- land use,
- power production and energy,
- aesthetic and visual resources,
- cultural resources,
- hazards and hazardous materials,
- socioeconomics,
- Indian trust assets,
- utilities and public services, and
- environmental justice.

The EIS also evaluates effects of climate change on Intertie project performance. Resources not expected to be affected by either the construction or operation of the Proposed Action and alternatives are:

- navigation,
- population and housing, and

- recreation

Table ES-1, below, provides an overview of the impacts identified and any applicable mitigation.

ES.7 Areas of Controversy

The scoping process and prior litigation revealed several areas of controversy surrounding the Proposed Action. The Proposed Action is controversial as it relates to diversions from the Delta and construction of facilities near the TANC California-Oregon Transmission Project (COTP). In the past several years, virtually any project proposal to change diversions in the Delta has been met with great resistance from a variety of agencies, organizations, and landowners depending on the specific proposal. It is assumed that the Intertie generates a similar level of controversy.

As described above, the Intertie was included in the consultation for OCAP. As such, restrictions on diversions outlined in the Operations BOs are part of the Intertie operations and would minimize or avoid adverse effects on fish related to the Intertie.

As described above, TANC submitted a comment letter during public scoping stating opposition to the proposed siting of the Intertie. In response, Reclamation has developed a Construction Safety Plan outlining the measures that will be implemented to avoid disruption of the transmission line and injury or death related to construction and maintenance of the Intertie facilities. These measures, as they apply to environmental effects disclosed in this EIS, have been incorporated into the project either as Environmental Commitments or as mitigation measures.

Additionally, the previous lawsuit brought by the Planning and Conservation League (PCL) on the EA for the Intertie indicates controversy related to the suit points:

1. Use of CALSIM model as the only tool for evaluation of effects without disclosing the limitations of the model.
2. Cumulative effects analysis that did not include all reasonably foreseeable projects.
3. Determination of significance based on a percentage change.

Reclamation has addressed each of the identified areas of controversy through changes in the project, impact assessment, and inclusion of measures required for ESA compliance.

ES.8 Public Involvement and Next Steps

Pursuant to the requirements of NEPA, Reclamation published a Notice of Intent (NOI) to prepare an EIS and Notice of Public Scoping Meetings in the Federal Register on Wednesday, July 12, 2006 (Vol. 71, No. 133) and held public scoping meetings on Tuesday, August 1, 2006, and Thursday, August 3, 2006. The August 1, 2006, scoping meeting was held in Sacramento from 10:00 a.m. to 12:00 noon at the Federal Building located at 2800 Cottage Way. Approximately 15 representatives of various organizations attended the Sacramento scoping meeting. The August 3, 2006, scoping meeting was held in Stockton from 6:00 p.m. to 8:00 pm at the Cesar Chavez Central Library located at 605 North El Dorado Street. Approximately 12 representatives of various organizations attended the Stockton scoping meeting. The purpose of the scoping meetings was to solicit input on the scope of the Intertie EIS, including potentially significant impacts, ways to mitigate these impacts, and feasible alternatives. Written comments were received by Reclamation between July 12, 2006, and September 6, 2006.

Reclamation filed a Notice of Availability (NOA) for the draft EIS in the Federal Register on July 17, 2009. The draft EIS was circulated for public review for 45 days, during which time Reclamation held two public hearings (August 4 and 5, 2009). No oral comments were received during these hearings, but ten written comments were received during the public review period. These comments and accompanying responses are included as Volume III of this final EIS, which represents the next step in public involvement. This final EIS will be circulated for at least 30 days before Reclamation issues a record of decision (ROD).

ES.9 Impact and Mitigation Measures Summary Table

Table ES-1. Summary of Impacts and Mitigation Measures for the Delta-Mendota Canal/California Aqueduct Intertie Project

Effect	Alternative	Adverse Effect?	Mitigation Measure
3.1 WATER SUPPLY AND DELTA WATER MANAGEMENT			
Construction Effects			
No changes			
Operation Effects			
WS-1: Changes in Central Valley Project Delta Pumping	2, 3, 4	No, beneficial	–
WS-2: Changes in Central Valley Project South-of-Delta Deliveries	2, 3	No, beneficial	–
WS-3: Changes in State Water Project Delta Pumping	2, 3, 4	No	–
WS-4: Changes in State Water Project South-of-Delta Deliveries	2, 3	No	–
3.2 DELTA TIDAL HYDRAULICS			
Construction Effects			
No effects			
Operation Effects			
HYD-1: Effects of Intertie Pumping on Tidal Elevations and Flow in Old River at Clifton Court Ferry	2, 3, 4	No	–
3.3 DELTA WATER QUALITY			
Construction Effects			
No impacts			

Effect	Alternative	Adverse Effect?	Mitigation Measure
Operation Effects			
WQ-1: Delta Salinity Changes at Jersey Point	2, 3, 4	No	–
WQ-2: Delta Salinity Changes at Rock Slough	2, 3, 4	No	–
WQ-3: Delta Salinity Changes at Los Vaqueros Intake	2, 3, 4	No	–
WQ-4: Delta Salinity Changes at Banks Pumping Plant	2, 3, 4	No	–
WQ-5: Delta Salinity Changes at Jones Pumping Plant	2, 3, 4	No	–
WQ-6: Increases in Dissolved Organic Carbon at CCWD, SWP, or CVP Intakes	2, 3, 4	No	–
3.4 GEOLOGY AND SOILS			
Construction Effects			
GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction	2, 3, 4	No	–
GEO-2: Potential Slope Failure along Canals Resulting from Project Construction	2, 3	No	–
GEO-3: Potential Structural Damage from Fault Displacement and Ground Shaking during a Seismic Event	2, 3, 4	No	–
GEO-4: Potential Structural Damage from Development on Materials Subject to Liquefaction	2, 3	No	–
GEO-5: Potential Structural Damage from Development on Expansive Soils	2, 3	No	–
GEO-6: Potential Rupture of Pipelines Caused by Expansive Soils and Pipeline Corrosion	2, 3	No	–
Operation Effects			
No effects			
3.5 TRANSPORTATION			
Construction Effects			
TN-1: Changes in Roadway Capacity as a Result of Truck and Commute Trips	2, 3, 4	No	–
TN-2: Damage to Roadways during Construction	2, 3, 4	No	–
TN-3: Disruption to Bikeways during Construction	2, 3, 4	No	–
TN-5: Disruption of Railroad Line or Service during Construction	3	No	–
TN-6: Disruption to I-205 during Construction	3	Yes	TN-MM-1: Non-Peak Hour Installation of I-205 Transmission Line Segment
Operation Effects			
TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility	2, 3, 4	No	–

Effect	Alternative	Adverse Effect?	Mitigation Measure
3.6 Air Quality			
Construction Effects			
AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities	2, 3, 4	No	–
AQ-2: Comply with General Conformity	2, 3, 4	No	–
Operation Effects			
No effects			
3.7 Noise			
Construction Effects			
NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise	2, 3, 4	Yes	NZ-MM-1: Employ Noise-Reducing Construction Practices
Operation Effects			
NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Intertie Operation	2, 3	No	
NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Temporary Intertie Operation	4	Yes	NZ-MM-2: Employ Noise-Reducing Measures for the Temporary Pumps
3.8 Climate Change Effects on Intertie Project Impacts			
Construction Effects			
CC-1: Construction-Related Changes in Greenhouse Gas Emissions	2, 3, 4	No	–
Operation Effects			
CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Intertie Operations	2, 3	No	–
CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Intertie Operations	4	No	–
CC-3: Project Performance under Changed Conditions	2, 3, 4	No	–
4.1 Fish			
Construction Effects			
No direct effects			
Operation Effects			
FISH-1: Operations-Related Decline in Migration Habitat Conditions for Chinook Salmon	2, 3, 4	No	–
FISH-2: Operations-Related Increases in Entrainment of Chinook Salmon	2, 3, 4	No	–
FISH-3: Operations-Related Decline in Migration Habitat Conditions for Steelhead	2, 3, 4	No	–

Effect	Alternative	Adverse Effect?	Mitigation Measure
FISH-4: Operations-Related Increases in Entrainment of Steelhead	2, 3, 4	No, beneficial	–
FISH-5: Operations-Related Loss of Spawning Habitat Area for Delta Smelt	2, 3, 4	No	–
FISH-6: Operations-Related Loss of Rearing Habitat Area for Delta Smelt	2, 3, 4	No	–
FISH-7: Operations-Related Decline in Migration Habitat Conditions for Delta Smelt	2, 3, 4	No	–
FISH-8: Operations-Related Increases in Central Valley Project and State Water Project Pumping Resulting in Entrainment of Delta Smelt	2, 3, 4	No	–
FISH-9: Operations-Related Loss of Spawning Habitat Area for Longfin Smelt	2, 3, 4	No	–
FISH-10: Operations-Related Loss of Rearing Habitat Area for Longfin Smelt	2, 3, 4	No	–
FISH-11: Operations-Related Increases in Central Valley Project and State Water Project Pumping Resulting in Entrainment of Longfin Smelt	2, 3, 4	No	–
FISH-12: Operations-Related Loss of Spawning Habitat Area for Splittail	2, 3, 4	No	–
FISH-13: Operations-Related Loss of Rearing Habitat Area for Splittail	2, 3, 4	No	–
FISH-14: Operations-Related Decline in Migration Habitat Conditions for Splittail	2, 3, 4	No	–
FISH-15: Operations-Related Increases in Entrainment Losses of Splittail	2, 3, 4	No	–
FISH-16: Operations-Related Decline in Migration Habitat Conditions for Striped Bass	2, 3, 4	No	–
FISH-17: Operations-Related Loss of Rearing Habitat Area for Striped Bass	2, 3, 4	No	–
FISH-18: Operations-Related Increases in Central Valley Project and State Water Project Pumping Resulting in Entrainment of Striped Bass	2, 3, 4	No	–
FISH-19: Operations-Related Decline in Migration Habitat Conditions for Green Sturgeon	2, 3, 4	No	–
FISH-20: Operations-Related Increases in CVP and State Water Project Pumping Resulting in Entrainment of Green Sturgeon	2, 3, 4	No	–
4.2 VEGETATION AND WETLANDS			
Construction Effects			
VEG-1: Direct and Indirect Effects on Sensitive Biological Resources within and Adjacent to the Construction Zone	2, 3, 4	No	–

Effect	Alternative	Adverse Effect?	Mitigation Measure
VEG-2: Introduction or Spread of Invasive Plant Species	2, 3, 4	No	–
VEG-3: Potential Impacts on Special-Status Plants	3, 4	No	–
Operation Effects			
No effects			
4.3 WILDLIFE			
Construction Effects			
WILD-1: Potential Degradation or Changes in Hydrology of Habitat for Longhorn Fairy Shrimp, Vernal Pool Fairy Shrimp, and Vernal Pool Tadpole Shrimp	2, 3	No	–
WILD-2: Potential Injury or Mortality of California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad	2, 3	Yes	WILD-MM-1: Conduct Preconstruction Surveys for California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot 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
WILD-3: Temporary and Permanent Loss of Upland Habitat for California Tiger Salamander, California Red-Legged Frog, and Western Spadefoot Toad	2, 3, 4	No	–
WILD-4: Potential Disturbance of Nesting Northern Harrier, Swainson’s Hawk, White-Tailed Kite, Loggerhead Shrike, and Non-Special-Status Migratory Birds	2, 3	Yes	WILD-MM-3: Avoid Construction during the Nesting Season of Migratory Birds or Conduct Preconstruction Survey for Nesting Birds
WILD-5: Loss of Suitable Foraging Habitat for Swainson’s Hawk	2, 3, 4	No	–
WILD-6: Potential Mortality or Disturbance of Western Burrowing Owl	2, 3	Yes	WILD-MM-4a: Conduct Preconstruction Surveys for Western Burrowing Owl WILD-MM-4b: Avoid and Minimize Effects on Western Burrowing Owl

Effect	Alternative	Adverse Effect?	Mitigation Measure
WILD-7: Potential Disturbance, Injury, or Mortality of San Joaquin Kit Fox and American Badger	2, 3	Yes	WILD-MM-5: Conduct Preconstruction Den Surveys for San Joaquin Kit Fox and American Badger and Avoid or Protect Dens 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
WILD-8: Temporary Disturbance and Permanent Loss of Suitable Habitat for San Joaquin Kit Fox and American Badger	2, 3, 4	No	–
Operation Effects			
WILD-9: Potential Injury or Mortality of Migratory Birds from Electrocution or Collisions with the New Transmission Line	2, 3	No	WILD-MM-7: Prepare and Implement an Avian Protection Plan WILD-MM-8: Consult with USFWS under the Bald and Golden Eagle Protection Act
5.1 POWER PRODUCTION AND ENERGY			
Construction Effects			
POW-1: Increased Energy Consumption as a Result of Constructing the Intertie	2, 3, 4	No	–
Operation Effects			
POW-2: Increased Electricity Consumption as a Result of Operating the Intertie	2, 3, 4	No	–
5.2 VISUAL RESOURCES			
Construction Effects			
VIS-1: Temporary Visual Impacts Caused by Construction Activities	2	No	–
VIS-1: Temporary Visual Impacts Caused by Construction Activities	3	No	VIS-MM-4: Limit Construction to Daylight Hours near Residences
Operation Effects			
VIS-2: Adversely Affect a Scenic Vista	2, 3, 4	No	–
VIS-3: Damage Scenic Resources along a Scenic Highway	2, 3, 4	No	–
VIS-4: Degrade the Existing Visual Character or Quality of the Site and Its Surroundings	2, 3	No	–

Effect	Alternative	Adverse Effect?	Mitigation Measure
VIS-5: Create a New Source of Light or Glare	2, 3	No	VIS-MM-1: Apply Minimum Lighting Standards VIS-MM-2: Construct Facilities and Infrastructure with Low-Sheen and Non-Reflective Surface Materials VIS-MM-3: Reduce Visibility of New Structures
5.3 CULTURAL RESOURCES			
Construction Effects			
CUL-1: Modification of Known Cultural Resources Resulting from Construction	2, 3	No	–
CUL-2: Visual Intrusions to the Historic Setting of Significant Cultural Resources from Transmission Line Construction	2, 3	No	–
CUL-3: Inadvertent Damage to or Destruction of Buried Archaeological Sites and Human Remains	2, 3, 4	No	–
Operation Effects			
No adverse effects			
5.4 HAZARDS AND HAZARDOUS MATERIALS			
Construction Effects			
HAZ-1: Exposure to or Release of Hazardous Materials during Construction	2, 3, 4	No	–
HAZ-2: Increased Risk to the Public Attributable to Potential Disturbance of Overhead Powerlines	2	No	–
HAZ-4: Risk to the Public during Installation of Transmission Line over I-205	3	No	–
Operation Effects			
HAZ-3: Exposure to or Release of Hazardous Materials during Operation	2, 3, 4	No	–
5.5 SOCIOECONOMICS			
Construction Effects			
SOC-1: Change in Population during Project Construction	2, 3, 4	No	–
SOC-2: Change in Employment and Income during Project Construction	2, 3, 4	No, beneficial	–
Operation Effects			
SOC-3: Change in Population, Employment, and Income during Project Operation	2, 3, 4	No	–

Effect	Alternative	Adverse Effect?	Mitigation Measure
5.6 Indian Trust Assets			
Construction Effects			
No effect			
Operation Effects			
No effect			
5.7 Utilities and Public Services			
Construction Effects			
PUB-1: Disruption of Electricity Service	2, 3, 4	No	–
PUB-2: Disruption to Underground Utility Lines during Excavation Activities	2, 3, 4	No	–
PUB-3: Disruption to Emergency Services during Construction	2, 3, 4	No	–
PUB-4: Increased Contributions to Local Landfills	2, 3, 4	No	–
Operation Effects			
No impacts			
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Construction Effects			
No effects			
Operation Effects			
No effects			

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Acronyms and Abbreviations

µS/cm	microSiemens per centimeter
1978 Delta WQCP	1978 Water Quality Control Plan (WQCP) for the Sacramento–San Joaquin Delta and Suisun Marsh
1995 WQCP	1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary
AB	Assembly Bill
ABAG	Association of Bay Area Governments
AC	Alternating Current
ADAM	Aerometric Data Analysis and Management System
AIP	Alternative Intake Project
ANPR	Advanced Notice of Proposed Rulemaking
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
APP	Avian Protection Plan
ARB	California Air Resources Board
ATCM	Air Toxics Control Measure
Authority	San Luis & Delta Mendota Water Authority
B.P.	years before present
BA	biological assessment
BAAQMD	Bay Area Air Quality Management District
BACT	Best Available Control Technology
Banks Pumping Plant	SWP Harvey O. Banks Pumping Plant
BDCP	Bay Delta Conservation Plan
bhp	brake horsepower
BMPs	best management practices
BOCA	Building Officials and Code Administrators International, Inc.
BOs	biological opinions
BSC	California Building Standards Commission
CAA	federal Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CAAQS	California ambient air quality standards
CAFE	Corporate Average Fuel Economy
Cal-IPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CAP	Bay Area Clean Air Plan
CAR	Coordination Act Report

CARB	California Air Resources Board
CBSC	California Building Standards Code
CCAA	California Clean Air Act
CCF	Clifton Court Forebay
CCIC	Central California Information Center
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CDFA	California Department of Food and Agriculture
CEC	California Energy Commission
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFGC	California Fish and Game Code
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
CH_4	methane
CHRIS	California Historical Resources Information System
CIWMB	California Integrated Waste Management Board
cm	centimeters
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
COA	Coordinated Operation Agreement
COI	California-Oregon Intertie
Corps	U.S. Army Corps of Engineers
COTP	California-Oregon Transmission Project
CRHR	California Register of Historical Resources
CVO	Central Valley Operations
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWA	federal Clean Water Act
D-1641	State Water Resources Control Board water right Decision 1641
dB	decibel
dBA	A-weighted decibel
DBPs	disinfection byproducts
DCC	Delta Cross Channel
Delta	Sacramento–San Joaquin River Delta

DIDI	Delta Island Drainage Investigations
DMC	federal Delta-Mendota Canal
DO	dissolved oxygen
DOC	dissolved organic carbon
DOE	Department of Energy
DOI	U.S. Department of the Interior
DOT	Departments of Transportation
DPSs	distinct population segments
Draft CARB Thresholds	October 24, 2008, CARB released a draft staff proposal entitled Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under CEQA
DSM2	Delta Simulation Model
DWB	2009 Drought Water Bank
DWR	California Department of Water Resources
DWSC	Deep Water Ship Channel
E/I	export/inflow
EA/IS	Environmental Assessment/Initial Study
EBMUD	East Bay Municipal Utility District
EC	electrical conductivity
EIS	environmental impact statement
EISA	Energy Independence and Security Act of 2007
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERP	Ecosystem Restoration Program
ESA	federal Endangered Species Act
FHWA	Federal Highway Administration
FMWT	Fall Mid-Water Trawl
FONSI	Finding of No Significant Impact
FR	Federal Register
FRWP	Freeport Regional Water Project
ft/sec	feet per second
FTA	Federal Transit Administration
FWCA	Fish and Wildlife Coordination Act
FWUA	Friant Water Users Authority
g	acceleration of gravity
g/bhp-hr	grams per brake horsepower hour
GCM	global circulation model
General Construction Permit	General Permit for Discharges of Storm Water Associated with Construction Activity
GHG	greenhouse gas

GPS	global positioning system
GWP	global warming potential
HECP	hazardous energy control program
HFCs	hydrofluorocarbons
HGWPG	high global warming potential gases
hp	Horsepower
I-205	Interstate 205
I-580	Interstate 580
I-5	Interstate 5
ICBO	International Conference of Building Officials
ICC	International Code Council
IDHAMP	Interagency Delta Health Aspects Monitoring Program
IEP	Interagency Ecological Program
IESP	Interagency Ecological Study Program
Intertie	Delta-Mendota Canal/California Aqueduct Intertie
IPCC	Intergovernmental Panel on Climate Change
ISAC	Invasive Species Advisory Committee
ITAs	Indian Trust Assets
Jones Pumping Plant	CVP C.W. “Bill” Jones Pumping Plant
JPOD	Joint Point of Diversion
kV	kilovolt
KWh	kilowatt-hour
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
LFC	low-flow channel
L_{max}	maximum sound level
L_{min}	minimum sound level
LOS	level of service
lower DMC	section of the DMC south of O’Neill Pumping Plant
L_{xx}	percentile-exceeded sound level
maf	million acre-feet
maf/yr	million acre-feet per year
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MBTA	Migratory Bird Treaty Act
Metropolitan	The Metropolitan Water District of Southern California
msl	above mean sea level
MTC	Metropolitan Transportation Commission
MVEBs	motor vehicle emissions budgets

MWh	megawatt hours
MWQI	Municipal Water Quality Investigations
N_2O	nitrous oxide
NAAQS	national ambient air quality standards
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NGVD	1929 national geodetic vertical datum
NHPA	National Historic Preservation Act
NHTSA	National Highway Traffic Safety Administration
NICS	National Invasive Species Council
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOI	Notice of Intent
NOP/NOI	Notice of Preparation/Notice of Intent
NO_X	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NWIC	Northwest Information Center
O&M	operations and maintenance
OAP	Ozone Attainment Plan
OCAP	Operations Criteria and Plan
ODS	ozone-depleting substances
OES	Office of Emergency Services
OHWM	ordinary high water mark
OMR	Old and Middle River
OPR	Office of Planning and Research
PFCs	perfluorocarbons
PG&E	The Pacific Gas and Electric Company
PM10	particulate matter 10 microns in diameter or less
PM2.5	particulate matter 2.5 microns or less in diameter
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PRC	Public Resources Code
Proposed Action	constructing and operating a proposed intertie between the federal Delta-Mendota Canal (DMC) and the state California Aqueduct
RACM	reasonably available control measures

RBDD	Red Bluff Diversion Dam
Reclamation	U.S. Department of the Interior, Bureau of Reclamation
RFS	Renewable Fuel Standard
RM	River Mile
ROD	Record of Decision
ROG	reactive organic gases
ROW	right-of-way
RPA	Reasonable and Prudent Alternative
RWQCB	Regional Water Quality Control Board
SA	Settlement Agreement
SB	Senate Bill
SBA	South Bay Aqueduct
SBCCI	Southern Building Code Congress International, Inc.
SCADA	supervisory control and data acquisition
SCVWD	Santa Clara Valley Water District
SCWA	Sacramento County Water Agency
SDIP	South Delta Improvements Program
SFBAAB	San Francisco Bay Area Air Basin
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJMSCP	San Joaquin County Multi Species Habitat Conservation and Open Space Plan
SO_2	sulfur dioxide
SR	State Route
SRRE	Source Reduction and Recycling Element
SS	suspended sediments
State Water Board	State Water Resources Control Board
Superfund	Comprehensive Environmental Response, Compensation, and Liability Act
SVWMA	Sacramento Valley Water Management Agreement
SWP	State Water Project
SWPPP	stormwater pollution prevention plan
TACs	toxic air contaminants
taf	thousand acre-feet
taf/yr	thousand acre-feet per year
TANC	Transmission Agency of Northern California
TBACT	Best Available Control Technology for Toxics
TCCA	Tehama-Colusa Canal Authority
TDF	Through-Delta Facility
TFCF	Tracy Fish Collection Facility
THMs	trihalomethanes
TMDL	total maximum daily load

UBC	Uniform Building Code
upper DMC	section of the DMC north of O'Neill Pumping Plant
USC	U.S. Government Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAMP	Vernalis Adaptive Management Program
VOCs	volatile organic carbons
Western	Western Area Power Administration
WQCP	Water Quality Control Plan
WTP	Water Treatment Plant
WY	water year
X2	position of the 2 ppt salinity gradient
YOY	young of the year

Chapter 1 Introduction

1.1 Purpose of This Document

This document is a final environmental impact statement (EIS) that has been prepared to comply with the requirements of the National Environmental Policy Act (NEPA). This final EIS was prepared by the U.S. Department of the Interior, Bureau of Reclamation, which is serving as the lead agency, to identify and analyze the anticipated environmental impacts from constructing and operating a proposed intertie (pumping plant and pipeline connection) between the federal Delta-Mendota Canal (DMC) and the state California Aqueduct (Proposed Action). The Proposed Action would provide operational flexibility for the Central Valley Project (CVP) and State Water Project (SWP) and improve conveyance capacity of the CVP. Because Reclamation owns and operates the CVP, it must comply with NEPA for its proposed action of operating the Delta-Mendota Canal/California Aqueduct Intertie (Intertie) and approving the construction of the Intertie by the San Luis & Delta Mendota Water Authority (Authority).

This final EIS is a public information document prepared to disclose environmental effects and to inform decision makers about these potential effects in compliance with NEPA. The document describes the existing conditions and the environmental impacts of the Proposed Action and alternatives, and discloses the potential direct, indirect, and cumulative impacts. This document also identifies measures that have been incorporated into the design of the project to minimize project impacts.

1.2 Relationship to the Intertie Environmental Assessment/Initial Study

In December 2004, Reclamation and the Authority issued an Environmental Assessment/Initial Study (EA/IS) for the Intertie project, prepared jointly to comply with NEPA and the California Environmental Quality Act (CEQA). The Authority adopted a Mitigated Negative Declaration on April 20, 2005, and Reclamation signed a Finding of No Significant Impact (FONSI) in May 2005. On August 31, 2005, the Planning and Conservation League brought suit against Reclamation claiming that the FONSI did not fully comply with NEPA. Reclamation withdrew the FONSI and committed to preparing this EIS.

1.3 Relationship to the Operations Criteria and Plan Biological Assessment and the National Marine Fisheries Service and U.S. Fish and Wildlife Service Biological Opinions

In August 2008, Reclamation submitted a biological assessment (BA) for the CVP and SWP facilities and operations, including as described in the Operations Criteria and Plan (OCAP) with a request for formal consultation with U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) under Section 7 of the federal Endangered Species Act (ESA). The OCAP BA, hereafter referred to as the CVP/SWP Longterm Operations Plan, included existing facilities and operations and some near-future changes in operations and new facilities. The subsequent biological opinion (BO), hereafter referred to as the Operations BO, issued by USFWS in December 2008 and the NMFS Operations BO issued in June 2009 include operational constraints that indirectly affect how and when the Intertie is operated (U.S. Fish and Wildlife Service 2008; National Marine Fisheries Service 2009). The Intertie was identified as a near-future project and the Operations BOs include take authorizations for the CVP and SWP operations with the Intertie in operation. To ensure consistency between NEPA and the ESA analysis for the Intertie, modeling assumptions for the Intertie analysis in this EIS were based on modeling assumptions used in the 2008 CVP/SWP Longterm Operations Plan.

1.4 Relationship to the Bay Delta Conservation Plan and other Long-Term Planning and Drought-Relief Efforts

Reclamation has executed Financial Assistance Agreements with DWR to assist in the completion of planning efforts, environmental documentation, and technical studies for the Bay Delta Conservation Plan (BDCP)—a process to develop a habitat conservation plan for the Delta and to provide for reliable water supplies to areas receiving supplies from or via the Delta.

Reclamation is also participating in or leading several efforts to minimize the impacts of the current drought on CVP contractors through helping to facilitate transfers, use of groundwater, use of carryover storage, implementation of recycling and reuse programs, and many other efforts. The Intertie, although not specifically a component of any of these programs, is consistent with the overall goal of providing increased operational flexibility to maintain reliable water supplies for CVP and SWP water contractors.

1.5 Purpose and Need

The Intertie is intended to improve the operations and maintenance (O&M) abilities of the CVP by addressing constraints in the DMC just south of the CVP C.W. “Bill” Jones Pumping Plant (Jones Pumping Plant). The purpose of the Proposed Action is to improve the DMC conveyance conditions that restrict the Jones Pumping Plant to less than its original-design pumping capacity of 4,600 cubic feet per second (cfs) and to improve operational flexibility for operations and maintenance and emergency activities.

The need for this action results from the following conditions:

- A lack of operational flexibility compromises the ability of the CVP and SWP to respond to emergencies, conduct necessary system maintenance, and provide capacity to respond to environmental opportunities in the Sacramento–San Joaquin River Delta (Delta).
- The amount, timing, and location of water deliveries from the DMC, apparent canal subsidence, siltation, the facility design, and other factors have resulted in a mismatch between designed Jones Pumping Plant export capacity and DMC conveyance capacity.
- There are unmet CVP water supply demands south of the Delta, and conditions along the DMC constrain CVP operations, reducing the water supplies reliably delivered to CVP water service contractors south of the Delta.

1.5.1 Background of the Purpose and Need

Overview of the Central Valley Project and the State Water Project

The CVP and SWP maintain facilities in California’s Central Valley to deliver water supplies to water right-holders and CVP/SWP contractors. Both projects are operated under restrictions imposed through a variety of agency jurisdictions and authorities, including State Water Resources Control Board (State Water Board) water right Decision 1641 (D-1641), ESA, California Endangered Species Act (CESA), water rights, and Delta inflow/outflow ratio.

The CVP was originally authorized by Congress in 1937, and operation began in 1951. The CVP is operated and maintained by Reclamation. The CVP can deliver about 7 million acre-feet (maf) annually—for agriculture (6.2 maf), urban (0.5 maf), and wildlife refuge (0.3 maf) use (California Department of Water Resources 1998a, 1998b). Service areas for CVP contracting agencies are shown on Figure 1-1. CVP water is pumped from the Jones Pumping Plant located northwest of the city of Tracy. The Jones Pumping Plant consists of six pumps that discharge water into the DMC, a gravity-flow canal located in the western San Joaquin Valley. The DMC travels south for 117 miles from the Jones

Pumping Plant to the Mendota Pool, a small reservoir at the confluence of the San Joaquin River and Fresno Slough. A portion of CVP water is diverted into the O'Neill Forebay and pumped into the San Luis Reservoir, a joint-use facility built and used by the state and federal governments to store water diverted from the Delta. The DMC capacity starts at 4,600 cfs in the northernmost section, decreases to 4,200 cfs upstream of the O'Neill Forebay, and is 3,200 cfs at the Mendota Pool.

The SWP is operated and maintained by the California Department of Water Resources (DWR) and conveys an annual average of 2.5 maf of water from northern California to agricultural and urban water users south of the Delta. Service areas for SWP contracting agencies are shown on Figure 1-1. SWP water is pumped into the California Aqueduct at the SWP Harvey O. Banks Pumping Plant (Banks Pumping Plant) near Tracy. The capacity of the aqueduct is 10,300 cfs, decreasing to 10,000 cfs as contractors divert water to the South Bay Aqueduct from Bethany Forebay. Currently, diversions into the Clifton Court Forebay (CCF) and the California Aqueduct are constrained to an average daily flow of 6,680 cfs, resulting in unused conveyance capacity.

Some conveyance and storage facilities are joint CVP/SWP facilities. Both the CVP and the SWP use the San Luis Reservoir, O'Neill Forebay, and more than 100 miles of the California Aqueduct and its related pumping and generating facilities. Reservoir releases and Delta exports must be coordinated to ensure that each project receives its share of benefit from shared water supplies and bears its share of joint obligations to protect beneficial uses. Operation of the Projects is governed by the Coordinated Operation Agreement (COA). The COA was authorized in 1986 and is both an operations agreement and a water rights settlement.

Delta-Mendota Canal Capacity Constraints

The Jones Pumping Plant and the DMC were originally designed to pump and convey about 4,600 cfs, and these facilities have routinely been operated at 4,600 cfs for many years. The operations of the Jones Pumping Plant are dictated not only by the design capacity, but also by tidal fluctuations at the Jones pumping plant and the capacity of the DMC south of Tracy. Because the DMC capacity upstream of Santa Nella and the pumping capacity at O'Neill Pumping Plant is about 4,200 cfs, additional Jones Pumping Plant pumping can presently be accommodated only if deliveries are made to contractors upstream of the O'Neill Pumping Plant. These factors reduce the opportunities for Reclamation to maximize its full design monthly average pumping rate of 4,600 cfs at Jones Pumping Plant during the fall and winter months.

The Intertie project would allow Reclamation to increase the maximum pumping at Jones Pumping Plant during the fall and winter months from about 4,200 cfs to about 4,600 cfs. This 400-cfs increase in maximum pumping therefore would

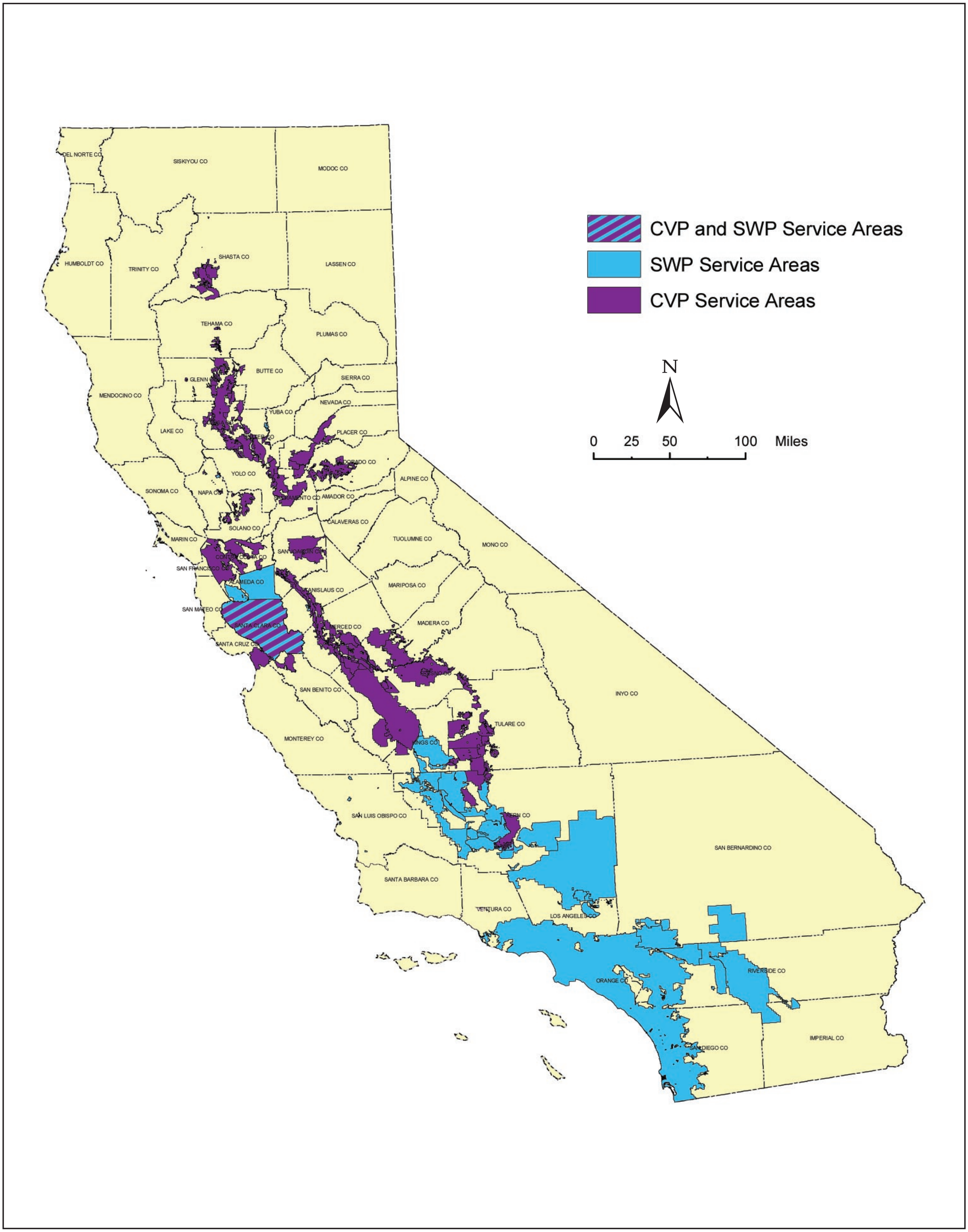

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Figure 1-1
State Water Project (SWP) and
Central Valley Project (CVP) Service Areas

increase the flow and velocities in the DMC intake channel by about 10%. This increased pumping flow would have some effects on the tidal elevations at the DMC intake and would have smaller effects on the tidal elevations, flows, and velocities in the south Delta channels. These tidal effects would be much smaller in other portions of the Delta.

The tidal hydraulic conditions in the Delta channels are governed by the same balance of gravitational and friction forces as the flows, velocities, and water elevations in the DMC. The hydraulic conditions in the DMC recently have been evaluated by Reclamation using the HEC-RAS model, developed by the U.S. Army Corps of Engineers (Corps) (Jonas and Associates and West Consultants 2004a).

The (upstream section) from the Jones Pumping Plant discharge at DMC mile 3.5 to Check 13 (DMC mile 70) was modeled. The DMC design flow (completed in 1952) was 4,600 cfs for the first 10 miles downstream from the Jones Pumping Plant discharge and decreased to 4,200 cfs at DMC mile 54, about 50 miles downstream of the Jones Pumping Plant. This area, from the Jones Pumping Plant to DMC mile 54 is considered the ‘upper DMC.’ The upper DMC was constructed with an average slope of about 4 inches/mile. The canal bottom elevation at the Jones Pumping Plant discharge is about 180 feet msl, and the canal bottom at Check 13 (O’Neill Pumping Plant) is about 158 feet msl. The bottom width is about 48 feet, and the design water depth is about 16.5 feet. With side slopes of 1.5:1 (i.e., 34°), the top width is 98 feet, the wetted perimeter is 106 feet, the conveyance area is about 1,150 square feet, the hydraulic radius is about 11 feet, and the design velocity is 3.7 feet per second (ft/sec). Twelve sets of radial gates (three gates with widths of 20 feet and open depths of 17 feet) are located along the canal to regulate water surface elevations. The canal is operated at a high water surface elevation to prevent maintenance problems caused by changing water pressures behind the canal lining. When the gates are raised, there are relatively small (0.25 foot) water elevation changes through the gates.

Flow in the DMC (and in Delta channels) is governed by the slope and hydraulic radius according to Manning’s hydraulic flow equation as:

$$\text{Velocity (ft/sec)} = 1.5/n * R^{2/3} * S^{1/2}$$

Where n is the friction factor (i.e., a value of about 0.015 for concrete), R is the hydraulic radius (i.e., area/perimeter) of about 11, and S is the water surface slope of about 0.00006.

The flow is the velocity times the conveyance area. A friction factor of 0.014 is needed to give a velocity of 4 ft/sec and a flow of 4,600 cfs with a depth of 16 feet. The DMC modeling suggested a friction factor of 0.016 provided the best match with measured surface elevation along most of the DMC. The DMC water velocity would be lower and the water depths would be greater with this higher friction factor.

The DMC modeling (Jonas and Associates and West Consultants 2004b) indicated that increasing the flow from 4,200 cfs to 4,600 cfs would raise the water surface elevation at the upstream end of the DMC about 2 feet. The DMC water elevation is almost overtopping the canal lining, and the water surface touches many of the bridges across the canal at full water surface elevation. The modeling suggests that 25 bridges or culvert crossings are within 6 inches of the maximum water surface elevations. The water surface elevation drops about 1 foot through the Mountain House Road Siphon (at DMC mile 4.5) which is a 24-foot-diameter tunnel 1,200 feet long.

The DMC lining was raised by 1.5 feet, from about 18 feet above the canal bottom to about 19.5 feet above the bottom, in 1965 to compensate for canal settling and various other factors. The canal lining was raised with tubular concrete bladders in 2002 along portions of the DMC to reduce overtopping spills. About 10 locations with a total length of 2 miles were raised about 6 inches along local “sags.” Locating the Intertie as close as possible to the upstream end of the DMC would allow the full design capacity of 4,600 cfs to be achieved more easily. The DMC is brim full at the design flow of 4,600 cfs. The DMC cannot convey more than 4,600 cfs.

Delta-Mendota Canal/California Aqueduct Intertie Background

A potential intertie to connect the DMC and the California Aqueduct was studied in 1988 by Westlands Water District and Reclamation. The original concept of an intertie involved a pumped connection between DMC and the California Aqueduct that would allow up to 600 cfs of CVP supplies to be diverted from the DMC to the California Aqueduct and conveyed either to San Luis Reservoir or directly to Westlands Water District. This concept was withdrawn before final environmental studies were completed. Additionally, the Intertie was proposed project to implement the California Bay-Delta Program described in the CALFED Programmatic Record of Decision (ROD) issued August 28, 2000. The Intertie is consistent with the implementation approach in the ROD.

The first use of a temporary intertie between the DMC and the California Aqueduct was during construction of the SWP. The South Bay Aqueduct and pumping plant in Bethany Forebay were built in stages between 1960 and 1969. Bethany Forebay reservoir was constructed in 1959–1961. The South Bay pumping plant was built between 1960 and 1969. For several years prior to completion of the Banks Pumping Plant in 1969, an intertie canal and pumping facility were constructed to connect the DMC Tracy Pumping Plant (since renamed as Jones Pumping Plant) headworks to the Bethany Forebay. This intertie canal and pumping facility has not been used in approximately 30 years. Portions of the canal have been removed, several structures have been permanently plugged or removed and the pumping plant is inoperable.

An emergency arose in spring 2001 that called for the installation of a temporary intertie in June 2001 because of damage to the canal lining of the California Aqueduct that affected water deliveries to SWP contractors. At that time, DWR met environmental compliance requirements and installed a temporary intertie. The temporary intertie used rented portable pumping equipment and pipelines to deliver about 100 cfs of SWP water supplies from the DMC to the California Aqueduct for about a 30-day period. This water was used to supply the South Bay Aqueduct pumping from Bethany Forebay (just as during the mid-1960s). Since the one-time operation of the temporary intertie in 2001, discussions have focused on a variety of options to restore capacity in the DMC and address outages and water delivery reductions that could occur as a result of pumping plant or conveyance outages on either the California Aqueduct or the DMC.

The Record of Decision for the CALFED-Bay Delta Program included the Intertie as a related action to the Preferred Program Alternative. Congress confirmed that the Intertie is an operation and maintenance activity in the 2004 “CalFed Bay Delta Authorization Act.” Pub.L 108-361, Title I, § 103(d)(2)(c)(i), 118 Stat. 1681 (Oct. 25, 2004).

1.6 Consultation and Coordination

1.6.1 Public and Agency Coordination

Public Involvement

Reclamation issued a news release on July 20, 2006, seeking public input on preparation of an EIS for the Intertie project. A Notice of Intent (NOI) announcing the preparation of an EIS was published in the Federal Register (FR) on July 12, 2006. Two scoping meetings were held to solicit written comments about the scope of the environmental review. A Sacramento meeting was held August 1, 2006, and a Stockton meeting was held August 3, 2006. Comments were received and incorporated as appropriate into this document. Additionally, a scoping report was prepared and is included as Appendix A.

Reclamation filed a Notice of Availability (NOA) for the draft EIS in the Federal Register on July 17, 2009. The draft EIS was circulated for public review for 45 days, during which time Reclamation held two public hearings (August 4 and 5, 2009). No oral comments were received during these hearings, but ten written comments were received during the public review period. These comments and accompanying responses are included as Volume III of this final EIS, which represents the next step in public involvement. This final EIS will be circulated for at least 30 days before Reclamation issues a record of decision (ROD).

Areas of Controversy

The scoping process and prior litigation revealed several areas of controversy surrounding the Proposed Action. The Proposed Action is controversial as it relates to diversions from the Delta and construction of facilities near the TANC California-Oregon Transmission Project (COTP). In the past several years, virtually any project proposal to change diversions in the Delta has been met with great resistance from a variety of agencies, organizations, and landowners depending on the specific proposal. It is assumed that the Intertie generates a similar level of controversy.

As described above, the Intertie was included in the consultation for OCAP. As such, restrictions on diversions outlined in the Operations BOs apply to the Intertie operations and would minimize or avoid adverse effects on fish related to the Intertie. These restrictions are adopted in this EIS as mitigation where an effect attributable to the Intertie is identified.

As described above, TANC submitted a comment letter during public scoping stating opposition to the proposed siting of the Intertie. In response, Reclamation has developed a Construction Safety Plan outlining the measures that will be implemented to avoid disruption of the transmission line and injury or death related to construction and maintenance of the Intertie facilities. These measures, as they apply to environmental effects disclosed in this EIS, have been incorporated into the project either as Environmental Commitments or as mitigation measures.

Additionally, the previous lawsuit brought by the Planning and Conservation League (PCL) on the EA for the Intertie indicates controversy related to the suit points:

- Use of CALSIM model as the only tool for evaluation of effects without disclosing the limitations of the model.
- Cumulative effects analysis that did not include all reasonably foreseeable projects.
- Determination of significance based on a percentage change.

Reclamation has addressed each of the identified areas of controversy through changes in the project, impact assessment, and inclusion of measures required for ESA compliance.

1.6.2 Agency Coordination and Consultation

As part of the development of the Intertie, Reclamation has coordinated with several agencies, including USFWS, DWR, and cooperating agencies. Reclamation has coordinated with USFWS for development of the Coordination Act Report (CAR) and consultation under Section 7 of the ESA (OCAP) and with

DWR to obtain right-of-way access on the California Aqueduct. Coordination with the cooperating agencies is described below.

Cooperating Agencies

The Western Area Power Administration (Western) has participated in the preparation of this EIS in regards to the interconnection and the construction and operation of the new transmission line associated with Alternatives 2 and 3. They will use this EIS as their NEPA compliance document for construction and operation of the new transmission line and a new point of delivery on Western's system for delivery of power for the Intertie.

The Authority is the local project proponent for the Intertie, and will be responsible for its construction. They have participated in the preparation of this EIS.

Consultation

Table 1-1 summarizes the status of consultation and other requirements that must be met by Reclamation before the Proposed Action can be completed.

Table 1-1. Summary of Environmental Compliance for the Proposed Action

Requirements	Status of Compliance/Expected Completion
National Environmental Policy Act	Ongoing as part of this document.
Federal Endangered Species Act	Reclamation has received BOs from NMFS and FWS for long-term operations of the CVP, which includes the Intertie.
Magnuson-Stevens Fishery Conservation and Management Act	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.
Fish and Wildlife Coordination Act	USFWS provided a Coordination Act Report (CAR) for the project in November 2004 and the recommendations in the report were incorporated into the final EA/IS for the Proposed Action. 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.
Migratory Bird Treaty Act	Reclamation will comply with provisions of the Migratory Bird Treaty Act.
Clean Air Act	The Intertie incorporates measures consistent with the applicable Air Quality Management Districts.

Requirements	Status of Compliance/Expected Completion
National Historic Preservation Act	Reclamation consulted with the SHPO regarding the Proposed Action on January 25, 2005. The SHPO concurred with Reclamation that efforts to identify historic properties in the APE were adequate and that no historic properties would be adversely affected by the Proposed Action.
Uniform Building Code	Reclamation will comply with the Uniform Building Code.
Executive Order 13112—Prevention and Control of Invasive Species	The environmental commitments in Chapter 2 of this document include measures to avoid and minimize the introduction and spread of invasive plants into and from the project area for the Proposed Action.
Executive Order 12898—Environmental Justice	No minority or low-income areas or communities would be disproportionately affected by the Proposed Action.

1.7 Relationship between Short-Term Uses and Long-Term Productivity

NEPA requires that the local short-term benefits of implementing any of the project alternatives be compared to the maintenance and enhancement of long-term productivity (42 U.S. Government Code [USC] 4332; 40 Code of Federal Regulations [CFR] 1502.16). The Intertie has been proposed to improve the DMC conveyance conditions that restrict the Jones Pumping Plant to less than its monthly average pumping capacity of 4,600 cfs, thus contributing to long-term productivity related to the use of the CVP water that can be pumped as a result of the Intertie.

The short-term effects as a result of implementation of project alternatives include construction-related emissions and effects on aquatic and terrestrial species in the project area, and the conversion of agricultural and/or open space lands. A small amount of agricultural land would be permanently converted within the Alternative 3 footprint; however, this represents a small amount of the total area of agricultural lands within the project area. The short-term effect on air quality would occur only during project construction. The small loss in agricultural land would not result in the loss of the long-term productivity of remaining agriculture lands.

1.8 Irreversible and Irretrievable Commitments

This section fulfills the requirement to address irreversible and irretrievable commitments of resources. Irreversible impacts are those that cause, through direct or indirect effects, use or consumption of resources in such a way that they cannot be restored or returned to their original condition despite mitigation. Potentially irreversible impacts are documented in this report. An irretrievable impact or commitment of resources occurs when a resource is removed or consumed. These types of impacts are evaluated to ensure that consumption is justified.

Irreversible commitments of resources would result from implementing project Alternatives 2, 3, or 4. These resources include:

- construction materials;
- labor;
- energy needed for construction, operation, and maintenance; and
- minor land conversion of open space, agricultural, and natural environments.

Land uses that would be irreversibly committed include agricultural land and open space. The loss of agricultural land occurs only under Alternative 3 and is minimal, and affects lands currently fallowed. However, this conversion of some agricultural lands to nonagricultural uses is considered an irreversible and irretrievable commitment of resources.

1.9 Organization of This Document

The content and format of this final EIS are based on NEPA requirements and standard practices and evaluate the project's effects on the following resources:

- Section 3.1, Water Supply and Delta Water Management;
- Section 3.2, Delta Tidal Hydraulics;
- Section 3.3, Delta Water Quality;
- Section 3.4, Geology and Soils;
- Section 3.5, Transportation;
- Section 3.6, Air Quality;
- Section 3.7, Noise;
- Section 3.8, Climate Change Effects;
- Section 4.1, Fish;
- Section 4.2, Vegetation and Wetlands;
- Section 4.3, Wildlife;
- Section 5.1, Land Use
- Section 5.2, Power Production and Energy;
- Section 5.3, Aesthetics and Visual Resources;

- Section 5.4, Cultural Resources;
- Section 5.5, Hazards and Hazardous Materials;
- Section 5.6, Socioeconomics;
- Section 5.7, Indian Trust Assets;
- Section 5.8, Utilities and Public Services;
- Section 5.9, Environmental Justice;
- Chapter 6, Cumulative Impacts; and
- Chapter 7, Growth-Inducing Impacts.

Appropriate setting information and a discussion of adverse effects are provided for each resource. Additionally, the changes in water supply, Delta water management (Section 3.1), and Delta tidal hydraulics (Section 3.2) are described to provide information for the assessment of effects on the resources listed above. Volume III contains the comments received during public review of the draft EIS and Reclamation's responses to these comments.

1.10 Resources Eliminated from Detailed Discussion

Some resources are not expected to be affected by either the construction or operation of the Proposed Action and alternatives. The reasons these resources are not discussed in detailed are explained below.

1.10.1 Navigation

Navigation would not be affected by the Proposed Action because none of the project components would be constructed in, or alter, a navigable waterway. Additionally, the small changes that could occur as a result of operating any of the action alternatives would not result in changes in navigation in the affected channels. Therefore, navigation is not included for detailed discussion.

1.10.2 Population and Housing

No changes in population or housing would occur as a result of implementing any of the alternatives. The construction of the Intertie would not require new housing and would not result in changes in population. Similarly, the installation of the temporary Intertie during emergencies would not require new housing or result in an increase or change in population. Operating neither the Intertie nor the temporary Intertie would require housing, and neither would change populations in the Intertie area or in the services areas. Therefore, population and housing are not discussed further. However, Chapter 7 specifically addresses the potential for indirect growth-inducing effects.

1.10.3 Recreation

The alternatives would not result in changes in recreation or require the construction of new recreational facilities. The alternatives would be installed or constructed in an area that is currently used only to access the DMC, and would not result in changes in upstream or downstream water levels that could affect recreational opportunities. Therefore, recreation is not discussed in further detail.

Chapter 2 Project Description and Alternatives

2.1 Introduction

Reclamation is considering the implementation of the Intertie to provide operational flexibility and address operations and maintenance constraints of the CVP just south of the Jones Pumping Plant. The Intertie action alternatives are intended to satisfy the project purpose and needs of meeting current water supply demands, allowing for the maintenance and repair of the CVP Delta export and conveyance facilities without water supply interruptions to the upper DMC contractors, and providing operational flexibility to respond to emergencies related to both the CVP and the SWP.

2.2 Alternatives Development

The Jones Pumping Plant and the DMC were designed to pump and convey about 4,600 cfs. The operations of the Jones Pumping Plant are dictated not only by the design and permitted limits, but also by the tidal fluctuations at the Jones Pumping plant and the capacity of the DMC south of Jones Pumping Plant. Because the DMC capacity upstream of Santa Nella and the pumping capacity at O'Neill Pumping Plant is about 4,200 cfs, additional Jones Pumping Plant pumping can be presently accommodated only if deliveries are made to contractors upstream of the O'Neill Pumping Plant. These factors reduce the opportunities for Reclamation to utilize its maximum monthly average pumping rate of 4,600 cfs at Jones Pumping Plant during the fall and winter months.

As such, alternatives to allow Reclamation to maximize pumping were evaluated. Ultimately, the construction and operation of an intertie between the California Aqueduct and the DMC was proposed. Locations were evaluated based on their ease of access, length between the California Aqueduct and the DMC, geological conditions, distance from Jones Pumping Plant, and other physical factors.

The EA (Bureau of Reclamation 2004) evaluated the Proposed Action, an Intertie connection between Mile 7.2 of the DMC and Mile 9 of the California Aqueduct. This EIS also evaluates an alternate location for the same structure (Alternative 3) farther south. This alternative was suggested by TANC as a result of their concerns with the Proposed Action's location relative to the COTP. Additionally, a less permanent alternative is evaluated (Alternative 4) that utilizes Banks Pumping Plant capacity to pump the 400 cfs that cannot be conveyed after Jones Pumping Plant.

Alternative 2 is the Proposed Action and the Preferred Alternative due to its proximity to the Jones Pumping Plant, the short distance between the California Aqueduct and DMC in this location, and the water supply reliability it provides.

2.3 Alternative 1 (No Action)

NEPA requires the lead agency to analyze a no action alternative. This alternative represents the future conditions without the Proposed Action or alternatives. Under the No Action Alternative, the Intertie between the DMC and California Aqueduct would not be constructed or operated, and CVP operations would continue without the use of an intertie connection to the California Aqueduct. It is anticipated that maintenance and repairs to the DMC would increase, water supply deliveries would be interrupted during O&M activities, and conveyance capabilities would continue to be constrained.

The No Action Alternative assumes that project operations would continue under the existing regulatory and legal constraints. Because the No Action Alternative represents future conditions, it is possible that other actions may take place and projects may be constructed and implemented in the foreseeable future that could affect environmental resources absent the Proposed Action. NEPA requires the disclosure of effects that these foreseeable actions may have on environmental resources. These effects are discussed in Chapter 6, “Cumulative Impacts,” of this EIS.

2.4 Alternative 2 (Proposed Action)

Alternative 2 (Intertie) is the Proposed Action. The site of the Proposed Action is in an unincorporated area of the San Joaquin Valley in Alameda County, west of the city of Tracy (Figure 2-1). The site is in a rural area zoned for general agriculture and is under federal and state ownership. Alternative 2 consists of constructing and operating a pumping plant and pipeline connection between the DMC and the California Aqueduct at Mile 7.2 of the DMC and Mile 9 of the California Aqueduct, where the DMC and California Aqueduct are approximately 500 feet apart (Figure 2-2).

The Intertie would allow the DMC and California Aqueduct to share conveyance capacity and could be used to convey water in either direction. To convey water from the DMC to the California Aqueduct, the Intertie would include a pumping plant at the DMC that would allow up to 467 cfs to be pumped from the DMC to the California Aqueduct via an underground pipeline. This additional 467 cfs would allow the Jones Pumping Plant to pump at its designed maximum monthly average rate of about 4,600 cfs. Additionally, water could be conveyed from the California Aqueduct to the DMC. Because the California Aqueduct is approximately 50 feet higher in elevation than the DMC, up to 900 cfs flow could be conveyed from the California Aqueduct to the DMC through the Intertie using

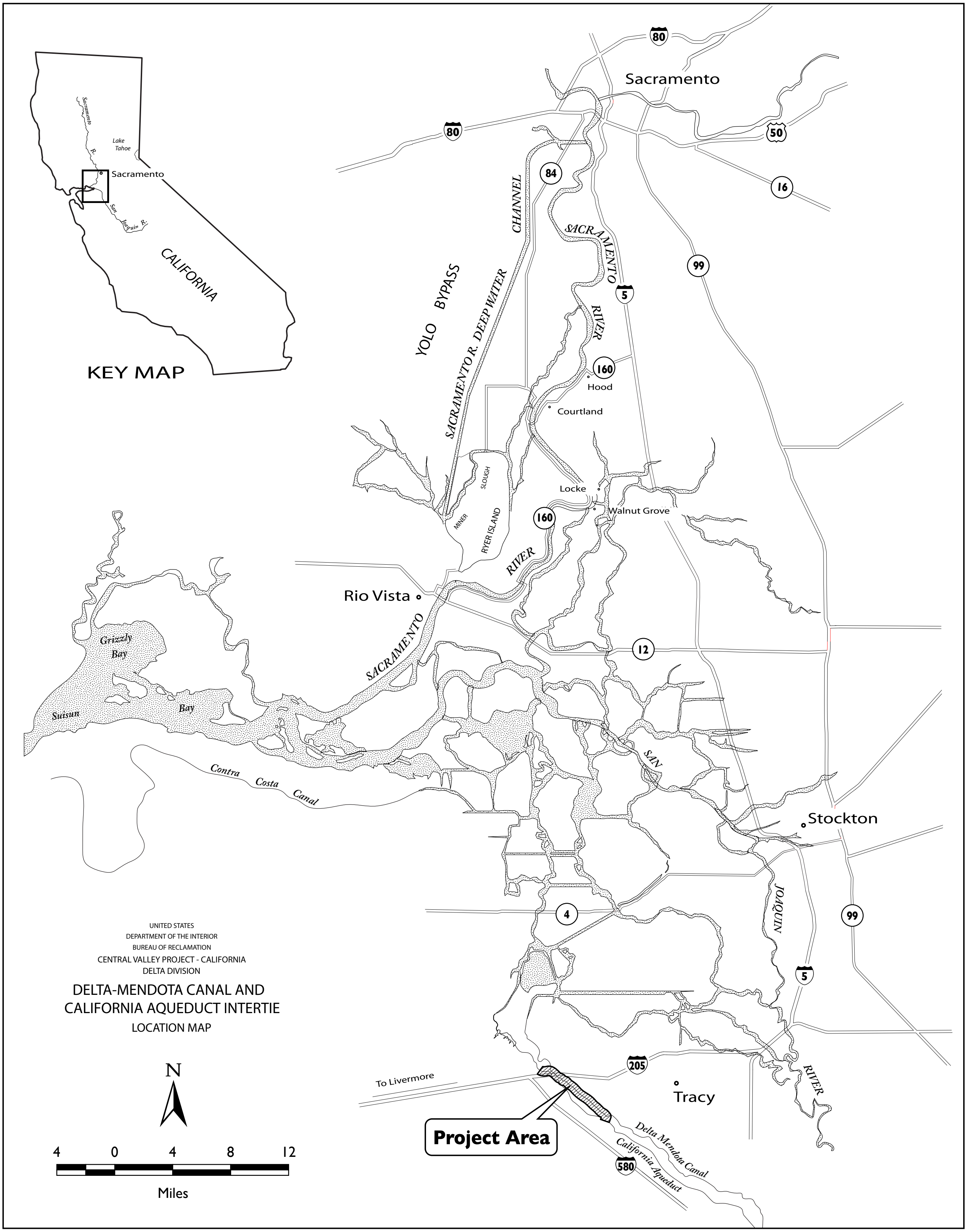

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Figure 2-1
Regional Location Map

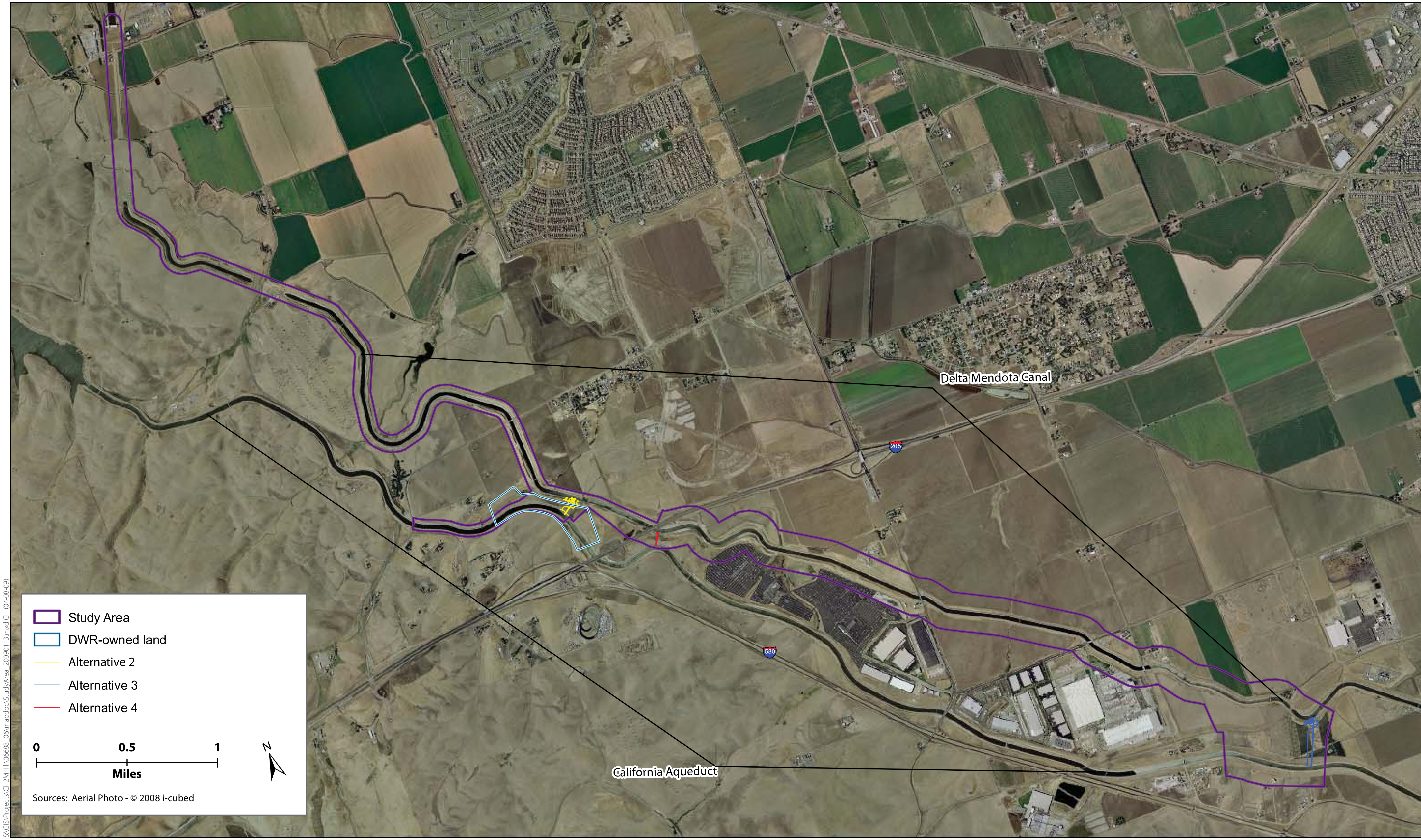

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Figure 2.2
Project Study Area

gravity flow. The operations of the Intertie would be subject to all applicable export pumping restrictions for water quality and fisheries protection.

The Intertie would be owned by the federal government and operated by the Authority. An agreement among Reclamation, DWR, and the Authority would identify the responsibilities and procedures for operating the Intertie. Reclamation would obtain a permanent easement for the portion of the Intertie alignment that is constructed on the state property (Figures 2-2 and 2-3).

2.4.1 Design

The primary project component of the Intertie would be a pumping plant with a total pumping capacity of 467 cfs, although the maximum average monthly pumping is expected to be around 400 cfs. Figure 2-3 shows a preliminary site plan. The Proposed Action would involve the installation of four electrically powered pumping units, each rated at 116.7-cfs capacity, within the pumping plant structure. Water would be withdrawn from the DMC through a conventional-style intake structure consisting of four bays (one bay for each of four pump units) with trashracks mounted flush with and parallel to the existing canal sideslope. Each intake bay would contain stoplog slots to allow isolation of the intake structure from the pumping plant sump. Water would be pumped uphill a vertical distance of about 50 feet through belowground pipelines and discharged into the California Aqueduct.

A switchyard would be located northwest of the pumping plant. A new power transmission line would be extended to the new switchyard site from the Tracy switchyard located 4.5 miles to the north. The O&M roads along the DMC and California Aqueduct would be realigned to accommodate project structures. A new access road would connect the DMC and California Aqueduct, and a service yard would be constructed adjacent to the pumping plant. The road would be 16–20 feet wide and surfaced with gravel. Guardrails, drainage culverts, and suitable erosion control measures would be installed as necessary for safety and controlling surface runoff. A pre-engineered steel building would be constructed at the southeast end of the project site and would house the pumping plant units and motor control equipment. A 9-foot-high chain link security fence with razor wire on top would be installed around the pumping plant and associated facilities. The exterior of the facilities would be lighted.

2.4.2 Construction Activities

Construction of the Intertie would be completed within approximately 12–15 months after award of the construction contract. Construction activity would occur 8–10 hours per day, 6 days per week.

DMC Pumping Plant, Intake Structure, and Pipeline

Construction activity would begin with site excavation for the pumping plant. A sheet pile cofferdam would be installed on the DMC and dewatered to allow construction of the pumping plant intake. It is anticipated that the contractor would use a vibratory hammer for sheet pile installation for a period of 8 to 10 hours per day; cofferdam construction for the DMC intake would take approximately 6 days. The cofferdam would be dewatered prior to the removal of the canal lining. Once this is accomplished, excavation for the pumping plant intake would proceed. Relatively deep excavation would be required at the intake site. The excavation sideslopes would be shored using sheet piling. A dewatering system would be installed outside as necessary to maintain reduced groundwater levels in the construction area. These measures would ensure the stability of the excavation and allow construction to proceed in dry conditions. It is estimated that construction of the intake structure floors and walls would take 47 days. Installation of the pumping plant floor slabs also would occur during this period.

Following construction of the intake structure and pumping plant floor, construction of the pumping plant would continue, as would the installation of the pumping plant discharge lines. Each pair of pumping units would be connected via a manifold to a 9-foot-diameter discharge pipe. A flow measurement structure would be located midway between the pumping plant and the intake structure to allow monitoring of flow rates in each pipe.

Cumulatively, construction of the pumping plant, intake structure, and associated components (e.g., trashracks, bulkhead gates, pumps and valves) would take approximately 200 days and would extend from April through September. Roads and a parking lot at the site would be constructed in mid-September. The construction of the pumping plant, intake structure, and pipeline would require a maximum construction crew of 24 people.

Construction of the intake structure on the DMC and the turnout on the California Aqueduct likely would require lowering the water surfaces of both canals. To minimize impacts on water deliveries, these drawdowns would be timed to occur during periods of lower demand and would be limited in duration.

Two discharge pipes would cross under the California Aqueduct O&M road and connect to the California Aqueduct turnout. Motor-operated slide gates would be mounted over each discharge pipe at this structure. Installation of the pipeline and associated structures would take approximately 46 days and would extend from July through August, using a maximum construction crew of 10 people.

Excavated material not reused in permanent construction would be disposed of in spoilbanks in the federal and state right-of-way land between the two canals. The exact location of the new spoilbanks has not been determined, but they would be placed adjacent to the existing spoilbanks and canal embankments within 2,600 feet of their point of origin. They would not be placed where they would

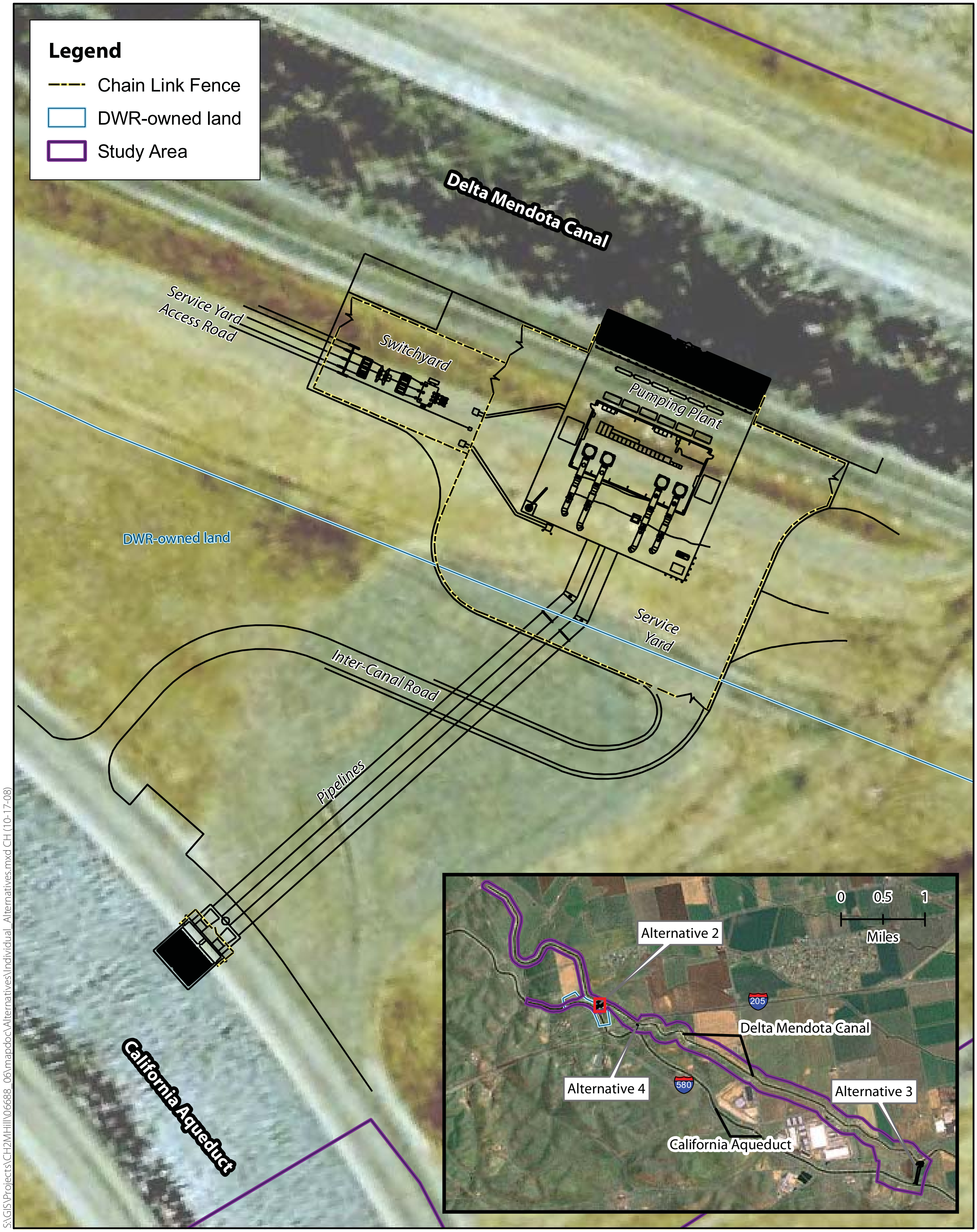

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Figure 2.3
Alternative 2

result in an effect on any sensitive resources such as wetlands or cultural resources. The potential footprint has been surveyed and no resources are within the footprint of the Proposed Action. No material would be hauled or disposed of outside the right-of-way.

Staging and stockpile areas would be located in flat areas along the federal right-of-way on both the sides of the canal. Areas disturbed by construction activities would be restored by grading and revegetating at the completion of construction. During construction, these areas would be controlled using best management practices (BMPs) to minimize potential temporary erosion effects.

Construction of the pumping plant, intake structure, and pipeline would require backhoe and front-end loaders, excavators, dump trucks, a crane, vibratory compactor, vibratory pile hammer, concrete mixers, and boom and scissor lifts. A 10-ton flatbed truck and pickup trucks would deliver materials and equipment. Additional equipment to be used includes a roller, trailer-mounted diesel pump, air compressor, generator, and welder. Construction materials would include contractor offices and various support facilities; pipe, pumps, valves, and other permanent machinery and equipment; temporary equipment such as dewatering systems; and imported earth materials such as gravel and asphalt. Portable generators and air compressors would be used at the pumping plant until the structure is complete and permanent power is installed.

California Aqueduct Turnout Structure

Initial excavation for the California Aqueduct turnout would begin after construction at the pumping plant site is initiated. As with the DMC intake site, relatively deep excavations would be required at the California Aqueduct turnout site. The excavation sideslopes would be shored using sheet piling, and a dewatering system would be installed as necessary to maintain reduced groundwater levels in the construction area.

A prefabricated steel cofferdam would be trucked to the turnout site, and lifted and positioned with a crane at the California Aqueduct. Complete installation of the cofferdam would require approximately 10 days. The turnout cofferdam then would be sealed and dewatered prior to removal of the aqueduct lining. Further excavation for the turnout structure then would proceed. It is estimated that construction of the turnout would take 52 days. Trashracks, grating, slide gates, and bulkhead gates then would be installed over a period of approximately 7 days. The cofferdam would be removed once the gates are tested and the turnout structure is completed. With the gates installed and the canal lining repaired, the cofferdam would be removed.

Installation of the turnout structure and associated components would extend from the end of April through mid-August for approximately 94 days, with a maximum construction crew of 12 people.

Construction equipment would include a grader, excavator, dump truck, crane, vibratory compactor, air compressor, generator, loaders, and concrete mixers. Delivery vehicles, such as pickup trucks and a 10-ton flatbed truck, would deliver preassembled components such as the bulkhead and turnout gates and additional construction materials to the turnout site.

Switchyard

The new switchyard would be located adjacent to the pumping plant on the northwest side. Construction of the switchyard would begin with excavation and fill for the switchyard followed by excavation for the pull boxes. Gates and fencing for the switchyard would be constructed once excavation is completed. A 480-volt engine-generator would be installed as well as a fire detection and suppression system.

Construction of the switchyard and installation of associated electrical equipment would take an estimated 107 days and would extend from mid-July through October, with a maximum construction crew of 8 people.

Construction equipment would include a forklift, excavator, vibratory compactor, roller, grader, crane, dozer, concrete mixer, loaders, and dump trucks. In addition, a water truck would be used to control dust.

Transmission Line

To supply the Intertie with power, a new overhead 69-kilovolt (kV) transmission line connecting to the Tracy substation would be constructed. The transmission line would run parallel to the DMC for approximately 4.5 miles and be built entirely on the west side of the canal. The line would be constructed using approximately 51 wood poles and 25 glue laminate poles, which would be placed in augered holes in the spoil piles from the construction of the canal. The holes would be no more than 3 feet, 5 inches in diameter and approximately than 14 feet in depth, supporting poles approximately 61 feet tall. Although span lengths will vary according to ground and alignment conditions, it is estimated that the average span length across straight segments of the transmission line would be approximately 300 feet.

Typically, following soil excavation/extraction, structure installation is done in three distinct steps: (1) vehicles traverse the transmission line right-of-way delivering materials at each structure site, such as poles, steel, hardware, etc; (2) once the materials are at each site, the structures are assembled prior to erection; and (3) the structures generally are erected with a large crane. The majority of the extracted dirt would be backfilled and compacted to support the poles. The remainder would be placed back onto the spoil piles. Wood poles would be further stabilized by guy wires anchored 50–60 feet from the pole’s base. Conductor, fiber optic cable, and optical ground wire would be strung on these poles. Transmission line installation would result in a permanent ground disturbance of approximately 3 to 13 square feet for each pole; the total permanent ground disturbance for the entire transmission line would be 0.005 to 0.02 acre. These estimates are based on a permanent ground disturbance diameter of 2 to 4 feet for each pole.

Temporary staging and stockpile areas would be required to store construction equipment and other construction-related material. Typical construction equipment would include a drill rig, grader, backhoe, loader, dozer, aerial lift truck, line trucks, pole and cable trucks, utility trucks, puller/tensioners, and a crane. Delivery vehicles such as flatbed trucks generally would be used to deliver preassembled and additional support structure components to each pole site. In addition, a water truck would be used to control dust. Construction of the transmission line would take approximately 40 work days.

As described above, there are no sensitive resources within the footprint of the project. Areas disturbed by construction activities would be restored by grading and revegetating at the completion of construction. BMPs to minimize potential temporary erosion effects during construction will be incorporated in the project.

2.4.3 Operation

During startup, the pumping plant would be operated in manual and local automatic mode. Shortly after startup, installation of supervisory control and data acquisition (SCADA) equipment would allow the facility to operate in full automatic mode and would integrate data feedback to the Delta and CVP Operations Centers to facilitate overall system operations. Prior to any operations, Reclamation will seek approval from DWR for the introduction of water into the California Aqueduct. The Intertie would be used under three different scenarios:

1. Up to 467 cfs would be pumped from the DMC to the California Aqueduct to help meet water supply demands of CVP contractors or be stored in the CVP portion of San Luis Reservoir for later release to meet CVP demands. This would allow Jones Pumping Plant to pump to its full-design monthly average capacity of 4,600 cfs in the fall and winter months, subject to all applicable export pumping restrictions for water quality and fishery protections. As modeled and analyzed for this EIS, the Intertie would be operated primarily in September through March.
2. Up to 467 cfs would be pumped from the DMC to the California Aqueduct to minimize impacts on water deliveries attributable to temporary restrictions in flow or water levels in the DMC south of the Intertie, or the California Aqueduct north of the Intertie, for system maintenance or because of an emergency outage.

3. Up to 900 cfs would be conveyed from the California Aqueduct to the DMC using gravity flow to minimize impacts on water deliveries attributable to temporary restrictions in flow or water levels in the California Aqueduct south of the Intertie, or the DMC north of the Intertie, for system maintenance or for an emergency outage of the DMC, Jones Pumping Plant, or Tracy Fish Facility.

During normal Intertie use, water in the DMC would be conveyed to the California Aqueduct via the Intertie. Water diverted through the Intertie would be conveyed through the California Aqueduct to O'Neill Forebay. The CVP water reaching O'Neill Forebay could be pumped into CVP San Luis Reservoir, released to the San Luis Canal and the Dos Amigos pumping plant, or released through the O'Neill Pumping Plant to the section of the DMC south of O'Neill Pumping Plant (lower DMC) and Mendota Pool.

Under reverse flow operations, water would be withdrawn from the California Aqueduct using gravity flow. The pumping plant would incorporate reverse flow pipelines and valves that would bypass the pumping units and discharge directly into the pumping plant sump. The Intertie would provide operational flexibility in using the conveyance capacity of the DMC and the California Aqueduct. These operations would not result in changes to authorized or permitted levels of pumping or capacity of the Jones Pumping Plant or Banks Pumping Plant.

Water conveyed through the Intertie to minimize reductions in water deliveries during system maintenance or an emergency outage of any portion of the CVP or SWP Delta export and conveyance facilities could include pumping CVP water at Banks Pumping Plant or pumping SWP water at Jones Pumping Plant through use of Joint Point of Diversion (JPOD). In accordance with COA Articles 10(c) and 10(d), JPOD may be used to replace conveyance opportunities lost because of scheduled maintenance or unforeseen outages. Use of JPOD for this purpose could occur under Stage 2 operations defined in D-1641 or could occur as a result of a Temporary Urgency request to the State Water Board. Use of JPOD for this purpose does not result in any net increase in allowed exports at CVP and SWP export facilities. Use of Stage 2 JPOD requires review and approval by the State Water Board.

2.4.4 Transmission Line Inspection and Maintenance

Periodic inspection activities may include ground and aerial patrols along the transmission line right-of-way. Inspections generally would involve visual evaluations of components such as conductors, transmission line support structures, and hardware.

Routine minor maintenance within the transmission line right-of-way would include, but would not be limited to, the following activities:

- pole and guy wire–anchor maintenance;

- insulator maintenance;
- cross arms maintenance;
- vegetation clearance, as needed, around poles and guy-wire anchors;
- vehicle and equipment staging; and
- conductor upgrade/maintenance.

These maintenance tasks, as well as other preventive maintenance, would cause no or nominal effects on sensitive resources with the implementation of BMPs. Maintenance equipment may include, but would not be limited to, aerial lift trucks, line trucks, steel-tracked and/or rubber-tired bulldozers, graders, backhoes, and front-end loaders.

2.5 Alternative 3 (TANC Intertie Site)

Alternative 3 is similar in design to the Proposed Action and the same in operation. The only difference is the location of the Intertie and appurtenant structures. The TANC Intertie Site alternative was developed in response to scoping comments submitted by TANC, which requested that the Intertie site be relocated to avoid high-voltage transmission lines. TANC identified two options for alternative sites. Option 1 is evaluated in this EIS because it is most similar in length and distance from the Jones Pumping Plant. Alternative 3 would be located at Milepost 11.6 of the DMC and Milepost 13.8 of the California Aqueduct, where these facilities are approximately 1/4 mile apart (Figure 2-2).

2.5.1 Construction

Construction activities associated with Alternative 3 would be the same as described for Alternative 2. Similar to Alternative 2, Alternative 3 includes the construction of a new transmission line to connect to the Tracy Substation. This transmission line would be longer than the line for Alternative 2 because the Intertie structure is farther from the substation and would cross Interstate 205 (I-205). Approximately 152 poles would be installed for the transmission line; therefore, more excavation would be required to install the additional poles. Total permanent ground disturbance for the entire transmission line would be approximately 0.01 to 0.04 acre. This estimate is based on a permanent ground disturbance diameter of 2 to 4 feet for each pole.

2.5.2 Operation

Operation of Alternative 3 would be the same as described for Alternative 2.

2.6 Alternative 4 (Virtual Intertie)

Alternative 4 (Virtual Intertie) would use Banks Pumping Plant capacity not used by SWP for Table A deliveries to pump the increment of CVP water that cannot be conveyed in the DMC without the Intertie. This would use some of the available pumping and conveyance capacity of the SWP. CVP operations at Jones Pumping Plant therefore would not change. Under the Virtual Intertie alternative, the CVP would use the Banks Pumping Plant to convey CVP water to O'Neill Forebay and CVP San Luis Reservoir.

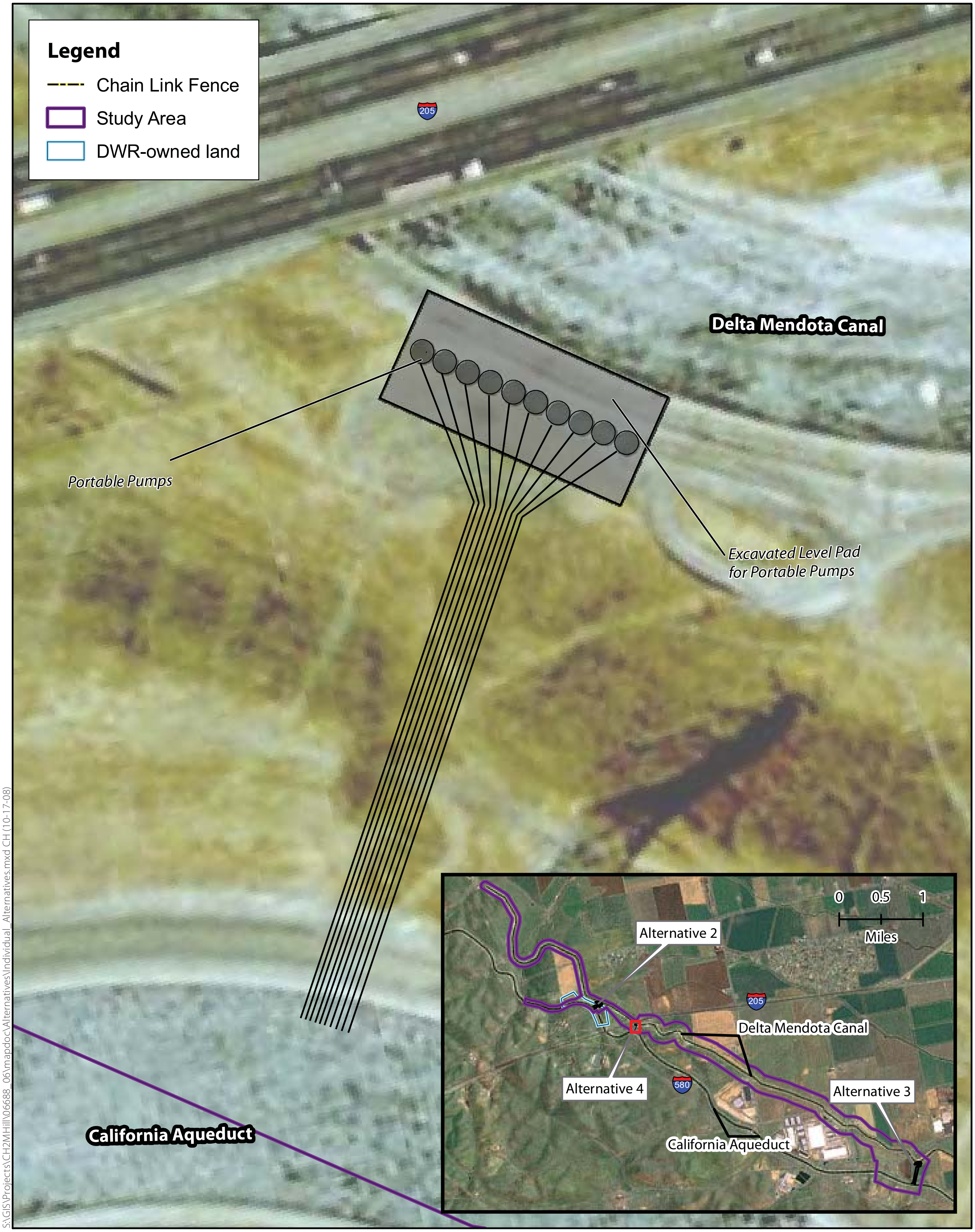
The permitted pumping capacity at Banks would not change from the No Action Alternative. Under the No Acton Alternative, available CVP water for export that cannot be pumped at Jones because of the DMC conveyance limitations is treated as unused federal share under the COA and can be exported by the SWP at Banks. This water, released from upstream CVP reservoirs for instream or temperature control flows, is often more than is required for Delta outflow and the maximum pumping capacity at the Jones Pumping Plant.

During emergencies, a temporary intertie-like structure would be installed to connect the DMC with the California Aqueduct. This structure would be similar to the structure installed in 2001.

2.6.1 Location and Design

No new facilities other than the temporary intertie would be needed to implement the Virtual Intertie. The temporary intertie would be located approximately 0.5 mile south of the Proposed Action at milepost 7.69 of the DMC and at milepost 9.70 of the California Aqueduct (Figure 2-2) and would be accessible only at the intersection of Mountain House Parkway/Patterson Pass Road and the DMC. The temporary intertie would be installed as needed during emergencies and O&M activities. Figure 2-4 provides a preliminary site plan.

The temporary intertie would use rented portable pumping equipment, piping, and associated accessories. This equipment would be hauled to the site on flatbed trailers. If necessary, the site would be re-graded to create a level pad for the pumps to allow them to be positioned close to the DMC water surface. Similarly, grading near the California Aqueduct may be necessary in order to minimize the elevation difference between the DMC and the California Aqueduct, and thereby reduce the height the pumps need to lift the water. The pumps then would be positioned on the leveled pad near the DMC, and 10 diesel-powered pumps would be hoisted into position with a crane. Each pumping unit would require a suction pipe to be installed in the DMC, and approximately 400 feet of discharge pipe would be positioned on the ground and would extend from the pump outlet to the discharge site in the California Aqueduct. It is estimated that pump and pipe installation would require 5 days. Each pump would have a self-contained diesel-fuel storage tank that would be refilled daily during the period of operation.



N

0 100 200
Feet

Figure 2.4
Alternative 4

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When not needed, pumps, piping, and accessories would be loaded onto flatbed trucks with a crane and hauled away. The site would be cleaned and restored in a manner that would allow the temporary intertie to be easily reestablished without significant effort. The leveled pumping pad would remain in place.

2.6.2 Operation

Under the Virtual Intertie Alternative, the CVP would be given up to 400 cfs of priority capacity at Banks to pump water that is released from CVP project reservoirs and is available for CVP pumping under the COA allocation rules. This additional capacity would be allowed during the period from September through March when Jones Pumping Plant typically cannot pump at full capacity.

2.7 Summary Comparison of Alternatives

This section provides a summary of how each alternative meets the project purpose and a comparison of the effects associated with each of the project alternatives. Full discussion of effects on resources may be found in the specific resource sections in Chapters 3, 4, 5, and discussion of cumulative and growth-inducing impacts may be found in Chapters 6 and 7, respectively. Table 2-1 provides an overview of the comparison of alternatives.

Table 2-1. Comparison of Relative Effects under Each Alternative

Item	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3 (TANC Intertie Site)	Alternative 4 (Virtual Intertie)
Attainment of Objectives				
Improve the DMC conveyance conditions that restrict the Jones Pumping Plant	0	+	+	+
Improve operational flexibility for the CVP and the SWP	0	+	+	+
Affected Environment				
Water Supply and Delta Water Management;	0	+	+	+
Delta Tidal Hydraulics	0	-	-	-
Delta Water Quality	0	-	-	-
Geology and Soils	0	-	-	-
Transportation	0	-	-	-
Air Quality	0	-	-	-
Noise	0	- -	- -	- -
Climate Change Effects	0	-	-	-

Item	Alternative 1 (No Action)	Alternative 2 (Proposed Action)	Alternative 3 (TANC Intertie Site)	Alternative 4 (Virtual Intertie)
Fish:				
Chinook salmon	0	-	-	-
Steelhead	0	+	+	+
Delta smelt	0	-	-	-
Longfin smelt	0	-	-	-
Splittail	0	-	-	-
Striped bass	0	-	-	-
Green sturgeon	0	-	-	-
Vegetation and Wetlands	0	-	-	-
Wildlife	0	- -	- -	-
Land Use	0	-	-	-
Power Production and Energy	0	-	-	-
Visual Resources	0	- -	- -	-
Cultural Resources	0	-	-	-
Hazards and Hazardous materials	0	-	-	-
Socioeconomics	0	+	+	+
Indian Trust Assets	0	0	0	0
Utilities and Public Services	0	-	-	-
Environmental Justice	0	0	0	0

Notes:
Attainment of Objectives: “+” = achieves objective; “-” = does not achieve objective
Affected Environment: “+” = beneficial effect; “-” = no adverse effect; “- -” = adverse effect; “0” – no effect

2.7.1 Alternative 1 (No Action)

Alternative 1 would not result in changes to operations or conveyance conditions and, therefore, would not result in any increase in pumping at Jones Pumping Plant. With no Intertie in place, Reclamation and DWR would not be able to easily respond to emergencies related to the California Aqueduct and the DMC. Compared to the baseline, there would be no effects associated with the No Action Alternative.

2.7.2 Alternative 2 (Proposed Action)

The simulated (CALSIM II) results for the Intertie indicate that the maximum assumed CVP pumping capacity of 4,600 cfs would be used in many months of most years. The percentage of monthly pumping at 4,600 cfs would be increased to about 30% in July, 50% in August, 50% in September, 30% in October, 60% in

November, 70% in December, 60% in January and 30% in February. The March pumping would be reduced considerably in most years because CVP San Luis would be filled. As such, entrainment of steelhead in March is reduced, and there is a potential beneficial effect on steelhead. However, because pumping in the winter months is increased, there could be adverse effects on smelt and winter-run or spring-run Chinook salmon. Mitigation for these effects is presented in Section 4.1, as mitigation measures FISH-MM-1, “Eliminate the Change in Pumping Attributable to the Intertie in Months when the Chinook Salmon Salvage Density is Higher than the Historical Median”, and FISH-MM-2, “Eliminate the Change in Pumping Attributable to the Intertie in Months when the Delta Smelt Salvage Density is Higher than the Historical Median”. There could be increased entrainment of other species, but these effects were found to be not adverse.

Alternative 2 provides a benefit for water supply with an average increase of 35 taf/yr. Although this change is a relatively small fraction of the total CVP pumping, it is considered a substantial change in CVP pumping capability because it provides increased operational flexibility and increased emergency response capability. With a permanent structure, Reclamation could more easily and quickly respond to maintenance needs and emergencies, and the potential for water supply interruptions would be reduced compared to the No Action Alternative.

Physical effects include temporary and permanent disruption to the land within the footprint of the Intertie structure and associated transmission line. The land disturbed is ruderal grassland. No wetlands would be affected, but there are wetlands near the project site. This particular site is where the California Aqueduct and the DMC are closest together just south of the pumps, so impacts related to land conversion and habitat disturbance is minimized by this location. However, this site lies beneath the COTP, and TANC has raised concerns about the safety of workers and the risks of a power outage caused by construction and maintenance activities in the vicinity of the COTP.

2.7.3 Alternative 3 (TANC Intertie Site)

Alternative 3 is the same operationally as Alternative 2, and therefore would equally meet the project purposes as described above for Alternative 2. Additionally, the water supply and fish effects would be identical.

Alternative 3 is located farther south than Alternative 2, but is comprised of the same components. However, because it is farther from the Tracy Substation, there are greater effects related to disturbance from placement and maintenance of the new transmission line, although effects to sensitive habitats and land uses would be avoided to the extent possible. Similarly, this site is in a location where the California Aqueduct and the DMC are farther apart and some of the land that would be affected is mapped as prime farmland. No wetlands would be affected, but there are wetlands near the project site. This site is not located under the COTP and therefore poses no risk to workers or potential for power outages.

2.7.4 Alternative 4 (Virtual Intertie)

Alternative 4 would use both the Jones and Banks Pumping Plants to increase CVP deliveries by 27 taf/yr, which is similar to the Intertie CVP pumping increment of 35 taf/yr. Therefore the increase in CVP deliveries for the Virtual Intertie was assumed to be similar to the simulated increase in CVP deliveries for the Intertie Alternative. Entrainment effects of Alternative 4 would be similar to those described for Alternatives 2 and 3.During emergencies, a temporary intertie structure would be installed that would result in temporary disturbance to land, which is ruderal grassland.

2.7.5 Summary and Selection of Preferred Alternative

Each of the Alternatives meet the project purpose, although Alternatives 2 and 3 provide Reclamation with more water supply and greater reliability as these alternatives are not dependent on DWR facilities or installation of temporary structures. Alternative 2 is preferred over Alternative 3 because it results in less ground disturbance and associated impacts on habitat. Additionally, Alternative 3 requires conversion of agricultural land, some of which is designated prime farmland.

2.8 Environmental Commitments

The following measures have been incorporated as part of the Proposed Action and would be incorporated into the construction specifications to address project-related impacts on environmental resources. Because the Authority would be responsible for construction, commitments related to construction would be implemented by the Authority.

2.8.1 Soil Disturbance Requirements

Stormwater Pollution Prevention Plan

A stormwater pollution prevention plan (SWPPP) will be developed by a qualified engineer or erosion control specialist and implemented prior to construction. The objectives of the SWPPP will be to (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity and (2) identify, construct, and implement prevention measures to reduce pollutants in stormwater discharges during and after construction. Reclamation and/or its contractor(s) will develop and implement a spill prevention and control program as part of the SWPPP to minimize effects of spills of hazardous, toxic, or petroleum substances during construction of the Proposed Action. The program will be a component of the SWPPP, which will be completed before any groundbreaking or surface-disturbing activities begin. Implementation of this measure would comply with state and federal water quality regulations. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the Regional Water Quality Control Board (RWQCB). The SWPPP will include, but is not limited to, the following items:

- a description of potential pollutants of stormwater from erosion,
- a description of the management of dredged sediments and hazardous materials present on site during construction (including vehicle and equipment fuels), and
- details of how the sediment and erosion control practices will comply with state and federal water quality regulations.

County Requirements

The proposed action is located in Alameda County of California. Alameda County's grading and erosion control ordinance is intended to control erosion, runoff, and sedimentation caused by construction activities. As per the Alameda County General Ordinance Code (Alameda County 2006), the County's Grading Ordinance, Chapter 15.36, "Grading, Erosion and Sediment Control," outlines regulations and practices relevant to construction and grading activities in the county. Typically, a grading permit is required for all construction and grading activities in the county. Should Alternatives 3 or 4 be implemented, the sites are located in San Joaquin County of California.

2.8.2 California Building Standards Code

The State of California's minimum standards for structural design and construction are given in the California Building Standards Code (CBSC) (24 California Code of Regulations [CCR]). Reclamation will ensure that all proposed facilities meet or exceed all applicable CBSC standards. Design and construction of the Proposed Action facilities in accordance with these standards will prevent or minimize the potential for structural damage from unstable soils, geologic units, and seismic ground-shaking events.

2.8.3 Geotechnical Report

As part of their general plan, Alameda County requires all new development to be designed and constructed to minimize risk from geologic and seismic hazards, with geotechnical investigations to be performed prior to any planning or construction activities.

Reclamation completed a geotechnical investigation for Alternative 2. The pumping station and its associated facilities, the new access road, and pipelines will be constructed in accordance with recommendations set forth in the two available Geotechnical Reports (Mongano 2004; Sherer 2003). These reports evaluate the feasibility of the proposed construction with respect to the observed subsurface conditions and provide geotechnical recommendations for the project design. Should Alternative 3 or 4 be implemented, Reclamation will conduct appropriate geotechnical studies and reports prior to implementation per San Joaquin County requirements.

2.8.4 Pipeline Corrosion

The project pipelines and other facilities will be constructed to reduce the potential for corrosion and eventual failure to the extent feasible. Construction measures include:

- Construct pipelines and other project facilities to withstand the effects of soil corrosion using standard and tested methods of pipeline protection such as pipeline coating.
- Conduct regular inspections of the pipelines during operation at an interval that is in accordance with safe and standard operating practices. The inspections may be conducted visually or with specialized equipment used to detect potential damage and leaks.

2.8.5 Project Site Safety and Security

Reclamation will develop and implement a project-specific safety and security plan, which will establish policies and procedures to protect workers and the public from potential hazards posed by construction activities. The safety and security plan will include, but not be limited to, the following:

- Definitions for controlled access areas at the construction site according to “non-critical” (e.g., site entrance, visitors’ area, contractor’s office) and “critical” (e.g., restricted personnel and vehicle access areas);
- Personnel access requirements (e.g., contractor personnel with “unescorted access” shall be subjected to a background check and required to complete 1 hour of site-specific security training);
- Vehicle access requirements (e.g., no cranes, aerial lifts, or high profile equipment capable of coming within the minimum safe distance of the transmission line will be allowed to operate within the restricted personnel and vehicle access zone within the “critical area” of the construction site); and

- A safety and health specification section that defines the contractor's safety responsibilities.

Additionally, the contractor will also develop and maintain a written comprehensive safety plan covering all aspects of the onsite and applicable offsite operations and activities associated with the contract. Reclamation will monitor the contractor's safety program to ensure compliance with their safety program and contract safety provisions. This will be accomplished by frequent monitoring of job site safety conditions by Reclamation construction personnel, contractor weekly tool box meetings, monthly joint safety meetings, and periodic inspections by Reclamation's safety professionals. The contractor's safety plan will include, but not be limited to, the following:

- Statement of compliance with regulations, standards, and codes;
- Site emergency plans;
- Accident investigation and reporting procedures;
- Guidelines for working near exposed energized overhead lines, substations and switchyard;
- Machinery and mechanical equipment inspection and maintenance procedures; and
- A hazardous energy control program (HECP) that establishes the minimum performance requirements to control unexpected energization, release of stored energy, start up of machinery or equipment that could injure employees, as well as to ensure the protection of the TANC 500 kV transmission line. The plan would also include written procedures for the issue of clearances to work or transport equipment within the 200 foot wide easement of the TANC transmission line that crosses the construction right-of-way, the proper training of employees in the HECP, and the administration and periodic inspection of the program.
- Develop a specific Flashover Prevention Plan for all work adjacent to and underneath TANC's 500-kV transmission line. The plan would identify activities such as smoke from burning debris or power tools or their operation, water spray for dust control, etc., that could lead to fires, smoke, water spray, or other particulate matter or potential for other suspended fines between the ground and the 500-kV conductors. The intent of the plan is to address adequate safety procedures to ensure the insulation level of the air is maintained to avoid flashovers, which occur when higher voltage electricity "jumps across" an air gap to create a conductive path.

Reclamation, will take the following precautions to ensure site safety and security near the 500-kV transmission lines and transmission towers:

- Ensure that there are no cut, fill or spoil bank placement operations that compromise the clearances required for the 500-kV lines in accordance with the present conditions and the applicable government codes.
- Ensure that there are no cut or fill or cofferdam construction/dewatering activities that could affect the stability of the COTP transmission tower footings consistent with all applicable government codes.
- Maintain access to the COTP facilities by TANC and the COTP maintenance representatives at all times. TANC and its contractors, including Western, must be able to access all towers at any time with heavy equipment, and Reclamation will maintain this access during construction. Routine ground patrol to each tower occurs once a year; routine aerial patrol of the transmission lines occur four times a year.
- Allow a TANC representative on site at times when major work is underway on the transmission line right-of-way. Reclamation will provide TANC advance notice of not less than 60 days for all construction schedules to accommodate the necessary communications and arrangements for such TANC on-site representation at TANC's discretion.
- Consult with TANC and/or Western during the installation of temporary clearance markers to indicate the closest safe distances from the conductors.
- Furnish and install permanent markers on Reclamation's facilities indicating the proximity of energized high-voltage power line conductors before the completion of construction.
- Review and comply, during and after construction, with all regulatory requirements and industry standards for proper grounding of metallic equipment, structures, fences, platforms, and other metal facilities in the high-voltage electric field.

2.8.6 Traffic Control Plan

Reclamation, in coordination with affected jurisdictions, will develop and implement a traffic control plan, which will include an emergency access plan, to reduce construction-related effects on the local roadway system and to avoid hazardous traffic and circulation patterns during the construction period. All construction activities will follow the standard construction specifications and procedures of the appropriate jurisdictions.

The emergency access plan would include provisions to allow for access into and adjacent to the construction zone for emergency vehicles. The emergency access plan, which requires coordination with emergency service providers before construction, would require effective traffic and navigation direction, substantially reducing the potential for disruptions to response routes.

To the extent necessary, the traffic control plan would include the following actions:

- coordinating with the affected jurisdictions on construction hours of operation;
- following guidelines of the local jurisdiction for road closures caused by construction activities;
- installing traffic control devices as specified in the California Department of Transportation's (Caltrans') *Manual of Traffic Controls for Construction and Maintenance Works Zones* (California Department of Transportation 1996);
- notifying the public of road closures in the immediate vicinity of the construction zone and/or of temporary closures of bike lanes, and recreation trails;
- providing access to driveways and private roads outside the immediate construction zone;
- monitoring road and bike lane damage and repairing roads and bike lanes damaged during construction, or providing compensation for damage to roadways and bikeways; and
- coordinating with Caltrans and the California Highway Patrol if Alternative 3 is implemented. Alternative 3 would require stringing transmission line conductors and fiber over I-205, an activity that would require close coordination with these agencies to minimize hazards to workers and the public.

2.8.7 Coordination with Union Pacific Railroad

Reclamation will consult with Union Pacific Railroad if Alternative 3 is selected. Because of Alternative 3's proximity to an active railroad, it is assumed that permits would be needed to implement this alternative and that the permits would outline necessary setbacks and clearances to ensure that there are no disruptions to rail service, effects on the stability of the line, or changes in access for Union Pacific.

2.8.8 Revegetation

To minimize impacts on vegetation and wildlife resources, Reclamation will revegetate temporarily disturbed areas with seed suitable for the site conditions and land use. Native seed will be used where appropriate.

2.8.9 Avoid Disruption of Underground Public Utilities

Prior to excavating, existing underground utilities crossing the project study area will be identified. Underground utility lines will be avoided during excavation activities or relocated in coordination with the utility company or service provider. Work will be stopped immediately if an unanticipated conflict with a utility facility were to occur. The affected utility would be contacted immediately to (1) notify it of the conflict, (2) aid in coordinating repairs to the utility, and (3) coordinate to avoid further conflicts in the field.

2.8.10 Sensitive Biological Resources

The following environmental commitments have been incorporated into the project description to avoid potential adverse effects on sensitive biological resources. Additional information is provided in Sections 4.2, Vegetation and Wetlands, and 4.3, Wildlife.

Conduct Mandatory Contractor/Worker Biological Resources Awareness Training for Construction Personnel

Before any work, including grading and transmission line installation, occurs in the construction area occurs, a qualified biologist will provide biological resources awareness training to all construction personnel to brief them on the need to avoid effects on environmentally sensitive areas (i.e., wetlands and other waters, riparian habitat, and areas designated as habitat for special-status species) and the penalties for not complying with biological mitigation requirements. The biological resources training will include a description, representative photographs, and legal status of each special-status wildlife species that may occur in the construction area. If new construction personnel are added to the program, the contractor will ensure that the personnel receive the mandatory training before starting work.

Conduct Construction Activities during the Dry Season

All ground-disturbing activities will be conducted during the dry season, between May 1 and October 15, or before the onset of the rainy season, whichever occurs first.

Locate Staging Areas and Spoils Storage Areas Outside of Environmentally Sensitive Areas

Staging areas, laydown areas, and temporary spoils storage areas will be located as far from environmentally sensitive areas as possible. Preferably, staging areas will be located in developed or previously disturbed areas and/or a minimum of 250 feet from environmentally sensitive areas.

Install Construction Barrier Fencing

Reclamation or its contractor will install construction barrier fencing to protect sensitive biological resources (i.e., wetlands and other waters, riparian habitat, and areas designated as habitat for special-status species) within and adjacent to all construction zones, including the transmission line installation area. The construction specifications will require that Reclamation or its contractor retain a qualified biologist to identify environmentally sensitive areas that are to be avoided during construction. Environmentally sensitive areas adjacent to the directly affected area required for construction, including staging and access, will be fenced off to avoid disturbance in these areas. Before construction, the contractor will work with the qualified biologist to identify the locations for the barrier fencing and will place stakes around the environmentally sensitive areas to indicate the locations of the barrier fences. The protected area will be clearly identified on the construction specifications. The fencing will be installed a minimum of 50 feet (except as described in the mitigation measures for specific special-status species, where greater distances may be required) from the environmentally sensitive area and will be in place before construction activities are initiated. The fencing will be commercial-quality, woven polypropylene, orange in color, and at least 4 feet high (Tensor Polygrid or equivalent). The fencing will be tightly strung on posts with a maximum of 10-foot spacing. The fencing will be maintained throughout the duration of the construction period.

Install Erosion Control Measures near Aquatic Habitat for Special-Status Wildlife

Erosion control measures will be implemented in areas adjacent to aquatic habitat to prevent any soil or other materials from entering aquatic habitat. Erosion control features will be placed in areas that are upslope of or within 300 feet of wetlands or creeks to prevent any soil or other materials from entering aquatic habitat. The locations of erosion control features will be reviewed by a qualified biologist and identified on the final grading plans and construction specifications. Natural/biodegradable erosion control measures (i.e., coir rolls, straw wattles, use of straw over disturbed areas) will be used. Plastic monofilament netting (erosion control matting) will not be allowed because frogs and salamanders can become entangled in this type of erosion control material. Previously disturbed areas will be hydroseeded with native plant species upon project completion.

Retain a Biological Monitor

Reclamation will retain a qualified biologist to monitor construction activities adjacent to environmentally sensitive areas. The biologist will assist the construction crew, as needed, to comply with all environmental commitments and avoidance and minimization measures. Reclamation or its contractor will be responsible for maintaining the staked and flagged perimeters of the construction area and staging areas adjacent to sensitive biological resources. The biological monitor will possess qualifications to conduct additional monitoring activities (e.g., preconstruction surveys, inspection of trenches etc.) for special-status species, as described in the mitigation measures in Section 4.3, Wildlife.

Minimize Effects on Wildlife Movement/Migration

To minimize potential effects on wildlife movement/migration between the DMC and California Aqueduct, fencing will be limited to the general areas surrounding the pumping plant and canal turnouts. During the construction phase of the project, after each working day, a minimum 200-foot-wide area will be kept free of impediments that might block the corridor. In addition, upon completion of the construction of the Intertie, only the intake and outlet structures at each canal will be surrounded by permanent fencing. The flow measurement structure will not be enclosed. The corridor will remain unblocked to allowing wildlife to move freely through the area.

Avoid and Minimize the Introduction and Spread of Invasive Plant Species

Reclamation will incorporate the following measures into construction project terms and specifications to avoid and minimize the introduction of new invasive plant species into the project area and the spread of invasive species to undeveloped lands adjacent to the project area:

- clean construction equipment and vehicles at designated stations prior to entering and leaving the site for the duration of construction;
- use certified, weed-free, imported erosion-control materials (or rice straw in upland areas);
- coordinate with the Agricultural Commissioners in Alameda and San Joaquin Counties and land management agencies to ensure that the appropriate BMPs are implemented for the duration of project construction;
- educate construction supervisors and managers about weed identification and the importance of controlling and preventing the spread of invasive plants; and
- include invasive plant avoidance measures in contract documents and ensure that they are implemented by the project contractors.

2.8.11 Air Quality

Because construction of the Proposed Action could cause a short-term increase in particulate matter 10 microns in diameter or less (PM10) emissions, the Proposed Action has committed to comply with the Bay Area Air Quality Management District (BAAQMD) feasible PM10 emission control measures for construction. The BAAQMD's feasible control measures are summarized in Section 3.6, Air Quality.

2.8.12 Cultural Resources

The following avoidance and minimization measures have been incorporated into the project description to avoid potential adverse effects on sensitive cultural resources. See Section 5.7, Cultural Resources, for additional information.

Inadvertent Damage to or Destruction of Buried Archaeological Sites and Human Remains

In the unlikely event that buried cultural resources (such as chipped or ground stone, historic debris, building foundations, or non-human bone) or human remains are inadvertently discovered during ground-disturbing activities, construction work will stop and the following measures will be implemented.

The contractor will immediately cease work within 100 feet of the find. All construction personnel will leave the area. Vehicles and equipment will be left in place until a qualified archaeologist identifies a safe path out of the area. The on-site supervisor will flag or otherwise mark the location of the find and keep all traffic away from the resource. The on-site supervisor will notify the Reclamation archaeologist within 24 hours of the find.

Upon cessation of work and notification of responsible parties, the Reclamation archaeologist will determine whether the resource can be avoided. If avoidance is feasible and impacts on the cultural resource have not occurred, the project can proceed in accordance with recommendations from the Reclamation archaeologist. If the resource cannot be avoided or it already has been affected by construction, treatment of the find must comply with the discovery procedures of Section 106 of the National Historic Preservation Act (NHPA) (36 CFR 800.13[3]). These procedures consist of a determination of significance; consultation among Reclamation, other consulting parties (such as DWR), and State Historic Preservation Officer (SHPO); and, if the resource is determined to be significant, suitable implementation of mitigation, in consultation with the SHPO.

If any burials or fragmentary human remains of Native American origin are encountered as a result of project construction, the contractor will immediately cease work within 100 feet of the find. All construction personnel will leave the area. Vehicles and equipment will be left in place until a qualified archaeologist identifies a safe path out of the area. The on-site supervisor will flag or otherwise mark the location of the find and keep all traffic away from the resource. The on-site supervisor will notify the Reclamation archaeologist within 24 hours of the find. Reclamation is responsible for compliance with the Native American Graves Protection and Repatriation Act (43 CFR 10) if inadvertent discovery of Native American remains occurs on federal lands. Reclamation is responsible for compliance with state laws relating to the disposition of Native American burials (Public Resources Code [PRC] 5097 and California Health and Safety Code 7050.5[b]).

According to California Health and Safety Code, six or more human burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052). Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the county coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the Native American Heritage Commission (NAHC). No construction or disturbance of the area will occur until either (1) the descendants of the deceased Native Americans have recommended a means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in PRC 5097.98; or (2) the descendant fails to make a recommendation within 48 hours after being notified by the NAHC.

Chapter 3 Physical Environment

This chapter provides the results of the assessment of potential effects on physical 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 3.1, *Water Supply and Delta Water Management*;
- Section 3.2, *Delta Tidal Hydraulics*;
- Section 3.3, *Delta Water Quality*;
- Section 3.4, *Geology and Soils*;
- Section 3.5, *Transportation*;
- Section 3.6, *Air Quality*;
- Section 3.7, *Noise*; and
- Section 3.8, *Climate Change*.

3.1 Water Supply and Delta Water Management

3.1.1 Introduction

This section describes Delta conditions related to water supply (the amount of water available for beneficial uses) and the possible effects of the Intertie on water supply conditions. Beneficial uses of Delta water include in-Delta use (e.g., agricultural, municipal) by other water-right holders, maintenance of fish and wildlife habitat, and export to CVP and SWP contractors. Water supply changes for the CVP are small but are one of the project purposes. Water supply impacts on SWP or other water users are not anticipated. The water supply changes likely to result from the project alternatives are fully disclosed in this section.

The water supply evaluation of the Intertie relies on the DWR and Reclamation joint planning model—CALSIM II, which is a general-purpose reservoir simulation model of the combined CVP/SWP systems, as well as a host of smaller water supply entities with which the CVP/SWP systems interact. CALSIM II includes the Sacramento River basin, the San Joaquin River basin, and the Delta. All water supply evaluations of the Intertie used the CALSIM II model. Additional material summarized and used in this section can be found in Appendix B, "CALSIM II Modeling Studies of the Delta-Mendota Canal/California Aqueduct Intertie."

The CALSIM II model recently has been modified for the simulations for the 2008 OCAP conditions, as described in the August 2008 version of the CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). The modeling for the Intertie project uses this most recent version of the model and is fully compatible with the OCAP assumptions and results for the CVP and SWP system operations under D-1641, the Central Valley Project Improvement Act (CVPIA), and the existing BOs for CVP and SWP facilities and operations. This section describes the CVP and SWP water supply changes resulting from the Intertie alternatives.

3.1.2 CALSIM Model Limitations

The CALSIM model is the primary tool used to simulate and evaluate changes in the CVP and SWP operations. As such, it has been used for this analysis. Although it comprises the best available information, it does not represent a fault-proof tool. DWR, Reclamation, and others continue to modify and improve the CALSIM model to more accurately reflect actual conditions. In general, the CALSIM model does provide a basis for comparison of alternatives to guide decision-makers regarding implementation of Proposed Actions. For simulating current conditions and evaluating potential future changes, it provides only monthly outputs (because it uses a monthly timestep), limiting its ability to identify day to day or other instantaneous changes in the system. For evaluations related to water supply or other resources which are generally managed and discussed over a span of time, CALSIM can provide all the information needed. But for resources such as fish, some short-term (i.e., daily or weekly) effects are not detectable by CALSIM.

CALSIM relies on measured historical hydrology conditions (i.e., runoff). With the changes expected over the next century related to climate change, it is speculative to assume that the 1922–2003 hydrological conditions are representative of future hydrological conditions. However, because the CALSIM model uses so many different years, it is assumed that most potential future runoff conditions are captured in the model simulation of the CVP and SWP operations.

3.1.3 Water Supply Regulatory Framework

1978 Water Quality Control Plan and D-1485

In 1978, the State Water Board adopted water right D-1485 and the Water Quality Control Plan (WQCP) for the Sacramento–San Joaquin Delta and Suisun Marsh (1978 Delta WQCP). D-1485 modified the Reclamation and DWR water right permits to require the CVP and the SWP to meet water quality standards specified in the 1978 Delta WQCP. The general goal of D-1485 standards was to protect Delta resources by maintaining them under conditions that would have occurred in the absence of CVP and SWP operations. D-1485 also required extensive monitoring and special studies of Delta aquatic resources. The D-1485 objectives included reduced pumping in May and June for fish protection. The CVP and SWP pumping were each limited to 3,000 cfs in May and June. The SWP pumping was limited to 4,600 cfs in July (which was the CVP design average monthly capacity). The D-1485 objectives are still relevant because the CVP and SWP operations under D-1485 are used as the baseline for evaluation and allocation of the CVPIA(b)(2) water dedicated to fish and wildlife enhancement.

Water Quality Control Plan and D-1641

Numerous parties hold rights to divert water from the Delta and upstream Delta tributaries. Various water quality and flow objectives have been established by the State Water Board to ensure that the quality of Delta water is sufficient to satisfy all designated uses; implementation of these objectives requires that limitations be placed on Delta water supply operations, particularly operations of the SWP and CVP, affecting amounts of fresh water and salinity levels in the Delta. The Proposed Action is modifying none of these protective measures.

The State Water Board's 1995 WQCP (adopted May 1995; State Water Resources Control Board 1995) incorporated several elements of the U.S. Environmental

Protection Agency (EPA), NMFS, and USFWS regulatory objectives for salinity and endangered species protection. The changes from D-1485 regulatory limits for CVP and SWP Delta operations are substantial. The State Water Board implemented the 1995 WQCP with D-1641 in 2000. The new provisions for X2 (i.e., the position of the 2 parts per thousand [ppt] salinity gradient), export/inflow (E/I) ratio, and the Vernalis Adaptive Management Program (VAMP) that are implemented in D-1641 are described in some detail because these are the basis for the baseline CVP and SWP operations assumed in CALSIM II. The WQCP was amended by the State Water Board in 2006, but the major Delta objectives were unchanged.

The limits on Banks and Jones Pumping Plant pumping are important to understanding Delta water management because these regulatory limits collectively restrict supply of full CVP and SWP demands for Delta exports. These regulatory limits may result from Delta outflow requirements, E/I limits, and permitted or physical export pumping capacity. The Intertie would not change any of these regulatory limits and therefore would not change the protections provided for water quality and fish in the Delta.

Delta Outflow Requirements

The minimum monthly Delta outflow objectives protect the salinity range for the estuarine aquatic habitat and are included in D-1641. The monthly minimum depends on the water-year type, which is calculated as the Sacramento Four-River Index from the unimpaired runoff of the Sacramento, Feather, Yuba, and American Rivers. The monthly outflows from February to June are calculated on a daily basis to satisfy the X2 objective. Minimum monthly flows for July range from 4,000 cfs in critical years to 8,000 cfs in wet years. The August outflows range from 3,000 cfs in dry years to 4,000 cfs in below normal years and wetter year types. The September minimum outflow is 3,000 cfs in all year types. The October minimum outflows are 3,000 in critical and 4,000 cfs in all other year types. The November and December required outflows are 3,500 cfs in critical and 4,500 cfs in all other year types.

Although these D-1641 outflow objectives specify the minimum outflows during these months, a water supply and water quality tradeoff is involved in the actual operation of the Delta. A slightly higher outflow will reduce the salinity intrusion of Suisun Bay water into the central Delta and reduce the salinity (i.e., electrical conductivity [EC], chloride, bromide) of the CVP and SWP exports. The CVP and SWP operations sometimes may reduce pumping during these fall months to reduce the salinity of the exports, even though this will also reduce the water supply volume pumped during these months.

X2 Objective

The location of the estuarine salinity gradient is regulated during the months of February–June by the X2 objective in the 1995 WQCP (D-1641). The X2 position must remain downstream of Collinsville (kilometer 91 upstream from the Golden Gate Bridge) for the entire 5-month period. This requires a minimum outflow of about 7,100 cfs. The X2 objective specifies the number of days each month when the location of X2 must be downstream of Chipps Island (kilometer 75) or downstream of the Port Chicago EC monitoring station (kilometer 64). The number of days depends on the previous month's runoff index value. Maintaining X2 at Chipps Island requires a Delta outflow of about 11,400 cfs, and maintaining X2 at Port Chicago requires a Delta outflow of about 29,200 cfs. Meeting the X2 objectives can require a relatively large volume of water for outflow during dry months that follow months with large storms.

Maximum Export/Inflow Ratios

D-1641 includes a maximum E/I ratio objective to limit the fraction of Delta inflows that is exported. This objective was developed to protect fish species and to reduce entrainment losses. Delta exports used to compute the E/I ratio are the amounts diverted at the Jones and Banks Pumping Plants. Delta inflows are the gaged river inflows (does not include rainfall runoff in the Delta). The maximum E/I ratio is 0.35 for February through June and 0.65 for the remainder of the year. If the January runoff index is relatively low, the February E/I ratio is increased to 0.45. CVP and SWP have agreed to share the allowable exports if the E/I ratio is limiting at less than twice the Jones Pumping Plant capacity.

Delta Cross Channel Operations

Reclamation operates the Delta Cross Channel (DCC) to improve the transfer of water from the Sacramento River to the export facilities at the Jones Pumping Plant and to improve water quality in the south Delta by reducing saltwater intrusion from Antioch. The gates, however, are closed whenever flows in the Sacramento River at Freeport reach about 25,000 cfs to reduce scour on the downstream side of the gates and to reduce potential flooding on the Mokelumne River channels.

State Water Board D-1641 provides for closure of the DCC gates from February 1 through May 20 for fish protection. From November through January, the DCC may be closed up to an additional 45 days. The gates also may be closed for 14 days during the period of May 21 through June 15. Reclamation determines the timing and duration of the closures after consultation with USFWS, DFG, and NMFS. Monitoring for fish presence and movement in the Sacramento River and Delta, the salvage of salmon at the Tracy and Skinner facilities, and hydrologic "cues" (e.g., storm events) are used to determine the timing of DCC closures, subject to water quality conditions.

Central Valley Project Improvement Act Water Management in the Delta

The USFWS manages 800 thousand acre-feet per year (taf/yr) of CVP water supply that is dedicated for anadromous fish enhancement and wildlife purposes. A portion of this water is designated to reduce Jones Pumping Plant pumping during periods of high risk to the protected species. The VAMP period of April 15–May 15 is one of the designated periods of protection. Because the D-1485 conditions are considered the baseline for the (b)(2) water accounting, the 3,000 cfs Jones Pumping Plant pumping limit (that originally was replaced with wheeling by SWP pumping) often is maintained as part of the (b)(2) allocation in May and June. Additional reduction of CVP pumping to 800 cfs usually is requested during the VAMP period and sometimes extending into May and June if fish densities at the salvage facilities remain high and water remains in the CVPIA(b)(2) water account. The Intertie action would allow some additional portion of the CVP demands to be pumped at the Jones Pumping Plant facility without relying on SWP wheeling at the Banks Pumping Plant.

Environmental Water Account Operations

The EWA is a cooperative management program with the purpose of providing protection to at-risk fish species of the Bay-Delta estuary through environmentally beneficial changes in SWP and CVP operations at no uncompensated water cost to the projects' users. This approach to fish protection involves changing project operations to benefit fish and the acquisition of alternative sources of project water supply, called the *EWA assets*, which the EWA agencies use to replace the regular project water supply lost by pumping reductions (U.S. Department of the Interior, Bureau of Reclamation 2003).

The EWA program consists of two primary elements: implementing fish actions that protect species of concern and increasing water supply reliability by acquiring and managing assets to compensate for the effects of these actions. Actions that protect fish species include reduction of pumping at the Banks and Jones Pumping Plants in the Delta. Pumping reductions can reduce water supply reliability for the SWP and CVP export service area, causing conflicts between fishery and water supply interests. A key feature of the EWA is use of water assets to replace supplies that are interrupted during pumping reductions. The EWA assets also can provide benefits such as augmenting instream flows and Delta outflows (U.S. Department of the Interior, Bureau of Reclamation 2003).

The EWA implementation is assumed in the CALSIM II modeling of the Intertie project. The EWA actions generally have been used to reduce SWP pumping at Banks Pumping Plant because the CVPIA(b)(2) water management actions have been used to restrict Jones Pumping Plant pumping in the April–June period of highest fish density.

3.1.4 Affected Environment

Sources of Information

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

- The most recent and complete description of the existing CVP and SWP facilities and operations is included in the August 2008 CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). These materials, which provide extensive information on the facilities, the operating criteria, and the CALSIM modeling assumption and results, are available from: <http://www.usbr.gov/mp/cvo/ocap_page.html>.
- The 2008 OCAP evaluation and modeling studies included the Intertie project as part of the assumed future facilities, but because the OCAP evaluations cover the entire CVP and SWP system and operations effects on the ESA species (i.e., take assessment), the incremental effects of individual facilities and operations are not identified. Therefore, Reclamation has used the CALSIM II model to separate the relatively small effects of the Intertie. These modeling studies are described fully in Appendix B.

The SWP and the CVP store and release water upstream of the Delta and export water from the Delta to areas generally south and west of the Delta. Reclamation diverts water from the Delta through its Jones Pumping Plant to the DMC. DWR pumps for export through the California Aqueduct and South Bay Aqueduct at its Banks Pumping Plant in CCF, and also diverts water at the Barker Slough Pumping Plant for export through the North Bay Aqueduct. The State Water Board first issued water right permits to Reclamation for operation of the CVP in 1958 (water right Decision 893) and to DWR for operation of the SWP in 1967 (water right Decision 1275 and Decision 1291).

A third substantial diverter of Delta water is the Contra Costa Water District (CCWD), which currently diverts water from Rock Slough under Reclamation's CVP water rights and from a second intake constructed on Old River near the State Route (SR) 4 Bridge that serves as the pumping plant for Los Vaqueros Reservoir. Several municipal users and many agricultural users also divert water from the Delta under riparian and appropriative rights. The upstream CVP and SWP facilities and operations are described briefly below because they are operated in conjunction with the Delta facilities. Much more information is available in the 2008 CVP/SWP Longterm Operations Plan.

Central Valley Project and State Water Project Facilities and Operations

The following description of CVP and SWP facilities and operational constraints in the Delta and upstream tributaries (i.e., reservoirs) is provided to establish current operational conditions needed to evaluate Intertie project alternatives for water supply conditions. These constraints have been incorporated into the CALSIM II simulations that are used to evaluate monthly changes in water supply conditions attributable to the Intertie. The CALSIM II results from the upstream reservoirs are shown here, although the Intertie alternatives generally would not change Future No Action upstream reservoir operations in any systematic or substantial way.

Trinity River Division

The CVP Trinity River Division, completed in 1964, has facilities to store and regulate water in the Trinity River and facilities to transfer water to the Sacramento River basin. Trinity Reservoir (formerly called Clair Engle Lake) has a maximum storage capacity of approximately 2.4 maf. All releases from Trinity Dam are re-regulated downstream at Lewiston Lake to meet downstream flow requirements, and supply exports through Clear Creek tunnel and the Carr power plant to Whiskeytown Lake. Spring Creek tunnel and power plant convey water from Whiskeytown Lake to Keswick Lake, located on the Sacramento River below Shasta Dam. The mean annual flow into Trinity Reservoir is approximately 1.2 maf, and the instream flow requirements range from about 370 thousand acre-feet (taf) to about 815 taf, depending on the Trinity runoff volume. There is some flood storage space reserved in the winter months, and the minimum storage in Trinity Reservoir generally is maintained above 1,000 taf for recreation and water temperature considerations. The reservoir normally is filled to the highest storage level in April–June and then is drawn down slightly by the end of September. Only in the drought year sequences was the simulated carryover storage less than 1,000 taf.

Figure 3.1-1 shows the annual sequence of carryover (end of September) storage in Trinity Reservoir for the Future No Action and Intertie conditions. The maximum storage for each year also is shown. The absolute minimum storage simulated was about 500 taf in a few years. Several other years have carryover storage of between 500 taf and 1,000 taf. The normal seasonal drawdown of Trinity Reservoir is moderate, with carryover storage usually between 1,000 taf and 2,000 taf. The change between the previous carryover storage and the maximum storage shows the seasonal filling in the winter and spring months. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for exports and Trinity River flows. The Intertie would cause only minor changes in the carryover storage or the maximum storage in a few years, because the Trinity reservoir operations are determined primarily by the runoff to the reservoir, with almost all of the runoff not required for Trinity River flows exported to the Sacramento River through the Clear Creek tunnel.

The Trinity River flow requirements for the Trinity River Restoration Program (ranging from 370 taf/yr to 815 taf/yr) are included accurately in the simulation. The Future No Action Trinity exports (Clear Creek Tunnel) average about 535 taf/yr, with a range of about 100 taf/yr to about 1,200 taf/yr.

Table 3.1-1 shows a summary of the simulated monthly distribution of Clear Creek Tunnel flows. The simulated flows are sorted for each month, and the cumulative distribution values are shown in the summary. The annual volumes (taf) are also sorted separately and the cumulative distribution is given. The average values, given at the bottom of the table, are often higher than the median (50%) values because there are a few very high flows. The months of highest export are June–October, corresponding to the highest demands (and prices) for the hydroelectric energy produced by these exports through Carr and Spring Creek power plants. Most of the runoff is released for required Trinity River flows or exported through the Clear Creek tunnel. Trinity Reservoir flood control releases are infrequent. The Intertie would not substantially change the monthly pattern or the annual total of Trinity exports because most of the runoff not required for Trinity River flows is exported.

Lake Shasta

Runoff from the upper Sacramento River and tributaries is regulated by the CVP Shasta Dam and re-regulated approximately 10 miles downstream at Keswick Dam. The watershed above Shasta Dam drains approximately 6,650 square miles and produces an average annual inflow of about 6 maf. Inflows generally increase from November through March, with peak flows generally occurring in March. As snowmelt is not the dominant component of Shasta inflows, runoff generally decreases in April and May, and inflow is less than 5,000 cfs from June through October.

Maximum Lake Shasta storage occurs in April–June. A considerable portion of the maximum storage of about 4.5 maf is reserved for flood control space between November and March. Storage usually increases from January through April and decreases from June through October. Figure 3.1-2 shows the Shasta Reservoir carryover storage simulated by CALSIM II for the 1922–2003 hydrology. The maximum storage for each year also is shown. The normal seasonal drawdown of Shasta Reservoir is moderate, with carryover storage usually between 2,500 taf and 3,500 taf. Shasta carryover storage generally is held above 2.0 maf for water temperature–control purposes but is simulated to be less than 2.0 maf in about 10% of the years. The change between the previous carryover storage and the maximum storage shows the seasonal filling in the winter and spring months. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for Sacramento River diversions, minimum Keswick flows, and Delta exports. The Intertie would cause only minor changes in the carryover storage or the maximum storage in a few years, because the reservoir operations are determined primarily by the runoff to the reservoir, with almost all of the seasonal storage released during the summer and fall.

Table 3.1-2 shows the monthly Keswick Dam release flows simulated by CALSIM II for the Future No Action and Intertie conditions. The Keswick flows generally are regulated by the minimum fish flows and the downstream water supply demands of CVP contractors along the Sacramento River and south of the Delta. Summer flows also are sometimes regulated for river temperature control. The Keswick flows represent the full regulated CVP water supply from Shasta and Trinity, as well as some flood control spills from Shasta. The annual Keswick releases average about 6.25 maf and range from less than 4.0 maf in the lowest 10% of the years to more than 9 maf in the highest 10% of the years.

The median (50% distribution) flows can be used to indicate the seasonal flow pattern at Keswick. The median flows are about 5,000 cfs from September through April, and about 7,500 in May, 10,000 cfs in June and August, with a peak of 14,000 cfs in July. The Keswick powerhouse has a maximum capacity of about 15,000 cfs.

The Intertie did change the simulated monthly sequence of flows but did not change the seasonal pattern of Keswick flows. Because the monthly changes in Keswick flows do not correspond to the monthly increased pumping at the Jones Pumping Plant, the simulated changes are indirect consequences of slightly changed CVP San Luis Reservoir storage effects on Shasta and Trinity Reservoir releases. The Intertie has the general effect of allowing more of the regulated CVP releases from Keswick to be pumped at the Jones Pumping Plant, rather than causing any direct changes in the Trinity and Shasta releases.

Lake Oroville

Lake Oroville was completed in 1968 and is the major SWP storage reservoir, with a maximum capacity of about 3.5 maf. However, the Hyatt Power Plant inlets (which can be selected to regulate the release temperature) are located at elevations that provide a minimum storage volume of about 1.0 maf. The effective seasonal and year-to-year drawdown therefore is limited to 2.5 maf. The average annual inflow to Lake Oroville is about 4.0 maf and is a combination of rainfall runoff and snowmelt. Releases from Oroville flow into the Thermalito Reservoir complex, which provides a storage facility (i.e., afterbay) to allow pumped-storage operations at the Hyatt Power Plant and deliveries of up to 900 taf to SWP Settlement contractors. A release of 600 cfs is made to the river to provide spawning and attracting flows for the Feather River hatchery.

Maximum Lake Oroville storage occurs in April–June. About 700 taf of the maximum storage is reserved for flood control space between December and March. Storage usually increases from January through April and decreases from June through October. Figure 3.1-3 shows the Oroville Lake carryover storage simulated by CALSIM II for the Future No Action and Intertie conditions for the 1922–2003 hydrology. The maximum storage for each year also is shown. The carryover storage is highly variable, from about 750 taf in a few dry years to more than 3.0 maf in about 20% of the years. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for Thermalito diversions, minimum Feather River flows, and Delta exports.

As simulated, the Intertie has minor effects on the Oroville carryover storage and maximum storage in a few years. The simulated effects of the Intertie on Lake Oroville storage are indirect consequences of the simulated changes in SWP San Luis Reservoir storage, caused by the additional Jones Pumping Plant pumping allowed by the Intertie.

Table 3.1-3 shows the monthly Feather River flow releases below Thermalito Afterbay Reservoir for the Future No Action simulation. The Feather River flows below Thermalito are regulated by the minimum fish flows (of 900 cfs, 1,200 cfs or 1,700 cfs depending on runoff conditions) in a few months, and the downstream water supply demands of SWP for Delta export pumping. Highest release flows are made in the months of July, August, and September, corresponding to the higher Delta E/I ratio of 65% in these summer months, which allows a greater fraction of the reservoir releases to be exported. Annual flows vary with runoff conditions, and the average annual release flow volume is about 3.2 maf, with a flow volume of 1.6 maf in the lowest 10% of the years and a flow volume of about 5.3 maf in the highest 10% of the years. As simulated, the Intertie does not change the pattern of monthly Oroville release flows, but the CALSIM model simulates very large changes (of more than 1,000 cfs) in some monthly flows in a few years. The maximum simulated changes in the monthly Oroville releases (i.e., 4,000 cfs) are much larger than the maximum simulated changes in Jones Pumping Plant pumping (i.e., 400 cfs) caused by the Intertie. These are simulated indirect changes in Lake Oroville releases caused by small changes in SWP San Luis Reservoir storage, and the subsequent changes in the simulated seasonal allocation of SWP deliveries.

Folsom Lake

Folsom Lake was constructed by the U.S. Army Corps of Engineers (Corps) for Reclamation between 1948 and 1956 as part of the CVP. Folsom Dam impounds a maximum of about 1 maf and is a multipurpose reservoir that provides flood control and seasonal water storage for recreation, power, water supply, and minimum fish protection flows in the American River and to the Delta. Other agencies have constructed several major reservoirs upstream in the Sierra Nevada (with a total storage of another 1 maf) that provide additional flood control and seasonal storage and power benefits. The average runoff of about 2.6 maf is considerably larger than the Folsom Reservoir storage. Nimbus Dam, located 7 miles downstream, provides re-regulation of the Folsom releases and diversion to the Folsom South Canal. Total diversions from the American River are estimated in the CALSIM II model to be about 400 taf.

About 400 taf of storage is reserved for flood control space between December and March. Maximum Folsom Lake storage of 975 taf usually occurs in May–June. Figure 3.1-4 shows the Folsom Lake carryover storage at the end of September simulated by CALSIM II for the Future No Action and Intertie conditions for 1922–2003 hydrology. The maximum storage for each year also is shown. The reservoir storage is always less than 650 taf, in preparation for rainfall flood control storage in November–March. Storage is less than 300 taf in the driest 10% of the years. The carryover storage is generally between 400 taf and 650 taf. The difference between the maximum storage and the carryover storage indicates the volume of storage releases made during the summer for water supply diversions, minimum American River flows, and Delta exports. As simulated, the Intertie had only minor effects on the Folsom carryover storage.

Table 3.1-4 shows the monthly Nimbus Dam releases. The average Nimbus annual release volume was about 2,500 taf/yr, with a range of annual flow volumes from less than 1 maf in the lowest 10% of the years, more than 2 maf in 50% of the years, to more than 4 maf in the highest 10% of the years. The combination of upstream storage and Folsom Reservoir storage provides a very uniform seasonal release pattern. The lowest 10% of the simulated monthly flows are between 800 cfs and 1,800 cfs in all. The median Nimbus flows are about 2,000 cfs from August through January, about 3,500 in February, about 2,500 cfs in March–May, about 3,000 cfs in June, and 4,000 cfs in July. The highest 10% of the monthly flows are greater than 5,000 cfs only in December through June.

As simulated, the Intertie has no effects on the monthly pattern of Nimbus release flows, but the CALSIM model simulates very large changes (of more than 1,000 cfs) in some monthly flows in a few years. The maximum simulated changes in the monthly Nimbus releases (i.e., 2,000 cfs) are much larger than the maximum simulated changes in Jones Pumping Plant pumping (i.e., 400 cfs) caused by the Intertie. These are simulated indirect changes caused by small changes in CVP San Luis Reservoir storage, and the subsequent changes in the simulated seasonal allocation of CVP deliveries.

New Melones Reservoir

Operation of New Melones Reservoir is governed by the interim operations plan and includes higher releases for anadromous fish in April and May as part of the CVPIA(b)(2) water management program. Maximum storage of about 2,500 taf is achieved in only a few sequences of relatively wet years. New Melones Reservoir supplies irrigation diversions of about 600 taf/yr and provides considerable year-to-year storage protection. New Melones usually reaches seasonal maximum storage in June or July from snowmelt.

Figure 3.1-5 shows the New Melones Reservoir carryover storage for the Future No Action and Intertie conditions simulated by CALSIM II for the 1922–2003 hydrology. The carryover storage is strongly dependent on the sequence of hydrology because the storage is a relatively large fraction of average runoff. Storage is above 2 maf in about 10% of the years. Storage normally declines in subsequent years and may fall below 1 maf in drought sequences. The storage was simulated at about 500 taf in the 1931–1934 drought sequence and the 1990–1992 sequence.

The CVP release flows downstream of the irrigation diversions for South San Joaquin and Oakdale Irrigation Districts provide required minimum fisheries flows, provide additional flushing flows during the spring period of Chinook salmon outmigration (during April and May as part of the [b][2] water allocation), and help control salinity on the San Joaquin River at Vernalis. The average release is about 625 taf/yr, but ranges from about 300 taf/yr in dry years to more than 1 million acre-feet per year (maf/yr) in a few wet years (as a result of reservoir flood control spills). The Intertie does not change the simulated New Melones Reservoir operations.

The Tuolumne and Merced Rivers both have major storage reservoirs and large irrigation diversions and minimum river flows. These are not CVP or SWP reservoirs, so their operations are dependent only on hydrology and irrigation demands and instream flow requirements. Therefore, the Intertie project does not modify the CALSIM II model simulations of these reservoirs.

Delta Inflows

On average, about 21 maf of water reaches the Delta annually, but monthly average inflows vary widely from year to year and within each year. Delta inflow in water year 1977 totaled only 6 maf, and inflow for water year 1983 was about 70 maf. The average monthly natural runoff to the Delta is lowest in the summer and fall months. The operation of the upstream water supply reservoirs has increased summer and fall flows into the Delta.

Table 3.1-5 shows the CALSIM II simulated monthly Sacramento River flows at Freeport for the Future No Action and Intertie conditions for the 1922–2003 hydrology. The annual inflow at Freeport ranges from less than 7 maf to more than 35 maf. The lowest 10% of the years have an inflow of less than 8 maf, while the highest 10% of the years have an inflow of more than 26 maf. Very high flows bypass the Sacramento River channel at Freeport and enter the Delta through the Yolo Bypass.

The monthly flows are highly regulated by the upstream reservoirs. The minimum monthly flows are between 5,000 cfs and 10,000 cfs in all months. The 10% flow distribution in all months is between 8,000 cfs and 12,000 cfs. The median flows are between 10,000 cfs and15,000 cfs from August to November, and greater than 20,000 cfs only in January–March. The 90% flow distribution is greater than 50,000 cfs in December–April. The Intertie does not change the monthly distribution of flows. The CALSIM model does simulate a few months with large changes, which are the result of changes in releases subsequent to changes in CVP and SWP exports and San Luis Reservoir storage, rather than of direct changes in releases to support additional Intertie pumping.

Table 3.1-6 shows the monthly San Joaquin River flows at Vernalis, which include the releases from New Melones Reservoir and the flows from the Tuolumne and Merced Rivers, as well as floodflows from the San Joaquin River upstream of the Merced River (Friant Dam). The annual inflow at Vernalis is about 3 maf, and ranges from less than 1 maf in the lowest 10% of the years to more than 6 maf in the highest 10% of the years.

The monthly flows are highly regulated by the upstream reservoirs. The minimum monthly flows are between 500 cfs and 1,500 cfs in all months. The 10% flow distribution in all months is between 1,000 cfs and 2,000 cfs. The median flows are between 1,500 cfs and 2,000 cfs from June through January, about 3,000 cfs in February and March, and about 5,000 cfs in April and May (as regulated by VAMP flows). The Intertie has no effect on these simulated San Joaquin River inflows.

San Luis Reservoir

San Luis Dam and Reservoir are located near Los Banos. The reservoir, with a capacity of about 2.0 maf, is a pumped-storage reservoir used primarily to provide seasonal storage for both CVP and SWP water exported from the Delta. The CVP share of the San Luis Reservoir storage is 972 taf. The SWP share of the San Luis Reservoir storage is 1,067 taf.

O'Neill Dam and Forebay are located downstream of San Luis Dam along the California Aqueduct. The forebay is used as a hydraulic junction point for state and federal waters. The O’Neill pumping-generating plant lifts CVP water from the DMC to the O’Neill Forebay. The joint CVP/SWP William R. Gianelli pumping-generating plant lifts CVP/SWP water from O’Neill Forebay to San Luis Reservoir. The forebay provides re-regulation storage necessary to permit off-peak pumping and on-peak power generation by the Gianelli plant. When CVP water is released from O’Neill Forebay to the DMC, the units at the O’Neill pumping-generating plant operate as hydroelectric generators. The O’Neill Pumping Plant has a capacity of 4,200 cfs, which is not enough to pump the full DMC capacity of 4,600 cfs into O’Neill Forebay and subsequently into San Luis Reservoir. The Intertie is intended to eliminate this bottleneck in the CVP conveyance along the DMC to San Luis Reservoir storage in the fall and winter months.

The San Luis Canal, the joint federal and state (CVP/SWP) portion of the California Aqueduct, conveys water southeasterly from O'Neill Forebay along the west side of the San Joaquin Valley for delivery to CVP and SWP contractors. The Coalinga Canal conveys water from the San Luis Canal to the Coalinga area, where it serves the southern San Joaquin Valley region. The California Aqueduct continues south to the Edmonston Pumping Plant and over the Tehachapi Mountains to The Metropolitan Water District of Southern California (Metropolitan) and other SWP contractors.

Figure 3.1-6 shows the simulated CVP San Luis Reservoir winter maximum (January–March) and summer minimum (July–September) storage for the Future No Action and Intertie conditions for 1922–2003. Maximum CVP storage of 972 taf is simulated in the majority of years. The minimum CVP storage is more variable, with some years near the absolute minimum of 50 taf, and other years with 200 taf to 400 taf remaining in storage. Although the Intertie will allow CVP San Luis Reservoir to fill more rapidly, and maximum storage was achieved in a few more years, there were some years when filling of CVP San Luis Reservoir was not possible because of limited water supply. The minimum CVP storage was also shifted slightly in some years as a result of small changes in Jones Pumping Plant pumping and CVP water delivery.

Table 3.1-7 shows the CALSIM II simulated monthly distribution (range) of CVP San Luis storage for 1922–2003 under the Future No Action and Intertie conditions. The major water supply change allowed by the Intertie is this increase in CVP San Luis storage. Maximum CVP San Luis storage usually occurs in January to March. The Future No Action maximum CVP San Luis storage is more than 900 taf in about half of the years. Storage usually reaches a minimum in August or September. The assumed minimum CVP San Luis storage is 45 taf. The average simulated carryover storage was about 200 taf. The Intertie slightly increased the carryover storage to an average of 210 taf. The Intertie increased the maximum CVP San Luis storage in several years and allowed the CVP San Luis storage to reach capacity 1 month earlier in several years. The CVP San Luis Reservoir storage was full at the end of February in about 10% of the years for the Future No Action, and in about 30% of the years with the Intertie. The CVP San Luis Reservoir storage was full at the end of March in about 40% of the years for the Future No Action, and in about 60% of the years with the Intertie. The simulated average CVP San Luis Reservoir storage was higher in all months with the Intertie, and was about 50 taf higher than the Future No Action in December, January, and February.

Figure 3.1-7 shows the simulated SWP San Luis Reservoir winter maximum (January–March) and summer minimum (July–September) storage for the Future No Action and Intertie conditions for 1922–2003. Maximum SWP storage of 1,067 taf is simulated in the majority of years. The minimum SWP storage is more variable, with about 20% of the years below 200 taf, and about 20% of the years above 600 taf. The use of SWP San Luis Reservoir storage is dependent on the summer Banks Pumping Plant pumping and the water delivery allocation. Although the Intertie will delay the filling of SWP San Luis Reservoir in some years, maximum SWP San Luis Reservoir storage is still achieved in most years, although there are some years when filling SWP San Luis Reservoir was not be possible because of limited water supply. The minimum SWP storage also was shifted slightly in some years as a result of small changes in Banks Pumping Plant pumping and SWP water delivery.

Table 3.1-8 shows the CALSIM II simulated monthly range (distribution) of SWP San Luis storage for 1922–2003 under the Future No Action and Intertie conditions. Maximum SWP San Luis storage usually occurs in January to March. The maximum SWP San Luis storage is more than 1,000 taf in March of most (80%) of the years. Storage usually reaches a minimum in August or September. The average simulated carryover storage was about 420 taf for both the No Action and the Intertie. The minimum storage is assumed to be 55 taf. The Intertie generally delays the maximum SWP storage by a month, but does not usually change the maximum SWP San Luis storage. The average SWP San Luis Reservoir storage was reduced by about 10 taf in the months of November to February, but was the about the same in March. The simulated SWP San Luis storage for both the Future No Action and the Intertie reaches capacity of 1,067 taf in about 60% of the years.

Central Valley Project Delta Facilities

The Jones Pumping Plant, about 5 miles north of Tracy, consists of six pumps with a maximum rated capacity of about 5,100 cfs. The original motor-pumps had a maximum capacity of 4,600 cfs (about 767 cfs each). Bronze impellers were replaced with stainless steel impellers in three units which increased the capacity of each of these units to about 935 cfs. The Jones Pumping Plant is located at the end of an earth-lined intake channel about 2.5 miles long. At the head of the intake channel, “louver” screens that are part of the Tracy Fish Collection Facility intercept fish, which are then collected and transported by tanker truck to release sites away from the pumps. The water is pumped about 200 feet into the DMC, which has a maximum design capacity of about 4,600 cfs.

The Jones Pumping Plant has a maximum average monthly capacity of about 4,600 cfs. Table 3.1-9 compares the CVP monthly demands, based on full contract amounts, to the maximum Jones Pumping Plant monthly pumping volume (taf). The demand for water pumped at the Jones Pumping Plant is estimated by CALSIM II to be about 3,330 taf/yr. The CVP monthly demands exceed the CVP monthly pumping capacity in the May–August period. This 783 taf of summer demands must be pumped during the winter and early spring and stored in San Luis Reservoir to supply the full annual allocations of water. This imbalance is increased by the frequent allocation of CVPIA(b)(2) water to reduce CVP pumping to 3,000 cfs in May and June, which was the allowed pumping under the previous Delta water right decision, D-1485. This unused CVP pumping in May and June is almost 200 taf.

If the Jones Pumping Plant pumps were at maximum capacity of 4,600 cfs for the entire year, they could deliver about 3,330 taf/yr from the Delta (about 275 taf each month). This is unlikely to occur, however, because there are required periods for maintenance of the pump units and DMC facilities and because the hydrology and other regulatory restrictions in the Delta do not allow full pumping every day of the year. CVP water for the Cross Valley Canal is usually pumped by Banks Pumping Plant. Generally, however, the CVP demands exceed the available Jones Pumping Plant pumping capacity.

The DMC capacity north of Santa Nella and the O'Neill Pumping Plant capacity of 4,200 cfs creates a DMC capacity limit during the fall and winter period of September–April, when diversions from the upper DMC (between Jones and O'Neill Pumping Plants) are less than 400 cfs. This DMC limitation reduces the maximum Jones Pumping Plant pumping by about 200–400 cfs, or about 140 taf for the year. These constraints make it impossible for the Jones Pumping Plant to supply the full CVP demands. The Intertie project would allow some additional pumping in this October–March period to fill CVP San Luis Reservoir.

The CVPIA introduced additional constraints on the Jones Pumping Plant pumping capacity. A portion of the Section (b)(2) water (maximum of 800 taf/yr) that is dedicated to anadromous fish restoration (protection) purposes normally is allocated by USFWS to reduce pumping during the VAMP period (April 15–May 15), and additional CVP pumping reductions are often applied during the remainder of May and June. The CALSIM II modeling assumes a 3,000 cfs limit for Jones Pumping Plant pumping in May and June. The E/I ratio of 35% during the February–June period further limits pumping. Therefore, under current regulations, it is impossible for the Jones Pumping Plant to supply the full CVP demands. The Intertie would allow more of the CVP demands to be satisfied with the Jones Pumping Plant.

Table 3.1-10 shows the CALSIM II assumed maximum Jones Pumping Plant capacity for the Future No Action and the Intertie alternatives. The differences in maximum pumping volumes also are shown. For the August–April period with some assumed upper DMC delivery limitations, the difference is a total of 136 taf. The April and May pumping is limited for the Future No Action and the Intertie by the assumed (b)(2) reductions in export pumping for the VAMP period. The May and June pumping is limited for the Future No Action and the Intertie by the assumed (b)(2) reductions in export pumping for fish protection, corresponding to the previous D-1485 pumping limits. The current CVP contracts and refuge deliveries are more than the allowable pumping at the Jones Pumping Plant. The Intertie would allow more of the CVP demands to be satisfied with the Jones Pumping Plant.

State Water Project Delta Facilities

The Banks Pumping Plant has an installed capacity of about 10,668 cfs (two units of 375 cfs, five units of 1,130 cfs, and four units of 1,067 cfs). With full pumping capacity, the Banks Pumping Plant theoretically is capable of pumping 7,725 taf each year. However, the current permitted diversion rate into Clifton Court Forebay is 6,680 cfs as a 3-day average, and the pumping rate cannot be much higher than the diversion rate because the water elevation in CCF cannot be drawn down below –2.0 feet above mean sea level (msl) without introducing cavitation (i.e., air entrainment) problems at the pumps. This maximum permitted pumping would provide a maximum of about 4,836 taf/yr if full permitted pumping could be maintained every day of the year. Additional permitted diversions of one-third of the San Joaquin River at Vernalis, if the Vernalis flow is above 1,000 cfs, are allowed under the current permit rule for a 90-day period from December 15 to March 15. This additional increment of permitted pumping could yield a maximum of 710 taf/yr (for a total of 5,546 taf) if the San Joaquin River flow at Vernalis was higher than 13,000 cfs for the entire 90-day period (a very unlikely hydrologic condition).

The monthly pumping capacity of Banks Pumping Plant for the basic 6,680-cfs pumping limits is given in Table 3.1-11. The seasonal SWP demands, based on Table A contract amounts, are highest in the summer months, requiring a portion of the demands to be supplied from San Luis Reservoir storage. San Luis Reservoir releases often are needed during these months because the Banks Pumping Plant pumping is limited during April–June by a combination of assumed export reductions during the VAMP period and the 35% E/I ratio that applies from February–June.

Only in a few years will there be sufficient Delta inflow each month to satisfy the in-Delta water diversions, meet the required Delta outflow for water quality and fish protection, supply the full Jones Pumping Plant pumping, and also allow Banks Pumping Plant pumping of 4,300 taf to supply the entire SWP demand plus aqueduct and reservoir losses that are assumed to be 100 taf/yr. The current CVP and SWP pumping capacity, under the existing Delta objectives (D-1641), can rarely meet the full CVP and SWP water demands. The Intertie project will allow a small increase in the allowable CVP pumping (about 135 taf) and reduce the pumping limitation that currently restricts CVP water supply reliability in many years.

Central Valley Project South-of-Delta Deliveries

The recent historical monthly deliveries to Central Valley Project south-of-Delta locations (contractors and refuges) are described here to introduce the CALSIM modeling results and to illustrate the current limits on the Jones Pumping Plant and upper DMC capacity limitations. The Intertie would improve the water supply reliability for these CVP contractors while meeting all regulatory requirements for

Delta operations. The monthly pumping and delivery data for calendar years 2005, 2006, and 2007, as reported on the Central Valley Operations (CVO) website (www.usbr.gov/mp/cvo/deliv.html), are described to illustrate typical recent CVP delivery patterns (U.S. Department of the Interior, Bureau of Reclamation 2009). Total annual calendar year deliveries in these three recent years were very similar, with 2,705 taf delivered in 2005; 2,598 taf delivered in 2006; and 2,586 taf delivered in 2007.

Figure 3.1-8 shows a simplified diagram with the major categories of CVP south-of-Delta deliveries. The upper DMC, between Jones and O'Neill Pumping Plants at DMC mile 70, has several water districts, exchange contractors, and wildlife refuges. The upper DMC ends at the O'Neill Pumping Plant, located near DMC Check 13, at DMC mile 70. The lower DMC extends from Check 13 to the Mendota Pool at DMC mile 116. This section of the DMC also delivers water to water districts, exchange contractors, and wildlife refuges. The San Luis Canal (joint CVP/SWP facility) extends from O'Neill Forebay to deliver water to several water districts and the Cross Valley Canal. The CVP San Luis Reservoir stores water for summer deliveries to the lower DMC and San Luis Canal, and the Pacheco Pumping Plant delivers water from San Luis Reservoir to the San Felipe division.

Calendar Year 2005 Deliveries

Table 3.1-12 shows the monthly CVP pumping and south-of-Delta deliveries reported by CVO for calendar year 2005. The monthly and annual delivery values are given in acre-feet. The first section shows the CCWD and Jones Pumping Plant values. The pumping for CCWD is the only in-Delta CVP contractor. This water is pumped at the Rock Slough or Old River intakes. The CCWD pumping ranged from less than 1 taf in December to about 20 taf in June, with a total pumping of 123 taf. The Jones Pumping Plant supplies the DMC and all CVP deliveries, except that the Cross Valley Canal deliveries are usually pumped by the Banks Pumping Plant. The monthly Jones Pumping Plant pumping ranged from about 65 taf in May to more than 250 taf in several months (January, and June–December). The pumping was more than 4,000 cfs in eight months, and greater than 3,000 in two more months. Reduced pumping in April and May was for the VAMP fish protection period. The total annual pumping was about 2,705 taf in 2005.

The monthly deliveries from the upper DMC are shown in the second section of Table 3.1-12. The total annual deliveries in 2005 to the upper DMC water districts, exchange contractors, and refuges were about 396 taf, with 157 taf to water districts, 90 taf to exchange contractors, and 149 taf to refuges. The water district and exchange contractors are agricultural deliveries that are strongly seasonal, with peak deliveries in May–September. The wildlife refuges' delivery is more distributed throughout the year with peak deliveries in September and October. O'Neill pumping supplies the San Luis Canal deliveries, and some is pumped into San Luis Reservoir for seasonal storage.

The CVP San Luis Reservoir end-of-month storage values (taf) are given to indicate the seasonal storage and drawdown of water for CVP contractors. The CVP San Luis storage was about 610 taf at the beginning of 2005, increased by almost 190 taf to 797 taf at the end of January, increased by almost 70 taf to 868 taf at the end of February, and increased by almost 100 taf to 966 taf at the end of March. CVP San Luis Reservoir released about 65 taf in May, about 100 taf in June, 230 taf in July, and another 200 taf in August, with a minimum storage of about 375 taf. The CVP San Luis Reservoir storage increased in October, November, and December to about 725 taf at the end of 2005. The Jones Pumping Plant pumping was reduced in March because San Luis storage was filled, and was reduced in April and May for fish protection.

Deliveries from the lower DMC or Mendota Pool are shown in the third section of Table 3.1-12. The total annual deliveries in 2005 to the lower DMC water districts, exchange contractors, and refuges were about 911 taf, with 79 taf to water districts, 647 taf to exchange contractors, and 185 taf to refuges. The water district and exchange contractor peak deliveries are in June–August, and the wildlife refuge deliveries are highest in September and October.

Deliveries from the San Luis Canal are shown in the third section of Table 3.1-12. The total annual deliveries in 2005 from San Luis Reservoir (Pacheco Pumping Plant) and the San Luis Canal (including Cross Valley Canal) were about 1,320 taf. The majority of this water went to Panoche Water District (53 taf), San Luis Water District (67 taf) and Westlands Water District (1,051 taf), with 111 taf pumped at the Pacheco Pumping Plant. The Westlands Water District deliveries were highest in June–August, but were more than 40 taf/month in all months except January. The total DMC deliveries for 2005 were about 2,627 taf which is about 75 taf lower than the total Jones Pumping Plant pumping of about 2,705 taf. The San Luis storage increased by about 125 taf, and there were normal DMC losses to evaporation and seepage. Overall, this monthly accounting of DMC water pumped at Jones Pumping Plant, stored in CVP San Luis, and delivered to CVP contractors is very accurate.

All of the seasonal storage pumping into San Luis Reservoir, and the deliveries to the San Luis Canal, must be pumped from the DMC at the O’Neill Forebay, with a capacity of 4,200 cfs. This limit was approached in January and December of 2005. The Intertie project will increase the operational flexibility to pump water from the Jones Pumping Plant to the O’Neill Forebay for seasonal storage in San Luis Reservoir and delivery to the San Luis Canal and the lower DMC.

Calendar Year 2006 Deliveries

Table 3.1-13 shows the monthly CVP pumping and south-of-Delta deliveries reported by CVO for calendar year 2006. The CCWD pumping ranged from less than 1 taf in April (fish protection period) to 18 taf in June, with a total annual pumping of 120 taf. The Jones Pumping Plant supplies the DMC and all CVP deliveries, except that the Cross Valley Canal deliveries are usually pumped by the Banks Pumping Plant. The monthly Jones Pumping Plant pumping ranged from about 50 taf in April to about 250 taf in several months. The pumping was more than 4,000 cfs in seven months, and more than 3,000 cfs in three more months. The total annual pumping was about 2,598 taf in 2006.

The monthly deliveries from the upper DMC are shown in the second section of Table 3.1-13. The total annual deliveries in 2006 to the upper DMC water districts, exchange contractors, and refuges were about 368 taf, with 160 taf to water districts, 83 taf to exchange contractors, and 125 taf to refuges. The water district peak deliveries were in May–August, and the exchange contractor deliveries were greatest in June–August. The wildlife refuge peak deliveries were in August–October. O'Neill pumping supplies the San Luis Canal, and some is pumped into San Luis Reservoir for seasonal storage.

The CVP San Luis storage was 726 taf at the beginning of 2006, increased to 877 taf at the end of January, and was nearly full at the end of March. CVP San Luis released about 75 taf in May, 100 taf in June, 270 taf in July, and 130 taf in August of 2006. CVP San Luis storage was about 400 taf in August, September, and October and refilled by about 125 taf each month in November and December to about 680 taf at the end of the year.

Deliveries from the lower DMC or Mendota Pool are shown in the third section of Table 3.1-13. The total annual deliveries in 2006 to the lower DMC water districts, exchange contractors, and refuges were about 993 taf, with 108 taf to water districts, 677 taf to exchange contractors, and 208 taf to refuges. The water district and exchange contractor peak deliveries were in May–August, and the wildlife refuge deliveries were highest in February, and September–November.

Deliveries from the San Luis Canal are shown in the third section of Table 3.1-12. The total annual deliveries in 2006 from San Luis Reservoir (Pacheco Pumping Plant) and the San Luis Canal (including Cross Valley Canal) were about 1,356 taf. The majority of this water went to the Panoche Water District (50 taf), San Luis Water District (65 taf), and Westlands Water District (1,116 taf), with about 90 taf pumped at the Pacheco Pumping Plant. The Westlands Water District deliveries were highest (more than 100 taf/month) in May–August, but the deliveries in other months were more than 40 taf/month. All of the seasonal storage in San Luis Reservoir and the deliveries to the San Luis Canal must be pumped from the DMC at the O'Neill Forebay, with a capacity of 4,200 cfs. The Intertie project will increase the operational flexibility to pump water from the Jones Pumping Plant to the O'Neill Forebay for seasonal storage in San Luis Reservoir and delivery to the San Luis Canal and the lower DMC.

Calendar Year 2007 Deliveries

Table 3.1-14 shows the monthly CVP pumping and south-of-Delta deliveries reported by CVO for calendar year 2007. The first section shows the CCWD and Jones Pumping Plant values. CCWD is the only in-Delta CVP contractor. The

CCWD pumping ranged from less than 1 taf in April (fish protection period) to 24 taf in June, with a total pumping of 111 taf. The Jones Pumping Plant supplies the DMC and all CVP deliveries, except that the Cross Valley Canal deliveries are usually pumped by the Banks Pumping Plant. The monthly Jones Pumping Plant pumping ranged from about 50 taf in May to about 250 taf in several months (January–March, and July–October). The pumping was more than 4,000 cfs in seven months, and more than 3,000 in two more months. The total annual pumping was about 2,586 taf in 2007.

The monthly deliveries from the upper DMC are shown in the second section of Table 3.1-14. The total annual deliveries in 2007 to the upper DMC water districts, exchange contractors, and refuges were about 432 taf, with 154 taf to water districts, 152 taf to exchange contractors, and 126 taf to refuges. The water district and exchange contractors are agricultural deliveries that are strongly seasonal, with peak deliveries in May–August. The wildlife refuge deliveries are more distributed throughout the year with peak deliveries in September and October. O'Neill pumping supplies the San Luis Canal, and some is pumped into San Luis Reservoir for seasonal storage. The CVP San Luis Reservoir end-of-month storage values (taf) are shown to indicate the seasonal storage and drawdown of water for CVP contractors. For 2007, the CVP San Luis storage was 680 taf at the beginning of 2007 and increased to 778 taf at the end of January but never filled to capacity of 972 taf. CVP San Luis released about 80 taf in April, about 260 taf in May, and another 250 taf in June of 2007. The Jones Pumping Plant pumping was very low in these three months, requiring these large storage releases for seasonal deliveries. CVP San Luis storage was less than 100 taf in July and August and refilled by about 125 taf each month beginning in September to reach about 650 taf at the end of the year.

Deliveries from the lower DMC or Mendota Pool are shown in the third section of Table 3.1-14. The total annual deliveries in 2007 to the lower DMC water districts, exchange contractors, and refuges were about 844 taf, with 82 taf to water districts, 596 taf to exchange contractors, and 166 taf to refuges. The water district and exchange contractor peak deliveries are in May–August, and the wildlife refuge deliveries are highest in January, September, and October.

Deliveries from the San Luis Canal are shown in the third section of Table 3.1-14. The total annual deliveries in 2007 from San Luis Reservoir (Pacheco Pumping Plant) and the San Luis Canal (including Cross Valley Canal) were about 1,318 taf. The majority of this water went to San Luis Water District (70 taf) and Westlands Water District (928 taf), with 154 taf pumped at the Pacheco Pumping Plant. The Westlands Water District deliveries were more constant, with more than 80 taf delivered from January to August, and less than 30 taf delivered in September to December. All of the seasonal storage in San Luis Reservoir, and the deliveries to the San Luis Canal, must be pumped from the DMC at the O'Neill Forebay, with a capacity of 4,200 cfs. The Intertie project will increase the operational flexibility to pump water from the Jones Pumping Plant to the

O'Neill Forebay for seasonal storage in San Luis Reservoir and delivery to the San Luis Canal and the lower DMC.

3.1.5 Environmental Consequences

Approach

Evaluation of the CVP and SWP water supply conditions that may be affected by the Intertie alternatives uses the CALSIM II model, which simulates monthly CVP and SWP reservoir operations and Delta export pumping patterns for the 1922–2003 historical period of hydrology (runoff and estimated local water uses). The water supply evaluation using the CALSIM II model allows a quantitative approach for comparing the water supply reliability (i.e., ability to consistently meet the water supply demands) of the Proposed Action and alternatives. Although the Intertie will allow full CVP pumping capacity of 4,600 cfs in July–March (Table 3.1-10) of all years, the hydrology and reservoir storage conditions will vary, so the water supply effects of the Intertie will be slightly different in each year. Simulating the effects for the 82-year sequence of historical hydrology is the best available method for evaluating the range of potential water supply changes caused by the Intertie. The incremental effects of the Intertie are consistent with the August 2008 CVP/SWP Longterm Operations Plan Future conditions. The Intertie was assumed to be operational in this OCAP evaluation. The CALSIM II results described here resulted from removing the Intertie from the OCAP Future condition simulation (Run 8.0).

Additional Delta pumping restrictions have been included in the USFWS Operations BO for delta smelt that was released in December 2008. Additional upstream reservoir and/or Delta operational changes are required in the NMFS Operations BO released in June 2009. The Jones Pumping Plant will be operated in compliance with the USFWS Operations BO and NMFS Operations BO provisions. These Delta pumping restrictions may limit the use of the Intertie in some fish protection periods, but will increase the value of the Intertie water when it can be operated. The water supply operations described in this CALSIM-model evaluation of the Future No action and the Intertie represent the greatest likely use of the Intertie facility, with the greatest likely impacts on water quality and fish.

Water Supply Impacts

Changes in water supply may result in impacts to water rights, or be the causative agents that may result in impacts on resources such as water quality, fish habitat or fish populations, recreation, groundwater, and agricultural production. The magnitude of the simulated changes will be judged relative to the Future No Action conditions to allow the effects (i.e., monthly differences) of the Proposed Action on water supply conditions to be evaluated. No mitigation of any identified CVP or SWP water supply changes is required because these changes are not considered to be environmental impacts. The magnitude and pattern of the simulated changes in CVP and SWP pumping and south of Delta deliveries are described in the following section.

3.1.6 Environmental Effects

The results presented in this section are used to provide information for subsequent analysis of the environmental consequences of the Proposed Action and No Action Alternative for each resource area. Because the only likely water supply changes would be a slight increase in CVP pumping and a possible shifting of water deliveries between CVP and SWP, in accord with the Coordinated Operations Agreement, D-1641 Delta objectives and fish protection programs, no substantial environmental impacts are expected from these water supply changes.

Alternative 1 (No Action)

Construction Effects

The No Action Alternative will not require any construction activities.

Operation Effects

There are no operational changes of the No Action Alternative. This is the assumed Future No Action conditions that are simulated in CALSIM II as the baseline conditions, assuming all other existing CVP and SWP facilities, reservoir operating criteria, D-1641 Delta objectives, and full south-of-Delta CVP and SWP demands. These Future No Action conditions are described in comparison to the Proposed Action (Alternative 2).

Alternative 2 (Proposed Action)

Construction Effects

There are no expected changes in water supply during the construction period. The Jones Pumping Plant and the DMC will remain fully operational during construction of the Intertie project. The Banks Pumping Plant and the California Aqueduct also will remain fully operational during construction.

Operation Effects

The Intertie is expected to make some improvements in CVP water supply reliability without having any major impacts on the SWP or on local water supplies, including the water diversions that supply agricultural water needs in the south Delta. The Intertie would reduce the reliance of CVP deliveries on wheeling at Banks Pumping Plant, but may reduce the SWP supply because the SWP sometimes captures CVP water from upstream reservoir releases that cannot be physically pumped at the Jones Pumping Plant with the current DMC limitations. Slightly earlier filling of San Luis Reservoir may allow pumping surplus water (Section 215) to CVP contractors in some years. However, CVP Section 215 water is not included in the CALSIM II model.

Impact WS-1: Changes in Central Valley Project Delta Pumping

Table 3.1-15 shows the monthly distribution of simulated Jones Pumping Plant pumping for the simulated Existing Condition and the Proposed Action. The Jones Pumping Plant monthly pumping is given in units of flow (cfs). The annual pumping volumes are given in taf. The simulated Future No Action annual (water year) Jones Pumping Plant pumping ranged from a minimum of 1.1 maf (in 1934) to a maximum of 2.9 maf (in 1952), with an average annual total pumping of 2,355 taf/yr. The Proposed Action provides an average increase of 35 taf/yr (about 1.5% of the average Future No Action CVP pumping). Although this change is a relatively small fraction of the total CVP pumping, it is considered a substantial change in CVP pumping capability because it provides increased operational flexibility and increased emergency response capability.

The simulated Future No Action monthly distribution results indicate the percentage of years when pumping will be close to full Jones Pumping Plant capacity (greater than 4,000 cfs). The simulated Jones Pumping Plant pumping was greater than 4,000 cfs in more than 50% of the years for each month from July through February. Pumping was reduced in March because CVP San Luis Reservoir was often filled, was reduced in April and May because of VAMP pumping limits, and was reduced in May and June because of simulated CVPIA(b)(2) pumping reductions. The only month with a simulated monthly pumping of 4,600 cfs for the No Action was July, and only about 10% of the years would be pumping at capacity.

The simulated results for the Intertie indicate that the maximum assumed CVP pumping capacity of 4,600 cfs would be used in many months of most years. The percentage of monthly pumping at 4,600 cfs would be increased to about 30% in July, 50% in August, 50% in September, 30% in October, 60% in November, 70% in December, 60% in January and 30% in February. The March pumping would be reduced considerably in most years compared to the Future No Action because CVP San Luis would be filled more often. Simulated pumping at the Jones Pumping Plant with the Intertie was almost the same as the Future No Action in April and May because of VAMP pumping limits, and was the same as the Future No Action in May and June of most years because of simulated CVPIA(b)(2) pumping reductions.

The bottom panel of Table 3.1-15 shows the monthly distribution of monthly flows in the Intertie connecting the DMC with the California Aqueduct. The months of greatest use are the months with the increased Jones Pumping Plant Pumping. However, the average use of the Intertie Facility would be about 76 taf/yr. The increase Jones Pumping Plant pumping was only about 35 taf/yr, because the Intertie allowed the CVP San Luis Reservoir to be filled earlier, and the pumping in February or March was consequently reduced.

Although the monthly CALSIM II model cannot indicate the benefits of the Proposed Action during periods of routine maintenance or during emergency operations in the DMC or California Aqueduct that would be temporarily assisted with the Intertie connection between the two conveyance facilities, it is assumed that with a permanent structure, Reclamation can more easily and quickly respond to maintenance needs and emergencies, and the potential for water supply interruptions would be reduced compared to the No Action. As such, this would be a benefit.

Impact WS-2: Changes in Central Valley Project South-of-Delta Deliveries

Table 3.1-16 shows the simulated distribution of monthly and annual (water year) CVP south-of-Delta deliveries for the Future No Action simulation and the Intertie Proposed Action. The monthly and annual changes in the CVP deliveries also are shown. The average annual total CVP delivery was 2,536 taf/yr for the simulated Future No Action Condition. The simulated annual CVP south-of - Delta deliveries ranged from a minimum of 1,325 taf/yr to a maximum of 3,283 taf/yr. The lowest 10% of the years had a delivery of less than 1.5 maf/yr, and the highest 10% of the years had a delivery of more than 3.1 maf/yr. The average annual total CVP delivery with the Proposed Action was increased by 35 taf/yr to 2,571 taf/yr. As described for the Jones Pumping Plant pumping, the Intertie facility was simulated to be used for an average of about 76 taf/yr, but pumping was subsequently reduced in many years when CVP San Luis Reservoir was filled earlier.

Figure 3.1-9 shows the 1922–2003 water-year sequence of simulated CVP south-of-Delta deliveries for the Future No Action conditions. The simulated annual change in CVP south-of-Delta deliveries for the Existing Condition with the Proposed Action is relatively small. The CVP water supply was more than 3.0 maf (i.e., 90% of CVP demand of 3,332 taf) in about 20% of the years. The CVP delivery dropped below 2.0 maf (60% of CVP demand) in about 20% of the years. The CVP delivery was less than 1,500 taf (45% of CVP demand) in about 10% of the years. There are four drought sequences in the historical record, 1924–1926, 1929–1935, 1976–1977, and 1988–1992. All of these years have CVP south-of-Delta deliveries of less than 2,000 taf/yr.

Also shown in Figure 3.1-9 are the Jones Pumping Plant pumping for October–March, which is the period when the Intertie allows slightly more CVP pumping. The years with slightly higher pumping usually are years in which slightly higher CVP deliveries result. The Jones Pumping Plant pumping from October to March is generally about 1,500 taf. The years with reduced pumping in these months lead to reduced CVP San Luis storage, and usually correspond to greatly reduced CVP deliveries in the April–October period. This is because reduced Delta inflows in the fall and winter period correspond to reduced inflows to the upstream CVP reservoirs. This emphasizes the value of the Intertie facility, which will allow CVP to capture slightly more water during the winter in most years.

The average change in CVP deliveries with the Proposed Action was an increase of 35 taf/yr. The minimum annual change was –110 taf (in 1949), and the maximum annual change was 157 taf (in 1975). The changes in CVP deliveries were more than 25 taf in about 50% of the years, and more than 75 taf in about 20% of the years. This simulated increase in CVP deliveries is an average of about 1.5% of the average CVP deliveries. This is considered a beneficial effect for CVP water supply deliveries.

Impact WS-3: Changes in State Water Project Delta Pumping

Table 3.1-17 shows the monthly cumulative distribution of simulated Banks Pumping Plant pumping for the Future No Action and for the Proposed Action. The simulated Future No Action annual (water year) Banks Pumping Plant pumping ranged from a minimum of 1,055 taf (in 1991) to a maximum of 4,281 taf (in 1982), with an average annual pumping of 3,241 taf/yr. Banks Pumping Plant pumping was generally simulated to be the same with the Intertie Proposed Action and the Future No Action conditions in all months, although there was a slight decrease under the Proposed Action of 3 taf/yr in the average SWP pumping. The reduction in Banks Pumping Plant pumping generally occurred in the same months when the Intertie was operating, allowing slightly more CVP pumping. SWP pumping was simulated to increase slightly in the summer months.

The CALSIM model accounts for three categories of Banks Pumping Plant pumping. Most Banks Pumping Plant pumping is for SWP Table A contract demands (allocations). Some Banks Pumping Plant pumping is wheeling for CVP to deliver Cross Valley Canal water during the summer when there is excess CVP share (under the COA) and Banks Pumping Plant capacity. SWP Article 21 (surplus) water often is pumped in the winter months when SWP San Luis Reservoir is full.

Because the Jones Pumping Plant pumping was increased by about 35 taf/yr and the Banks Pumping Plant pumping was reduced by about 3 taf/yr, the overall change in total pumping was a slight increase of about 32 taf/yr. This is a small change relative to the combined average CVP and SWP pumping, and there would be no adverse effect.

Impact WS-4: Changes in State Water Project South-of-Delta Deliveries

Table 3.1-18 shows the simulated distribution of monthly and annual (water year) SWP south-of-Delta total deliveries for the simulated Future No Action and the

Intertie Proposed Action. The CALSIM model tracks three categories of SWP deliveries—Table A contract allocation (i.e., firm), Article 21 (i.e., surplus or interruptible), and Article 56 (i.e., held in San Luis Reservoir and delivered in January–March of following year). Article 21 water is available to SWP contractors when SWP San Luis reservoir is full and there is excess water in the Delta. Pumping Article 21 water must not interfere with delivery of allocated Table A water and contractors must use the water directly or store it in local storage facilities. Article 56 water, referred to as carryover water, is Table A water allocated to a contractor in one year but delivered in the following calendar year, provided storage is available in SWP storage facilities." Article 56 water, therefore, was pumped from the Delta in the previous (relatively wet year) and remained in San Luis Reservoir until delivered in the subsequent calendar year. The average simulated total SWP delivery for the Future No Action conditions was 3,407 taf/yr and was 3,406 taf/yr with the Intertie Proposed Action. The average simulated Table A contract allocation delivery was 3,007 taf/yr for the Future No Action and was 3,008 taf/yr for the Intertie Proposed Action. The average simulated Article 21 (surplus) delivery was 286 taf/yr for the Future No Action and was 283 taf/yr for the Intertie Proposed Action. The average simulated Article 56 (carryover) delivery was 113 taf/yr for the Future No Action and was 114 taf/yr for the Intertie Proposed Action.

Figure 3.1-10 shows the 1922–2003 sequence of simulated SWP south-of-Delta total deliveries for the Future No Action and the Intertie Proposed Project. Total simulated Future No Action SWP deliveries ranged from a minimum of 925 taf (in 1977) to a maximum of 5,350 taf (in 1983). The simulated SWP deliveries were very reliable in most years. The deliveries were greater than 3.7 maf (90% of Table A contracts) in 50% of the years. The deliveries were less than 2.0 maf (50% of Table A contracts) in only about 10% of the years. Also shown in Figure 3.1-10 are the simulated Table A deliveries. The simulated maximum Table A delivery was about 4.0 maf, and Table A deliveries were greater than 3.7 maf (90% of Table A contracts) in about 20% of the years for the Future No Action conditions.

The SWP deliveries were not changed by the Intertie because most of the reduced SWP pumping in the winter when additional Jones Pumping Plant pumping was simulated with the Intertie was balanced by additional SWP pumping in March once CVP San Luis was filled, or in the summer months. Therefore, there were no changes in water supply for SWP deliveries from the Intertie Proposed Project and there would be no effect.

Alternative 3 (TANC Intertie Site)

Construction Effects

There are no expected changes in water supply during the construction period. The Jones Pumping Plant and the DMC would remain fully operational during construction of the Intertie project.

Operation Effects

The operational effects of Alternative 3 are identical to the simulated changes shown for the Proposed Action (Alternative 2) because the operations of the Intertie would be identical.

Alternative 4 (Virtual Intertie)

Under the Virtual Intertie (Alternative 4), the CVP would use the Banks Pumping Plant to convey CVP water to San Luis Reservoir. The permitted pumping capacity at Banks Pumping Plant would not change from the No Action Alternative. Under the No Action Alternative, available CVP water for export that cannot be pumped at Jones Pumping Plant because of the conveyance limitations at Jones Pumping Plant is treated as unused federal share under the COA and can be exported by the SWP at Banks Pumping Plant. This water, often stemming from upstream CVP instream flow or temperature releases, cannot be recovered by the CVP with current pumping restrictions.

Under the Virtual Intertie Alternative, the CVP was assumed to be given up to 400 cfs of priority capacity in Banks Pumping Plant to pump water that is released from CVP reservoirs. Additional CVP pumping during the fall and winter months, when Jones Pumping Plant cannot pump at full capacity of 4,600 cfs, was assumed to be wheeled at the Banks Pumping Plant. The State Water Board would be petitioned to appropriately change the D-1641 JPOD requirements for this wheeling of the CVP share of Delta pumping under the COA. This likely would allow this wheeling under JPOD stage 1, which requires minimum conditions to protect south Delta water users (agricultural diversions).

CVP water recovered by Banks Pumping Plant pumping JPOD may reduce the total water available for SWP export. Through reoperation, the SWP may be able to recover the loss of supply later in the year or may need to reduce deliveries or San Luis storage. Reduced available capacity for the SWP at Banks Pumping Plant may affect the timing of SWP San Luis filling and SWP Article 21 deliveries. More coordination between CVP and SWP operations, and notification and reporting of this JPOD to the Water Board would be required to implement this Virtual Intertie Alternative. However, the physical Intertie facility would not be constructed.

Construction Effects

During emergency operations (Jones Pumping Plant or DMC shutoff period), a temporary pumping plant (or siphon) would be installed between the DMC and the California Aqueduct. This would not result in any changes in water supply.

Operation Effects

The operational effects of the Virtual Intertie (Alternative 4) would be similar to the Proposed Action (Alternative 2). The water supply effects on CVP and SWP were evaluated based on the CALSIM results from the Proposed Intertie (Alternative 2). This was evaluated by changing the priority for JPOD stage 2 (terms in D-1641) to allow this additional Intertie pumping of any unused federal COA share of upstream CVP storage releases at the Banks Pumping Plant.

The Virtual Intertie would provide the almost the same CVP pumping benefits as the Proposed Action, but in a few years the SWP pumping and Article 21 deliveries would be slightly reduced, unless the Banks Pumping Plant pumping limits were increased.

Impact WS-1: Changes in Central Valley Project Delta Pumping

Table 3.1-19 shows the monthly distribution of estimated Jones Pumping Plant pumping for the simulated Existing Condition and the Virtual Intertie. The Virtual Intertie would reduce the Jones Pumping Plant pumping by an average of about 33 taf/yr, because all of the Virtual Intertie pumping would be shifted to the Banks Pumping Plant, and reductions at Jones Pumping Plant would occur in February and March when CVP San Luis Reservoir was filled with the Virtual Intertie pumping.

The bottom panel of Table 3.1-19 shows the distribution of monthly pumping for the Virtual Intertie compared to the Intertie pumping. The reduction in pumping corresponds to the winter months when the Banks Pumping Plant pumping would wheel the Intertie pumping. The Virtual Intertie would allow the CVP pumping to be reduced by about 68 taf/yr compared with the simulated Intertie Alternative.

The monthly CALSIM II model was not used to simulate the Virtual Intertie. Therefore, the CVP deliveries can only be estimated from the change in CVP pumping, with Jones Pumping Plant and CVP wheeling at Banks Pumping Plant combined. This combined pumping was increased by 27 taf/yr, which is similar to the Intertie CVP pumping increment of 35 taf/yr. Therefore the increase in CVP deliveries for the Virtual Intertie was assumed to be nearly identical to the simulated increase in CVP deliveries for the Intertie Alternative and this would be beneficial.

Impact WS-3: Changes in State Water Project Delta Pumping

Table 3.1-20 shows the monthly cumulative distribution of simulated Banks Pumping Plant pumping for the No Action and for the Virtual Intertie Alternative. Banks Pumping Plant pumping (including the wheeling of CVP Intertie pumping) was estimated to increase by about 48 taf/yr compared to the No Action SWP pumping. The calculated changes in SWP pumping (not including CVP wheeling) was a decrease of about 13 taf/yr for SWP Article 21 pumping and an increase of 3 taf/yr for SWP Table A pumping. Therefore, without an allowed increase in SWP pumping limits during some of the Intertie pumping wheeling periods, a slight reduction in deliveries of SWP Article 21 water would result from the Virtual Intertie. This is a minor change and there would be no adverse effect.

Table 3.1-1. Comparison of Clear Creek Tunnel (Trinity Exports) Monthly Flow Distribution (cfs) for Future No Action and Intertie Conditions

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	0	0	0	0	0	0	0	0	0	0	152	6	89
0.1	0	0	0	0	0	0	0	0	0	1,250	1,275	516	283
0.2	250	0	0	0	0	0	100	0	18	1,500	1,500	1,000	342
0.3	250	88	2	79	0	100	136	0	112	1,500	1,500	1,438	399
0.4	750	100	100	100	24	100	201	0	189	1,500	1,622	1,500	468
0.5	750	100	104	100	100	100	277	0	250	1,500	1,750	1,500	536
0.6	750	307	154	124	100	112	321	0	687	1,888	2,000	2,000	571
0.7	750	500	250	250	100	192	398	100	750	2,000	2,029	2,000	611
0.8	1,653	500	353	755	100	453	447	250	750	2,655	2,500	2,500	703
0.9	1,858	522	832	1,740	250	1,034	907	250	1,374	3,300	2,750	2,541	789
Max	3,300	2,161	1,645	2,651	2,745	3,300	2,603	2,914	3,300	3,300	3,300	2,909	1,205
Avg	816	303	256	451	137	316	379	185	557	1,887	1,917	1,639	533
B. Intertie													
Min	0	0	0	0	0	0	0	0	0	0	182	6	107
0.1	20	0	0	0	0	0	0	0	0	1,234	1,286	324	278
0.2	250	0	0	0	0	0	100	0	22	1,500	1,500	1,000	341
0.3	250	100	4	100	0	100	136	0	131	1,500	1,500	1,322	401
0.4	714	100	100	100	4	100	215	0	195	1,500	1,622	1,500	464
0.5	750	175	104	100	100	100	277	0	250	1,500	1,750	1,500	531
0.6	750	369	154	250	100	112	321	0	636	1,898	2,000	2,000	578
0.7	750	500	250	479	100	190	398	100	750	2,068	2,047	2,000	621
0.8	1,653	500	353	796	100	387	447	250	750	2,678	2,500	2,500	705
0.9	1,858	606	711	1,740	250	1,034	907	250	1,374	3,300	2,775	2,541	805
Max	3,300	2,161	1,645	2,651	2,778	3,300	2,359	2,914	3,300	3,300	3,300	2,909	1,206
Avg	817	320	255	478	136	310	373	183	565	1,881	1,926	1,630	535
C. Intertie Minus Future No Action													
Min	0	0	0	0	0	0	0	0	0	0	30	0	18
0.1	20	0	0	0	0	0	0	0	0	-16	11	-192	-5
0.2	0	0	0	0	0	0	0	0	5	0	0	0	-1
0.3	0	12	2	21	0	0	0	0	19	0	0	-117	2
0.4	-36	0	0	0	-21	0	14	0	6	0	0	0	-4
0.5	0	75	0	0	0	0	0	0	0	0	0	0	-5
0.6	0	62	0	126	0	0	0	0	-51	10	0	0	6
0.7	0	0	0	229	0	-3	0	0	0	68	18	0	10
0.8	0	0	0	41	0	-66	0	0	0	22	0	0	2
0.9	0	84	-121	0	0	0	0	0	0	0	25	0	17
Max	0	0	0	0	33	0	-244	0	0	0	0	0	1
Avg	0	17	-1	27	0	-6	-5	-1	8	-6	9	-9	2

Table 3.1-2. Comparison of Monthly Keswick Flow Distribution (cfs) for Future No Action and Intertie Conditions (1922–2003)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	3,323	3,250	3,240	3,226	3,081	3,230	3,185	3,250	7,159	8,598	6,710	3,253	3,427
10%	4,219	3,783	3,250	3,250	3,250	3,250	3,516	4,965	8,813	10,419	8,091	4,020	4,139
20%	4,500	4,354	3,408	3,253	3,250	3,250	4,459	5,988	9,323	11,869	8,674	4,433	4,536
30%	4,961	4,500	3,617	3,622	3,250	3,256	4,500	6,445	9,529	12,571	9,122	4,739	4,786
40%	5,228	4,500	4,437	4,250	4,151	4,150	5,019	7,009	9,943	12,965	9,647	5,353	5,251
50%	5,680	4,678	4,500	4,500	4,500	4,500	5,447	7,388	10,630	13,853	10,094	5,780	5,721
60%	6,066	4,962	4,500	6,697	6,681	4,500	6,287	7,934	11,058	14,255	10,663	6,436	6,435
70%	6,692	5,409	5,694	8,037	11,850	7,905	6,896	9,013	11,655	14,851	10,976	6,887	6,992
80%	8,201	6,469	9,332	13,041	18,699	12,965	8,030	9,412	12,709	15,000	11,777	9,027	7,644
90%	8,725	7,996	16,691	19,756	29,296	18,417	10,081	10,611	14,993	15,000	13,029	11,181	8,785
Max	9,870	29,089	30,282	52,774	53,770	46,109	29,893	16,007	19,324	15,772	14,306	12,544	12,587
Avg	6,077	5,686	7,183	8,908	10,874	8,579	6,701	7,766	11,001	13,240	10,221	6,576	6,203
B. Intertie													
Min	3,323	3,250	3,250	3,250	3,150	3,231	3,222	3,250	7,135	8,596	6,297	3,250	3,412
10%	4,405	3,783	3,250	3,250	3,250	3,250	3,516	4,987	8,796	10,841	7,919	4,031	4,143
20%	4,500	4,262	3,408	3,252	3,250	3,250	4,460	5,973	9,314	12,065	8,732	4,456	4,560
30%	4,883	4,486	3,696	3,605	3,253	3,256	4,500	6,499	9,506	12,674	9,121	4,886	4,810
40%	5,203	4,500	4,363	4,136	4,277	4,134	4,978	7,057	9,934	13,190	9,657	5,356	5,293
50%	5,589	4,698	4,500	4,500	4,500	4,500	5,338	7,352	10,660	13,910	10,059	5,894	5,733
60%	6,040	4,999	4,500	6,521	5,950	4,656	6,285	7,960	11,056	14,293	10,552	6,325	6,458
70%	6,482	5,571	5,478	7,872	10,978	7,926	6,906	9,026	11,836	14,948	10,855	6,775	6,990
80%	8,197	6,600	8,937	13,041	18,699	12,965	8,039	9,494	12,915	15,000	11,878	9,086	7,667
90%	8,725	8,105	16,622	20,661	28,933	18,417	10,081	10,611	14,905	15,000	13,101	11,183	8,760
Max	9,870	29,089	30,282	52,774	53,770	46,109	29,893	16,007	19,324	15,772	14,306	12,544	12,589
Avg	6,049	5,681	7,172	8,852	10,822	8,584	6,692	7,770	11,034	13,374	10,206	6,611	6,205
C. Intertie Minus Future No Action													
Min	0	0	10	24	69	1	37	0	-24	-2	-413	-3	-15
10%	186	0	0	0	0	0	0	23	-17	422	-172	12	4
20%	0	-92	0	-1	0	0	1	-15	-10	196	58	23	25
30%	-78	-14	79	-17	3	0	0	54	-23	102	-1	147	24
40%	-25	0	-74	-114	126	-16	-41	48	-8	224	10	3	42
50%	-91	20	0	0	0	0	-109	-36	29	57	-35	114	12
60%	-26	36	0	-176	-732	156	-3	26	-1	39	-111	-111	23
70%	-210	162	-216	-165	-872	21	10	13	180	97	-121	-112	-2
80%	-4	131	-395	0	0	0	10	82	205	0	101	59	24
90%	0	109	-69	905	-363	0	0	0	-88	0	72	2	-25
Max	0	0	0	0	0	0	0	0	0	0	0	0	1
Avg	-27	-6	-11	-55	-52	5	-9	4	33	134	-15	34	2

Table 3.1-3. Comparison of Monthly Feather River Flow Releases below Thermalito Afterbay Reservoir (cfs) for Future No Action and Intertie Conditions

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	902	900	900	900	900	800	682	536	1,000	1,417	674	995	821
10%	1,581	930	900	900	900	800	858	985	1,732	2,377	1,497	1,072	1,631
20%	2,047	1,700	1,200	1,200	1,200	1,134	1,000	1,000	2,301	3,189	2,316	1,226	1,895
30%	2,867	1,700	1,700	1,700	1,700	1,700	1,000	1,024	2,956	4,623	2,853	1,316	2,151
40%	3,107	1,835	1,700	1,700	1,700	2,281	1,000	1,415	3,581	5,802	3,659	1,493	2,412
50%	3,373	2,474	1,700	1,700	2,747	4,342	1,232	1,755	4,814	6,942	4,472	1,831	2,725
60%	3,799	2,500	1,854	3,017	5,594	5,331	1,901	2,121	5,611	7,885	5,234	2,208	3,326
70%	3,951	2,500	3,010	5,093	8,590	6,893	2,803	3,071	6,434	8,737	5,840	2,773	3,778
80%	3,996	2,500	4,152	8,293	11,366	10,134	4,147	5,816	6,986	9,160	7,229	3,229	4,476
90%	4,000	3,439	9,053	14,317	16,507	14,383	7,791	10,314	8,182	9,715	7,619	3,623	5,304
Max	6,826	14,550	27,802	40,940	23,672	34,018	18,991	20,391	11,681	10,000	8,631	5,310	8,091
Avg	3,232	2,481	3,789	5,540	6,261	6,353	3,090	3,761	4,849	6,414	4,530	2,163	3,165
B. Intertie													
Min	902	900	823	806	900	799	682	536	1,000	1,417	674	995	841
10%	1,700	1,170	900	900	900	800	858	983	1,790	2,387	1,500	1,028	1,667
20%	2,096	1,417	1,200	1,200	1,200	1,219	1,000	1,000	2,303	2,998	2,499	1,156	1,864
30%	2,947	1,700	1,700	1,700	1,700	1,700	1,000	1,025	2,973	4,591	3,132	1,327	2,157
40%	3,223	1,715	1,700	1,700	1,700	1,946	1,000	1,426	3,779	5,650	4,013	1,477	2,405
50%	3,492	2,487	1,700	1,700	2,790	4,198	1,231	1,759	4,540	6,892	4,597	1,951	2,678
60%	3,764	2,500	2,119	2,953	5,004	5,280	1,901	2,218	5,569	8,040	5,225	2,348	3,378
70%	3,957	2,500	2,917	4,559	8,590	6,944	2,801	3,178	6,500	8,759	6,179	2,765	3,778
80%	4,000	2,500	4,357	8,293	11,691	10,134	4,147	5,816	6,972	9,029	7,248	3,174	4,476
90%	4,000	2,896	9,053	14,324	16,373	14,383	7,792	10,295	8,175	9,757	7,664	3,741	5,300
Max	6,826	14,550	27,802	40,940	23,672	34,018	18,991	20,391	11,681	10,000	8,601	5,082	8,090
Avg	3,273	2,454	3,807	5,481	6,195	6,292	3,090	3,781	4,870	6,369	4,667	2,186	3,166
C. Intertie Minus Future No Action													
Min	0	0	-77	-94	0	-1	0	0	0	0	0	0	20
10%	119	240	0	0	0	0	0	-1	58	10	2	-44	36
20%	49	-283	0	0	0	84	0	0	3	-191	183	-70	-31
30%	80	0	0	0	0	0	0	0	16	-32	280	12	6
40%	116	-119	0	0	0	-334	0	11	198	-152	354	-16	-7
50%	120	13	0	0	43	-145	-1	4	-274	-49	125	120	-47
60%	-35	0	266	-64	-590	-51	-1	98	-42	155	-9	140	52
70%	6	0	-94	-534	0	51	-2	107	66	22	339	-7	0
80%	4	0	205	0	325	0	0	0	-13	-131	19	-55	0
90%	0	-542	0	7	-134	0	0	-19	-8	43	45	118	-4
Max	0	0	0	0	0	0	0	0	0	0	-31	-228	-1
Avg	41	-27	18	-59	-66	-60	1	20	21	-44	137	23	0

Table 3.1-4. Comparison of Simulated Monthly Distribution of Nimbus Dam Releases (cfs) for Future No Action and Intertie Conditions (1922–2003)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	500	500	517	800	800	427	363	305	357	362	346	333	403
10%	866	806	850	987	1,270	901	985	958	1,482	1,811	807	801	1,066
20%	1,361	1,397	1,428	1,700	1,445	1,132	1,445	1,240	1,845	2,707	1,342	1,139	1,296
30%	1,500	1,696	1,836	1,700	1,750	1,554	1,560	1,500	2,333	2,996	1,750	1,533	1,490
40%	1,500	1,925	2,000	1,750	2,607	1,759	1,885	1,789	2,597	3,520	1,758	1,535	1,812
50%	1,500	1,925	2,000	1,986	3,463	2,372	2,356	2,678	2,950	3,870	2,031	2,079	2,071
60%	1,500	2,229	2,000	2,799	4,663	3,461	3,101	3,387	3,538	4,200	2,411	2,939	2,463
70%	1,500	2,612	2,316	4,632	6,379	4,162	4,179	4,021	4,137	4,702	2,712	3,721	3,058
80%	1,500	2,934	4,202	6,624	8,964	5,412	5,007	4,857	4,829	5,000	3,487	4,006	3,658
90%	1,855	3,943	7,221	10,267	11,399	7,597	6,572	8,147	6,979	5,000	4,056	4,071	4,174
Max	2,931	17,288	20,136	31,359	32,179	16,588	14,433	11,301	14,191	5,701	4,736	4,949	6,132
Avg	1,484	2,619	3,456	4,451	5,224	3,709	3,303	3,468	3,733	3,655	2,302	2,446	2,404
B. Intertie													
Min	618	500	517	800	800	427	363	305	357	362	346	395	403
10%	885	861	850	1,072	1,270	867	985	971	1,724	1,807	807	801	1,071
20%	1,388	1,428	1,416	1,700	1,445	1,128	1,445	1,292	1,980	2,696	1,303	1,132	1,315
30%	1,500	1,733	1,836	1,700	1,788	1,518	1,699	1,497	2,280	2,972	1,750	1,533	1,494
40%	1,500	1,925	2,000	1,761	2,471	1,750	1,997	1,774	2,607	3,454	1,760	1,572	1,823
50%	1,500	1,925	2,000	2,027	3,366	2,316	2,523	2,678	3,021	3,804	1,960	2,279	2,039
60%	1,500	2,282	2,000	2,845	4,727	3,403	3,119	3,377	3,497	4,125	2,361	2,702	2,482
70%	1,500	2,543	2,300	4,632	6,252	4,282	4,207	4,025	4,114	4,730	2,798	3,672	3,055
80%	1,500	2,911	3,924	6,658	8,893	5,394	5,007	4,862	4,828	5,000	3,568	3,989	3,659
90%	1,770	3,943	7,204	10,259	11,378	7,575	6,572	8,147	6,979	5,000	4,056	4,066	4,180
Max	2,884	17,233	20,206	31,318	32,178	16,671	14,432	11,301	14,191	5,701	4,736	4,949	6,133
Avg	1,477	2,619	3,444	4,464	5,195	3,697	3,317	3,475	3,763	3,640	2,292	2,447	2,403
C. Intertie Minus Future No Action													
Min	118	0	0	0	0	0	0	0	0	0	0	63	0
10%	19	54	0	84	0	-34	0	13	241	-4	0	0	5
20%	27	31	-11	0	0	-4	0	51	135	-11	-39	-7	18
30%	0	38	0	0	38	-36	139	-3	-53	-24	0	0	4
40%	0	0	0	11	-137	-9	112	-14	9	-66	2	38	11
50%	0	0	0	41	-96	-56	167	0	71	-66	-71	201	-32
60%	0	53	0	46	64	-58	18	-11	-41	-75	-50	-237	18
70%	0	-69	-16	0	-127	121	28	3	-23	28	86	-49	-3
80%	0	-23	-277	34	-72	-18	0	5	-1	0	82	-17	1
90%	-85	0	-17	-8	-21	-21	0	0	0	0	0	-5	6
Max	-46	-55	70	-41	0	83	-1	0	0	0	0	0	1
Avg	-8	0	-12	13	-29	-12	15	7	30	-14	-10	0	-1

Table 3.1-5. Comparison of Monthly Sacramento River Flows at Freeport (cfs) for Future No Action and Intertie Conditions

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	4,826	7,134	7,289	10,076	8,225	8,094	8,055	5,327	8,281	8,727	7,710	6,414	6,519
10%	7,727	8,579	11,132	13,062	13,516	12,205	9,752	8,519	11,146	11,139	9,442	8,169	8,398
20%	9,131	9,837	12,495	14,311	16,397	15,219	10,818	9,944	12,968	14,129	10,988	9,854	10,285
30%	9,834	10,811	14,149	15,924	21,052	19,215	11,686	11,188	14,073	16,479	13,602	11,155	11,725
40%	10,756	11,680	15,767	19,260	24,129	22,146	12,658	11,970	14,987	17,803	14,332	12,038	12,589
50%	11,271	12,174	16,951	23,710	33,989	28,088	15,903	13,240	15,842	19,115	15,016	12,664	13,726
60%	11,495	12,975	20,650	31,550	47,626	33,783	21,017	14,802	16,907	20,183	15,358	13,478	18,274
70%	11,996	14,898	25,051	44,578	57,721	43,858	24,465	18,335	19,042	21,631	15,910	14,491	20,083
80%	13,375	16,096	37,351	58,885	69,432	58,584	38,312	28,596	20,199	22,358	16,714	17,282	21,918
90%	15,632	25,518	63,363	73,144	74,453	70,464	53,205	42,311	25,376	23,254	17,261	19,495	26,309
Max	33,592	65,134	75,563	78,593	79,108	77,741	74,939	66,672	64,168	24,427	20,837	26,245	34,745
Avg	11,560	15,285	26,235	33,778	39,808	34,389	23,749	19,323	18,184	18,355	14,297	13,336	16,187
B. Intertie													
Min	5,249	7,130	7,300	9,388	8,223	8,121	8,053	4,941	8,295	9,085	7,890	6,409	6,692
10%	7,716	8,478	11,023	12,676	13,478	12,224	9,752	8,534	11,149	11,168	9,938	8,028	8,467
20%	9,175	9,724	12,699	14,274	16,170	15,222	10,781	10,385	12,905	14,624	11,075	10,155	10,319
30%	9,772	10,731	14,566	15,412	20,869	19,090	11,674	11,221	14,070	16,560	13,428	11,152	11,767
40%	10,669	11,738	15,763	19,571	24,169	22,082	12,657	11,970	15,149	17,932	14,295	12,110	12,521
50%	11,280	12,624	16,930	23,556	33,789	28,071	15,903	13,216	15,995	18,880	15,064	12,700	13,782
60%	11,610	13,157	20,678	31,594	46,600	33,525	21,019	14,762	17,444	20,272	15,506	13,508	18,269
70%	11,953	14,747	25,047	44,398	57,971	43,848	24,550	18,338	18,938	21,662	16,096	14,574	20,054
80%	13,549	15,821	36,980	58,765	69,079	58,473	38,317	28,595	20,088	22,367	16,785	17,221	21,926
90%	15,636	25,506	63,364	72,857	74,457	70,568	53,207	42,313	25,382	23,414	17,339	19,498	26,293
Max	32,979	65,135	75,563	78,588	79,089	77,740	74,939	66,673	64,169	24,483	20,838	26,247	34,740
Avg	11,576	15,260	26,237	33,659	39,637	34,320	23,754	19,347	18,254	18,422	14,391	13,393	16,184
C. Intertie Minus Future No Action													
Min	423	-4	12	-688	-3	26	-2	-386	15	358	179	-5	172
10%	-10	-102	-108	-385	-38	19	0	15	3	28	496	-141	68
20%	44	-113	204	-37	-227	3	-37	441	-63	495	87	301	33
30%	-62	-80	418	-512	-183	-125	-12	33	-3	81	-174	-3	42
40%	-88	58	-4	311	41	-64	0	0	163	129	-37	72	-68
50%	9	450	-22	-154	-200	-18	0	-24	153	-235	48	35	55
60%	115	181	27	44	-1,026	-258	2	-39	537	89	149	30	-4
70%	-42	-152	-3	-180	250	-10	84	4	-104	30	187	84	-29
80%	174	-275	-371	-120	-354	-111	5	-1	-111	9	71	-61	9
90%	4	-12	1	-287	4	103	1	2	5	160	78	3	-15
Max	-613	1	0	-5	-20	0	0	1	1	56	1	2	-5
Avg	16	-25	1	-119	-171	-69	4	24	71	68	94	56	-3

Table 3.1-6. Comparison of Monthly San Joaquin River flows at Vernalis (cfs) for Future No Action and Intertie Conditions

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	1,134	1,373	1,379	1,108	1,606	1,183	1,174	1,152	574	549	666	930	879
10%	1,506	1,659	1,667	1,469	1,867	1,670	1,706	2,061	1,071	918	1,032	1,428	1,128
20%	1,772	1,796	1,802	1,653	1,987	1,826	2,457	2,712	1,253	1,122	1,180	1,612	1,330
30%	1,878	1,896	1,916	1,939	2,198	2,035	2,576	2,987	1,393	1,188	1,255	1,700	1,538
40%	2,025	1,992	1,972	2,111	2,505	2,553	3,296	3,584	1,691	1,337	1,335	1,776	1,737
50%	2,194	2,121	2,126	2,331	3,185	2,929	4,456	4,279	1,931	1,509	1,426	1,884	1,884
60%	2,498	2,290	2,219	2,497	4,562	4,857	5,210	5,073	2,486	1,762	1,729	2,212	2,606
70%	2,702	2,457	2,436	3,490	6,491	6,705	6,181	5,728	3,090	2,153	2,359	2,517	3,299
80%	2,937	2,713	2,879	4,932	9,515	8,477	7,480	7,655	7,220	3,557	2,719	2,771	4,471
90%	3,623	2,996	4,660	9,690	15,465	14,429	11,803	14,264	13,613	7,256	4,224	4,089	5,957
Max	7,489	16,671	24,085	60,018	34,345	48,461	27,377	26,252	28,119	23,849	9,141	7,882	15,956
Avg	2,435	2,511	3,326	4,783	6,505	6,257	5,805	6,123	4,579	3,220	2,046	2,341	3,012
B. Intertie													
Min	1,135	1,373	1,379	1,108	1,606	1,183	1,175	1,153	575	550	668	930	879
10%	1,506	1,659	1,667	1,469	1,867	1,670	1,706	2,061	1,074	918	1,032	1,428	1,128
20%	1,772	1,796	1,802	1,653	1,987	1,826	2,457	2,712	1,253	1,123	1,181	1,612	1,330
30%	1,878	1,896	1,916	1,939	2,198	2,035	2,577	2,988	1,394	1,191	1,256	1,701	1,538
40%	2,025	1,992	1,972	2,111	2,505	2,554	3,296	3,585	1,692	1,338	1,336	1,777	1,737
50%	2,195	2,121	2,126	2,331	3,186	2,929	4,457	4,279	1,931	1,512	1,427	1,884	1,884
60%	2,498	2,290	2,219	2,497	4,562	4,855	5,210	5,074	2,487	1,763	1,732	2,212	2,607
70%	2,702	2,457	2,436	3,490	6,490	6,705	6,181	5,728	3,090	2,154	2,359	2,518	3,299
80%	2,937	2,713	2,879	4,932	9,516	8,477	7,480	7,655	7,223	3,560	2,719	2,771	4,471
90%	3,624	2,996	4,660	9,690	15,462	14,428	11,803	14,264	13,613	7,256	4,224	4,089	5,957
Max	7,489	16,671	24,085	60,018	34,345	48,461	27,377	26,252	28,119	23,849	9,141	7,882	15,956
Avg	2,435	2,511	3,326	4,783	6,504	6,257	5,805	6,123	4,580	3,221	2,047	2,341	3,013
C. Intertie Minus Future No Action													
Min	-1	0	0	-2	-5	-4	-3	-2	-2	-4	-2	-1	-1
10%	0	0	0	0	-1	-2	0	0	0	0	0	0	0
20%	0	0	0	0	0	0	0	0	0	0	0	0	0
30%	0	0	0	0	0	0	0	0	0	0	0	0	0
40%	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
60%	0	0	0	0	0	0	0	0	0	1	0	0	0
70%	0	0	0	0	0	0	0	0	1	1	1	0	0
80%	0	0	0	0	0	0	0	1	1	2	2	1	0
90%	0	0	0	0	0	0	1	1	2	3	2	1	1
Max	1	1	1	1	1	0	1	3	3	5	3	3	1
Avg	0	0	0	0	0	0	0	0	1	1	1	0	0

Table 3.1-7. Comparison of Monthly CVP San Luis Reservoir Storage (taf) for No Action and Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. Future No-Action												
Min	45	46	257	418	552	561	535	417	309	45	45	45
10%	152	258	411	574	669	766	713	582	376	127	45	78
20%	171	321	489	648	759	816	792	625	385	170	74	99
30%	185	326	504	664	790	876	841	639	415	212	94	117
40%	208	338	525	698	809	915	867	658	449	255	124	149
50%	240	369	542	725	840	947	882	704	484	294	161	167
60%	268	401	576	744	862	972	897	745	526	371	194	202
70%	317	436	605	765	892	972	927	772	578	415	234	241
80%	341	468	639	785	927	972	972	839	636	448	274	282
90%	401	559	742	891	972	972	972	914	726	522	375	352
Max	771	920	972	972	972	972	972	972	881	746	646	685
Avg	263	392	564	722	832	904	865	721	514	315	183	200
B. Intertie												
Min	45	55	283	369	580	595	568	448	230	45	45	50
10%	144	283	442	592	712	830	764	605	387	125	45	90
20%	176	333	528	714	808	882	825	646	406	167	56	104
30%	191	349	545	734	861	921	866	669	441	213	95	123
40%	210	368	569	753	885	967	885	703	468	271	124	151
50%	238	383	582	781	917	972	903	726	496	312	166	176
60%	287	425	615	809	951	972	923	749	560	388	208	207
70%	340	471	666	836	972	972	941	799	601	432	251	265
80%	371	526	704	879	972	972	972	840	659	469	307	297
90%	450	590	785	956	972	972	972	914	726	528	379	391
Max	801	970	972	972	972	972	972	972	881	746	653	701
Avg	276	417	605	779	883	927	885	738	528	324	191	211
C. Intertie minus No Action												
Min	0	9	25	-49	28	35	33	31	-79	0	0	5
10%	-8	25	31	17	43	64	51	23	11	-2	0	11
20%	5	12	38	66	48	66	33	21	21	-3	-18	4
30%	6	24	40	70	71	45	25	29	26	2	1	6
40%	3	31	44	55	75	51	18	45	19	16	1	2
50%	-2	14	40	56	77	25	20	22	12	18	4	9
60%	18	24	40	65	89	0	26	4	34	17	14	5
70%	23	34	61	72	80	0	14	27	23	16	17	24
80%	30	58	65	94	45	0	0	1	23	21	33	14
90%	49	31	43	65	0	0	0	0	0	5	4	39
Max	31	50	0	0	0	0	0	0	0	0	6	15
Avg	13	25	41	57	51	23	20	16	14	9	8	11

Table 3.1-8. Comparison of Monthly SWP San Luis Reservoir Storage (taf) for No Action and Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
A. Future No-Action												
Min	55	55	55	203	308	425	352	275	55	64	70	67
10%	140	184	304	545	704	749	612	458	272	226	171	140
20%	206	246	454	686	876	926	823	574	381	305	224	185
30%	251	365	532	784	961	1,006	882	661	449	342	271	251
40%	321	419	624	885	1,026	1,048	913	698	517	383	298	308
50%	400	486	707	973	1,067	1,064	932	733	554	421	338	337
60%	443	553	783	1,026	1,067	1,067	962	777	609	483	391	380
70%	596	679	869	1,067	1,067	1,067	986	841	680	549	495	550
80%	704	796	1,029	1,067	1,067	1,067	1,024	916	763	629	587	634
90%	1,018	1,066	1,067	1,067	1,067	1,067	1,030	988	902	865	829	889
Max	1,067	1,067	1,067	1,067	1,067	1,067	1,057	1,030	1,030	1,061	1,021	1,063
Avg	463	537	690	877	960	982	889	728	566	473	404	417
B. Intertie												
Min	67	55	55	201	318	418	349	256	55	64	55	89
10%	163	151	287	504	745	742	598	403	272	234	191	159
20%	199	232	412	668	809	887	831	585	385	279	234	195
30%	243	378	522	762	942	997	879	656	448	342	274	239
40%	317	420	612	892	1,016	1,052	902	690	508	381	301	289
50%	365	476	669	966	1,051	1,067	923	735	545	423	335	342
60%	451	529	785	1,026	1,067	1,067	959	772	587	475	390	385
70%	595	668	851	1,067	1,067	1,067	977	822	685	536	500	565
80%	686	791	1,016	1,067	1,067	1,067	1,020	924	766	630	558	625
90%	1,005	1,065	1,067	1,067	1,067	1,067	1,035	989	906	875	828	893
Max	1,067	1,067	1,067	1,067	1,067	1,067	1,062	1,030	1,030	1,061	1,021	1,063
Avg	461	528	680	870	952	979	885	725	561	469	407	418
C. Intertie Minus Future No Action												
Min	12	0	0	-1	9	-7	-2	-19	0	0	-15	22
10%	23	-34	-17	-41	41	-7	-14	-55	0	8	20	19
20%	-7	-15	-42	-18	-67	-39	8	11	4	-26	10	10
30%	-8	13	-10	-22	-19	-9	-3	-5	-1	0	3	-11
40%	-3	1	-12	7	-10	4	-11	-9	-9	-2	2	-20
50%	-35	-10	-38	-7	-16	3	-9	2	-9	2	-3	5
60%	9	-24	2	0	0	0	-3	-5	-22	-8	-1	5
70%	-1	-11	-18	0	0	0	-8	-19	5	-12	5	16
80%	-18	-5	-13	0	0	0	-4	9	3	2	-29	-8
90%	-13	-1	0	0	0	0	5	1	5	10	-2	4
Max	0	0	0	0	0	0	5	0	0	0	0	0
Avg	-1	-9	-10	-7	-8	-3	-5	-3	-4	-4	3	2

Table 3.1-9. CVP DMC Demands (Full Contract Amounts) and Jones Pumping Plant Pumping Capacity

Month	CVP Delta-Mendota Canal Demands (taf)	Maximum Volume at 4,600 cfs Jones Pumping Plant Capacity (taf)	Additional Needed from San Luis Reservoir (taf)
October	204	283	–
November	123	274	–
December	107	283	–
January	137	283	–
February	166	255	–
March	192	283	–
April	236	274	–
May	344	283	61
June	502	274	228
July	583	283	300
August	476	283	193
September	262	274	–
Total	3,332	3,332	782

CVP = Central Valley Project.
taf = thousand acre-feet.

Table 3.1-10. Assumed Monthly Maximum Jones Pumping Plant Pumping

Month	Future No Action Maximum Jones Pumping Plant Pumping Capacity (cfs)	Intertie Maximum Jones Pumping Plant Pumping Capacity (cfs)	Difference in Jones Pumping Plant Pumping Capacity (cfs)
October	4,387	4,600	213
November	4,264	4,600	336
December	4,226	4,600	374
January	4,231	4,600	369
February	4,253	4,600	347
March	4,300	4,600	300
April	3,518	3,745	227
May	3,000	3,000	0
June	3,000	3,000	0
July	4,600	4,600	0
August	4,600	4,600	0
September	4,490	4,600	110
Total (taf)	2,951	3,087	136

cfs = cubic feet per second.
taf = thousand acre-feet.

Table 3.1-11. Banks Pumping Plant Demands (Table A Contract Amounts) and Maximum Pumping Capacity

Month	Banks Pumping Plant Demand (taf)	Maximum Volume at 6,680 cfs Banks Pumping Plant Capacity (taf)	Additional Needed from San Luis Reservoir (taf)
October	295	411	–
November	261	397	–
December	245	411	–
January	173	411	–
February	203	371	–
March	235	411	–
April	302	397	–
May	407	411	–
June	520	397	123
July	541	411	130
August	532	411	121
September	404	397	7
Total	4,118	4,836	381

taf = thousand acre-feet.

Table 3.1-12. Historical Monthly CVP Pumping and South-of-Delta Deliveries for Calendar Year 2005

Canals (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Delta Pumping													
Contra Costa	6,503	10,143	2,444	7,761	16,498	19,980	17,289	15,234	10,660	11,462	4,809	740	123,523
Delta-Mendota	259,293	215,968	207,613	125,999	65,875	247,959	268,964	271,049	259,526	266,552	254,621	262,410	2,705,829
Jones Pumping Plant (cfs)	4,215	3,887	3,375	2,116	1,071	4,165	4,372	4,406	4,359	4,333	4,277	4,265	3,736
B. Upper Delta-Mendota Canal (af)													
Banta Carbona ID	0	0	0	0	13	164	987	177	0	0	274	0	1,615
Broadview WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Byron Bethany ID	16	15	24	203	407	512	668	575	425	207	49	21	3,122
Centinella WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Del Puerto WD	10	56	1,044	6,561	10,396	12,850	19,127	14,724	8,656	4,986	1,951	567	80,928
DWR Intertie at MP7.70-R	0	0	0	0	0	0	0	0	0	0	0	0	0
Eagle Field WD	0	103	1	184	98	541	659	650	7	163	125	13	2,544
Mercy Springs WD	0	0	0	43	12	75	142	12	250	31	0	0	565
Newman Wasteway	0	0	0	0	0	0	0	0	0	0	0	0	0
Oro Loma WD	0	37	0	0	0	36	67	41	0	0	0	0	181
Panoche WD—Ag	102	289	148	429	670	1,181	1,460	811	105	2	8	143	5,348
Panoche WD—M&I	2	2	2	2	2	2	2	2	2	2	2	2	24
Patterson WD	0	123	33	245	485	596	1,448	962	1,666	422	168	73	6,221
San Luis WD—Ag	175	646	769	678	645	2,171	2,902	2,014	631	148	117	7	10,903
San Luis WS—M&I	1	1	1	1	20	34	32	33	27	21	10	1	182
Tracy, City of	29	249	681	898	1,152	1,245	1,159	1,217	1,103	804	404	0	8,941
West Side ID	0	0	0	0	107	37	298	402	21	0	0	0	865
Widren	0	0	0	0	0	0	0	0	0	0	0	0	0
W. Stanislaus ID	0	1	279	2,630	3,271	2,686	6,266	8,497	5,598	3,617	1,789	590	35,224
Subtotal	**335**	**1,522**	**2,982**	**11,874**	**17,278**	**22,130**	**35,217**	**30,117**	**18,491**	**10,403**	**4,897**	**1,417**	**156,663**
Exchange Contractors													
Central California ID—above	452	0	189	926	1,583	1,670	2,144	2,886	1,952	626	498	746	13,672

Canals (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Central California ID—below	0	414	946	291	736	9,015	21,629	16,279	191	147	1,372	2,646	53,666
Firebaugh Canal Co	0	1,291	0	264	137	4,560	7,233	7,164	268	577	339	785	22,618
Subtotal	**452**	**1,705**	**1,135**	**1,481**	**2,456**	**15,245**	**31,006**	**26,329**	**2,411**	**1,350**	**2,209**	**4,177**	**89,956**
Refuges													
China Island—76.05	0	0	369	368	0	351	608	490	0	0	491	1,133	3,810
Freitas Unit—76.05L	0	0	335	507	0	458	473	236	0	0	845	1,023	3,877
Salt Slough Unit—76.05L	0	0	899	488	0	1,016	875	799	0	0	1,061	1,424	6,562
Los Banos WMA—76.05L (DF)	0	0	542	524	0	668	584	874	0	0	1,141	1,263	5,596
Volta Wildlife Mgmt Area	22	89	0	0	0	0	0	505	2,677	2,548	1,834	1,130	8,805
Grasslands WD—76.05L	2,043	2,460	3,373	2,870	6,883	4,926	1,520	5,468	16,334	14,370	4,752	4,892	69,891
Grasslands WD—Volta	69	151	0	205	3,428	2,668	1,451	3,031	11,744	12,672	5,741	3,343	44,503
Kesterson Unit—Volta	0	0	0	0	0	369	251	349	1,021	1,465	1,135	631	5,221
Kesterson Unit—76.05L	0	0	313	351	0	0	0	0	0	0	0	0	664
Subtotal	**2,134**	**2,700**	**5,831**	**5,313**	**10,311**	**10,456**	**5,762**	**11,752**	**31,776**	**31,055**	**17,000**	**14,839**	**148,929**
Total DMC Deliveries	**2,921**	**5,927**	**9,948**	**18,668**	**30,045**	**47,831**	**71,985**	**68,198**	**52,678**	**42,808**	**24,106**	**20,433**	**395,548**
O'Neill Net Pumping	**232,200**	**153,150**	**146,447**	**86,724**	**23,481**	**116,471**	**37,532**	**40,599**	**96,272**	**125,555**	**172,764**	**231,114**	**1,462,309**
CVP San Luis Reservoir (taf)	**797,060**	**868,408**	**966,291**	**965,050**	**896,693**	**803,548**	**571,673**	**377,525**	**402,364**	**472,717**	**605,191**	**725,856**	
C. Mendota Pool Deliveries (AF)													
Fresno Slough WD	0	29	201	107	367	546	892	576	73	109	0	0	2,900
Tranquillity Public Utilities	0	0	22	0	0	18	34	23	0	0	0	0	97
James ID	0	3,503	1,614	0	1,773	6,566	13,685	6,687	2,913	727	575	0	38,043
Laguna WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Meyers—SLWD	675	544	655	343	66	69	90	130	868	742	465	0	4,647
Dudley & Indart—formerly C	0	419	40	337	197	486	551	512	77	74	0	0	2,693
Mid-Valley WD—no contract	0	0	0	0	0	0	0	0	0	0	0	0	0
Reclamation District #1606	0	0	0	0	0	122	171	142	6	0	0	0	441
Terra Linda Farms—Coelho F	0	250	333	363	66	1,396	2,395	1,149	432	291	204	0	6,879
Tranquillity ID	0	2,069	2,908	1,033	816	4,172	5,057	5,865	835	129	39	0	22,923
Wilson, JW—no contract	0	0	133	72	0	222	293	235	0	0	0	0	955

Canals (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Subtotal	**675**	**6,814**	**5,906**	**2,255**	**3,285**	**13,597**	**23,168**	**15,319**	**5,204**	**2,072**	**1,283**	**0**	**79,578**
Exchange Contractors													
Central California ID	0	14,278	25,125	22,405	40,178	75,162	93,412	82,911	37,712	21,071	20,128	0	432,382
Columbia Canal Co	0	1,716	7,992	4,939	3,755	7,222	8,601	9,241	5,575	3,132	101	0	52,274
Firebaugh Canal Co	0	2,281	1,196	2,307	3,576	6,030	5,907	5,127	2,537	571	2,440	0	31,972
San Luis Canal Co	0	0	5,318	7,952	10,805	24,515	31,000	27,661	12,543	2,127	6,457	1,818	130,196
Subtotal	**0**	**18,275**	**39,631**	**37,603**	**58,314**	**112,929**	**138,920**	**124,940**	**58,367**	**26,901**	**29,126**	**1,818**	**646,824**
Refuges													
Grasslands WD—76.05L (CCI)	6,161	3,105	1,627	1,391	3,790	2,526	865	2,560	18,722	22,483	3,665	250	67,145
Kesterson—USFWS	403	487	104	117	296	0	0	0	0	0	0	0	1,407
Los Banos WMA—DFG	756	1,410	514	175	1,027	530	195	726	3,721	4,661	3,341	735	17,791
San Luis NWR—USFWS	3,283	10,823	0	0	0	3,693	3,586	660	2,500	7,358	3,802	0	35,705
Mendota Wildlife Area	694	546	428	353	1,021	1,633	2,794	2,335	4,612	6,413	2,514	0	23,343
China Island Unit	375	609	123	122	339	117	203	163	1,051	1,022	164	0	4,288
Salt Slough Unit	842	819	300	162	1,097	338	292	266	1,481	1,217	354	0	7,168
Freitas Unit	619	628	112	169	555	152	158	79	867	1,469	281	0	5,089
Kern National Wildlife Refuge	411	0	620	849	506	0	0	1,602	5,130	5,367	5,222	3,240	22,947
Subtotal	**13,544**	**18,427**	**3,828**	**3,338**	**8,631**	**8,989**	**8,093**	**8,391**	**38,084**	**49,990**	**19,343**	**4,225**	**184,883**
Lower DMC Deliveries	**14,219**	**43,516**	**49,365**	**43,196**	**70,230**	**135,515**	**170,181**	**148,650**	**101,655**	**78,963**	**49,752**	**6,043**	**911,285**
D. San Luis Canal													
Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
City of Avenal	181	167	187	218	247	264	241	340	274	108	342	202	2,771
Broadview WD	1	1	1	1	2	2	2	3	3	2	1	1	20
City of Coalinga	352	284	361	438	478	731	956	1,008	868	597	465	361	6,899
City of Dos Palos	66	62	74	96	144	172	205	193	152	138	95	73	1,470
City of Huron	49	44	65	98	86	113	139	132	115	87	89	64	1,081
Pacheco WD	1	1	1	1	1	818	2,327	1,654	255	157	8	444	5,668
Pacheco CCID Non-project	188	489	137	674	1,242	1,282	0	0	0	0	0	0	4,012
Panoche WD	1,859	2,546	2,071	3,029	4,239	10,753	14,537	10,168	1,147	673	595	1,328	52,945

Canals (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
San Luis WD	632	2,388	4,813	5,889	7,015	12,413	13,579	9,881	3,610	3,757	2,406	593	66,976
Westlands WD	23,005	42,250	58,254	77,959	91,619	181,375	212,408	172,050	56,187	46,208	39,326	50,878	1,051,519
Fish & Game	73	63	10	22	0	0	1	0	39	0	0	0	208
Fish & Game	6	0	0	0	0	0	0	0	0	0	0	118	124
O’Neill Forebay Wildlife	56	6	0	58	172	49	72	94	43	80	86	94	810
O’Neill Forebay Deliveries	53	165	604	802	1,112	1,840	2,143	1,401	723	341	319	155	9,658
Cross Valley Canal	0	0	0	0	0	0	0	0	0	4,938	0	0	4,938
Pacheco Pumping	10,593	3,673	2,497	2,218	5,866	9,213	14,527	18,542	15,439	16,500	5,845	6,696	111,609
Subtotal	**37,115**	**52,139**	**69,075**	**91,503**	**112,223**	**219,025**	**261,137**	**215,466**	**78,855**	**73,586**	**49,577**	**61,007**	**1,320,708**
Total DMC Deliveries	**54,255**	**101,582**	**128,388**	**153,367**	**212,498**	**402,371**	**503,303**	**432,314**	**233,188**	**195,357**	**123,435**	**87,483**	**2,627,541**

Table 3.1-13. Historical Monthly CVP Pumping and South-of-Delta Deliveries for Calendar Year 2006

Canals or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Delta Pumping													
Contra Costa	8,432	10,494	9,429	298	9,789	17,946	14,181	15,830	12,663	10,587	7,885	2,538	120,072
Delta-Mendota	240,471	239,578	200,225	48,483	110,651	199,739	270,452	270,127	260,072	264,891	239,617	254,129	2,598,435
Jones Pumping Plant (cfs)	3,909	4,312	3,255	814	1,799	3,355	4,396	4,391	4,368	4,306	4,025	4,131	3,587
B. Upper Delta Mendota Canal (AF)													
Banta Carbona ID	0	2	0	0	974	202	303	45	30	0	0	0	1,556
Broadview WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Byron Bethany ID	0	88	87	72	517	665	802	631	493	208	25	1	3,589
Centinella WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Del Puerto WD	20	2,038	928	995	12,379	15,778	18,642	14,494	8,987	4,004	1,126	503	79,894
DWR Intertie at MP7.70-R	0	0	0	0	0	0	0	0	0	0	0	0	0
Eagle Field WD	9	503	7	29	393	804	701	668	238	22	90	30	3,494
Mercy Springs WD	0	170	115	0	61	62	82	62	375	0	0	102	1,029
Newman Wasteway	0	0	0	0	0	0	0	0	0	0	0	0	0
Oro Loma WD	0	243	28	0	270	82	228	292	200	16	3	0	1,362
Panoche WD—Ag	184	436	65	26	570	2,569	2,703	1,725	369	2	107	105	8,861
Panoche WD—M&I	2	2	2	2	2	2	2	2	2	173	2	2	195
Patterson WD	0	27	61	48	1,169	1,183	2,253	764	404	49	92	4	6,054
San Luis WD—Ag	569	1,999	825	169	848	2,707	3,232	1,904	492	16	59	123	12,943
San Luis WD—M&I	1	1	3	2	31	49	44	41	29	36	4	1	242
Tracy, City of	0	0	108	338	792	941	992	1,046	976	671	128	0	5,992
West Side ID	0	0	0	0	0	246	559	317	73	0	0	0	1,195
Widren	0	0	0	0	0	0	0	0	0	0	0	0	0
West Stanislaus ID	0	1,380	684	581	5,602	6,016	7,493	5,959	3,616	1,768	678	331	34,108
Subtotal	**785**	**6,889**	**2,913**	**2,262**	**23,608**	**31,306**	**38,036**	**27,950**	**16,284**	**6,965**	**2,314**	**1,202**	**160,514**
Exchange Contractors													
Central California ID—above	0	657	439	157	1,869	2,727	2,432	3,180	2,733	1,230	306	783	16,513

Canals or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Central California ID—below	0	175	168	456	662	11,778	17,742	13,742	156	166	33	74	45,152
Firebaugh Canal Co	6	0	310	26	702	4,858	7,322	5,133	363	726	597	1,039	21,082
Subtotal	**6**	**832**	**917**	**639**	**3,233**	**19,363**	**27,496**	**22,055**	**3,252**	**2,122**	**936**	**1,896**	**82,747**
Refuges													
China Island—76.05	506	599	0	0	0	128	416	537	0	0	0	0	2,186
Freitas Unit—76.05L	710	538	0	0	0	268	0	95	0	0	0	0	1,611
Salt Slough Unit—76.05L	887	763	0	0	0	672	1,115	809	0	0	0	0	4,246
Los Banos WMA—76.05L	890	585	0	0	0	189	369	628	0	0	0	0	2,661
Volta Wildlife Mgmt Area	505	1,104	0	0	163	0	112	1,101	2,667	2,568	1,835	1,139	11,194
Grasslands WD—76.05L	35	0	0	0	3,769	5,676	5,653	10,655	20,390	4,294	2,321	0	52,793
Grasslands WD—Volta	0	1,196	0	0	2,735	1,059	175	3,514	13,319	12,095	5,202	4,244	43,539
Kesterson Unit—Volta	0	0	0	0	0	0	0	390	1,321	1,447	1,082	1,035	5,275
Kesterson Unit—76.05L	800	606	0	0	0	46	232	0	0	0	0	0	1,684
Subtotal	**4,333**	**5,391**	**0**	**0**	**6,667**	**8,038**	**8,072**	**17,729**	**37,697**	**20,404**	**10,440**	**6,418**	**125,189**
Total DMC Deliveries	**5,124**	**13,112**	**3,830**	**2,901**	**33,508**	**58,707**	**73,604**	**67,734**	**57,233**	**29,491**	**13,690**	**9,516**	**368,450**
O'Neill Net Pumping	**221,499**	**116,367**	**158,861**	**37,266**	**69,948**	**124,604**	**39,385**	**46,584**	**85,919**	**142,524**	**178,067**	**199,262**	**1,420,286**
CVP San Luis Reservoir (taf)	**877,097**	**875,439**	**968,493**	**964,671**	**893,434**	**798,169**	**530,061**	**402,776**	**402,112**	**438,764**	**563,953**	**679,751**	
C. Mendota Pool Deliveries (AF)													
Fresno Slough WD	0	608	28	0	89	496	716	552	76	21	0	0	2,586
Tranquillity Public Utilities	0	0	22	0	0	15	31	26	2	0	0	0	96
James ID	1,248	7,020	2,401	0	1,459	3,248	12,069	11,899	3,529	1,281	2,253	1,030	47,437
Laguna WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Meyers—SLWD	427	426	538	461	603	432	109	72	215	1,176	589	476	5,524
Dudley & Indart	36	258	138	21	79	298	769	469	183	0	0	24	2,275
Mid-Valley WD—no contract	0	0	0	331	1,438	1,832	111	0	0	0	0	0	3,712
Reclamation District #1606	0	79	37	0	0	0	0	0	0	0	0	0	116
Terra Linda Farms	200	1,032	234	102	1,076	1,588	1,546	1,016	870	208	233	0	8,105
Tranquillity ID	0	4,718	937	150	1,286	4,882	7,116	5,482	657	130	367	0	25,725
Westlands WD	0	0	0	0	6,032	5,374	0	0	0	0	0	0	11,406

Canals or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wilson, JW—no contract	0	171	0	0	0	139	222	178	9	0	0	0	719
Subtotal	**1,911**	**14,312**	**4,335**	**1,065**	**12,062**	**18,304**	**22,689**	**19,694**	**5,541**	**2,816**	**3,442**	**1,530**	**107,701**
Exchange Contractors													
Central California ID	176	35,265	15,536	4,457	47,950	67,227	102,849	87,760	45,070	30,466	13,339	12,587	462,682
Columbia Canal Co	0	3,636	4,414	670	3,896	4,367	7,555	7,642	3,596	4,156	1,042	4	40,978
Firebaugh Canal WD	843	4,368	817	871	4,852	6,555	6,613	5,847	2,880	454	474	0	34,574
San Luis Canal Co	0	7,560	6,641	1,554	14,485	24,579	33,190	25,758	10,905	6,136	3,860	4,362	139,030
Subtotal	**1,019**	**50,829**	**27,408**	**7,552**	**71,183**	**102,728**	**150,207**	**127,007**	**62,451**	**41,212**	**18,715**	**16,953**	**677,264**
Refuges													
Grasslands WD 76.05L	3,057	10,556	1,000	852	9,415	3,688	2,182	4,131	16,596	26,110	6,171	2,839	86,597
Kesterson—USFWS	267	477	887	292	278	15	77	0	1,694	1,397	0	0	5,384
Los Banos WMA—DFG	705	2,322	872	154	216	63	123	793	2,797	3,961	3,970	1,850	17,826
San Luis NWR—USFWS	2,372	9,887	0	0	0	2,500	1,000	0	2,500	5,404	4,098	0	27,761
Mendota Wildlife Area	981	2,486	354	273	1,102	2,030	2,621	2,513	4,254	6,955	2,476	1,644	27,689
China Island Unit	168	470	627	169	188	43	139	179	902	1,974	1,557	686	7,102
Salt Slough Unit	296	599	1,137	621	900	224	371	270	1,197	1,173	1,538	887	9,213
Freitas Unit	236	422	937	550	238	89	0	31	600	0	1,171	922	5,196
Kern National Wildlife Refuge	472	524	0	255	493	0	40	1,561	4,656	4,698	5,135	3,448	21,282
Subtotal	**8,554**	**27,743**	**5,814**	**3,166**	**12,830**	**8,652**	**6,553**	**9,478**	**35,196**	**51,672**	**26,116**	**12,276**	**208,050**
Lower DMC Deliveries	**11,484**	**92,884**	**37,557**	**11,783**	**96,075**	**129,684**	**179,449**	**156,179**	**103,188**	**95,700**	**48,273**	**30,759**	**993,015**
D. San Luis Canal													
City of Avenal	182	176	198	201	255	269	323	324	285	240	231	224	2,908
Broadview WD	1	1	1	0	3	2	5	6	3	3	6	4	35
City of Coalinga	404	396	336	401	568	751	1,073	1,024	991	609	131	730	7,414
City of Dos Palos	71	57	65	79	154	180	206	139	200	118	88	79	1,436
City of Huron	57	60	63	108	146	113	136	131	118	106	87	66	1,191
Pacheco WD	19	1	1	1	1	1,024	2,546	1,397	410	113	103	341	5,957
Pacheco CCID Non-project	65	670	568	326	1,401	1,262	0	0	0	29	14	0	4,335
Panoche WD	1,701	2,826	1,265	943	5,467	12,017	14,963	8,279	1,094	294	975	467	50,291

Canals or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
San Luis WD	1,167	4,569	3,111	2,711	7,945	12,972	14,248	8,405	3,677	2,390	2,391	1,499	65,085
Westlands WD	50,509	77,456	45,092	39,714	113,392	202,459	230,170	155,853	62,723	48,712	39,745	50,147	1,115,972
Fish & Game	0	29	0	0	0	1	0	134	0	31	0	0	195
Fish & Game	62	0	0	0	0	0	0	0	0	0	0	69	131
O'Neill Forebay Wildlife	60	118	81	18	3	28	143	160	64	182	56	24	937
O'Neill Forebay Deliveries	211	898	737	389	969	2,000	2,423	1,952	791	591	251	140	11,352
Cross Valley Canal	0	0	0	0	0	0	0	0	0	0	0	0	0
Pacheco Pumping	2,828	6,360	2,453	2,180	3,242	7,990	12,486	12,643	11,827	10,168	9,719	7,962	89,858
Subtotal	**57,337**	**93,617**	**53,971**	**47,071**	**133,546**	**241,068**	**278,722**	**190,447**	**82,183**	**63,586**	**53,797**	**61,752**	**1,357,097**
Total DMC Deliveries	**73,945**	**199,613**	**95,358**	**61,755**	**263,129**	**429,459**	**531,775**	**414,360**	**242,604**	**188,777**	**115,760**	**102,027**	**2,718,562**

Table 3.1-14. Historical Monthly CVP Pumping and South-of-Delta Deliveries for Calendar Year 2007

Canal (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
A. Delta Pumping													
Contra Costa	1,878	4,978	12,645	495	11,346	24,023	21,705	9,039	4,843	6,820	7,468	6,213	111,453
Delta-Mendota	267,158	242,188	246,918	162,070	51,730	147,174	269,482	271,856	257,465	261,605	207,504	201,233	2,586,383
Jones Pumping Plant (cfs)	4,343	4,359	4,014	2,722	841	2,472	4,380	4,419	4,325	4,252	3,485	3,271	3,571
B. Upper Delta Mendota Canal (af)													
Banta Carbona ID	0	0	0	215	60	369	473	71	0	1	0	0	1,189
Broadview WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Byron Bethany ID	31	33	224	523	586	529	523	384	342	84	91	17	3,367
Centinella WD	0	0	0	0	0	0	0	0	0	0	0	0	0
Del Puerto WD	1,834	2,039	8,761	11,388	12,724	13,590	14,848	10,322	5,575	2,079	1,218	149	84,527
DWR Intertie at MP7.70-R	0	0	0	0	0	0	0	0	0	0	0	0	0
Eagle Field WD	125	425	378	459	494	343	293	260	24	12	0	0	2,813
Mercy Springs WD	305	0	286	151	35	66	26	49	10	78	129	31	1,166
Newman Wasteway	0	0	0	0	0	0	0	1,459	0	0	0	0	1,459
Oro Loma WD	27	61	38	1	44	19	33	35	0	0	0	0	258
Panoche WD—Ag	468	354	590	720	1,434	1,291	1,282	1,273	417	90	91	1	8,011
Panoche WD—M&I	2	2	2	2	2	3	2	2	2	2	2	2	25
Patterson WD	140	0	699	614	667	1,157	1,031	387	109	18	612	295	5,729
San Luis WD—Ag	1,176	1,822	900	786	837	1,817	1,449	914	172	112	92	98	10,175
San Luis WD—M&I	1	2	14	15	22	25	28	31	19	12	12	2	183
Tracy, City of	0	0	0	0	453	860	1,085	1,287	1,050	721	528	443	6,427
West Side ID	0	0	72	0	186	298	359	0	0	0	0	0	915
Widren	0	0	0	0	0	0	0	0	0	0	0	0	0
West Stanislaus ID	1,644	1,064	4,237	2,938	2,217	3,075	6,086	5,815	745	0	0	0	27,821
Subtotal	**5,753**	**5,802**	**16,201**	**17,812**	**19,761**	**23,442**	**27,518**	**22,289**	**8,465**	**3,209**	**2,775**	**1,038**	**154,065**
Exchange Contractors (af)													
Central California ID—above	357	286	2,615	1,748	2,245	2,140	2,878	2,739	2,227	1,706	194	0	19,135

Canal (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Central California ID—below	639	4,804	8,399	6,112	21,117	24,773	27,133	20,498	285	149	0	0	113,909
Firebaugh Canal Co	663	869	0	191	1,428	4,036	5,425	4,728	227	506	475	197	18,745
Subtotal	**1,659**	**5,959**	**11,014**	**8,051**	**24,790**	**30,949**	**35,436**	**27,965**	**2,739**	**2,361**	**669**	**197**	**151,789**
Refuges (af)													
China Island Unit	0	952	605	536	410	673	638	647	0	0	0	0	4,461
Los Banos WMA	0	1,204	497	298	222	446	451	1,322	0	0	0	0	4,440
Salt Slough Unit	0	225	652	529	395	455	575	641	0	0	0	0	3,472
Volta WMA	929	565	341	151	220	576	0	2,167	2,638	2,756	1,541	411	12,295
Grasslands WD	3,144	0	3,675	1,211	2,500	978	84	2,204	16,860	4,959	2,995	0	38,610
Grasslands WD—Volta	3,354	0	0	1,526	6,077	1,599	0	742	20,192	13,002	5,393	1,299	53,184
Kesterson Unit—76.05	0	0	845	289	275	448	317	570	0	0	0	0	2,744
Kesterson Unit—Volta	61	100	0	0	0	0	0	0	932	1,021	801	709	3,624
Freitas Unit—76.05	0	1,194	432	347	455	422	473	466	0	0	0	0	3,789
Subtotal	**7,488**	**4,240**	**7,047**	**4,887**	**10,554**	**5,597**	**2,538**	**8,759**	**40,622**	**21,738**	**10,730**	**2,419**	**126,619**
Upper DMC Total	**14,900**	**16,001**	**34,262**	**30,750**	**55,105**	**59,988**	**65,492**	**59,013**	**51,826**	**27,308**	**14,174**	**3,654**	**432,473**
O'Neill Pumping	**190,971**	**122,096**	**140,261**	**63,180**	**-104,564**	**-45,443**	**48,651**	**91,911**	**117,176**	**148,913**	**157,240**	**168,558**	**1,098,950**
CVP San Luis Reservoir (taf)	**777,646**	**743,340**	**764,836**	**688,202**	**426,148**	**173,215**	**82,689**	**96,410**	**194,300**	**327,922**	**482,150**	**649,105**	
C. Mendota Pool Deliveries (af)													
Dudley & Indart	138	712	102	126	220	537	593	285	7	3	0	0	2,723
Fresno Slough WD	0	613	187	221	470	525	727	647	123	62	0	0	3,575
James ID	3,538	7,983	4,017	928	3,271	5,420	5,734	2,769	278	0	0	0	33,938
Laguna WD—via CCID	0	0	0	0	0	0	0	0	0	0	0	0	0
Meyers—SLWD	643	441	542	382	122	91	103	140	80	0	282	30	2,856
Mid-Valley WD—no contract	0	0	0	0	0	0	0	0	0	0	0	0	0
Reclamation District #1606	5	4	45	26	95	122	43	44	0	0	18	0	402
Terra Linda Farms	431	880	622	529	1,321	1,708	1,977	1,454	433	271	10	197	9,833
Tranquillity ID	88	5,053	1,170	1,149	4,084	5,220	5,841	4,144	689	384	329	0	28,151
Tranquillity Public Utilities	0	8	19	0	27	23	9	0	0	0	0	0	86
Westlands WD—Lateral 6 & 7	0	0	0	0	0	0	0	0	0	0	0	0	0

Canal (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Wilson, JW—no contract	0	153	59	0	104	93	114	83	0	0	0	0	606
San Luis WD—via CCID	59	8	62	62	9	41	49	61	43	0	0	0	394
Subtotal	**4,902**	**15,855**	**6,825**	**3,423**	**9,723**	**13,780**	**15,190**	**9,627**	**1,653**	**720**	**639**	**227**	**82,564**
Exchange Contractors (AF)													
Central California ID—CCID	6,331	34,894	21,197	21,247	49,924	60,206	72,431	49,545	17,095	26,587	1,197	1,915	362,569
Columbia Canal Co	71	3,664	5,565	4,888	6,972	8,277	9,717	6,833	3,945	5,048	0	0	54,980
Firebaugh Canal WD	2,640	6,304	1,392	4,842	6,387	7,138	7,804	5,592	1,400	1,416	0	0	44,915
San Luis Canal Co—SLCC	0	7,500	7,800	11,346	19,532	26,047	28,512	20,178	7,726	4,079	500	0	133,220
Subtotal	**9,042**	**52,362**	**35,954**	**42,323**	**82,815**	**101,668**	**118,464**	**82,148**	**30,166**	**37,130**	**1,697**	**1,915**	**595,684**
Refuges (AF)													
Grasslands WD	8,854	0	1,902	403	1,259	326	28	735	21,978	12,143	5,390	3,199	56,217
China Island Unit	922	317	202	178	137	224	213	216	1,240	801	460	936	5,846
Los Banos WMA	4,106	1,171	563	99	74	149	150	903	3,004	4,299	3,324	2,950	20,792
Mendota Wildlife Area	1,254	1,950	790	843	1,551	2,027	2,937	2,172	5,178	4,473	2,009	2,285	27,469
Salt Slough Unit—CDFG	945	75	217	176	132	151	192	214	1,213	1,400	1,244	1,081	7,040
Freitas Unit	1,259	398	144	116	151	140	158	155	700	1,892	1,101	1,023	7,237
Kesterson	0	0	282	96	92	149	106	190	0	0	0	0	915
San Luis NWR	9,983	8,865	632	0	0	2,500	362	2,242	2,564	4,378	5,077	3,727	40,330
Subtotal	**27,323**	**12,776**	**4,732**	**1,911**	**3,396**	**5,666**	**4,146**	**6,827**	**35,877**	**29,386**	**18,605**	**15,201**	**165,846**
Lower DMC Total	**41,267**	**80,993**	**47,511**	**47,657**	**95,934**	**121,114**	**137,800**	**98,602**	**67,696**	**67,236**	**20,941**	**17,343**	**844,094**
D. San Luis Canal													
City of Avenal	234	199	249	256	293	302	288	256	201	205	216	193	2,892
Broadview WD	11	11	0	0	0	0	0	0	0	0	0	0	22
City of Coalinga	468	403	474	593	805	967	937	1,016	728	584	490	342	7,807
City of Dos Palos	93	80	106	115	190	201	201	195	164	122	109	144	1,720
City of Huron	70	63	90	115	118	129	140	133	105	89	81	74	1,207
Pacheco WD	891	408	1,101	1,070	1	1,614	2,434	2,158	492	126	145	117	10,557
Pacheco CCID Non-project	0	0	0	670	2,107	868	0	0	0	0	0	0	3,645
Panoche WD	2,508	3,181	4,216	4,524	5,638	7,820	7,953	5,233	2,221	939	495	445	45,173

Canal (af) or Water User	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
San Luis WD	3,299	4,373	7,340	7,465	9,688	12,421	11,734	6,380	3,078	3,251	1,689	99	70,817
Westlands WD	78,995	82,114	99,694	109,425	137,133	145,142	123,579	79,378	30,628	21,521	11,257	9,705	928,571
Mendota WMA—CDFG	0	0	0	0	0	1	1	1	1	0	0	0	4
Mendota WMA—CDFG	0	0	0	0	0	0	0	0	0	0	0	0	0
Kern National Wild	1,020	806	0	305	500	200	0	2,050	3,470	4,104	2,974	2,097	17,526
O’Neill Forebay	447	610	1,045	948	1,136	1,574	1,698	1,114	594	193	193	90	9,642
Cross Valley Canal	0	0	0	0	0	0	18,696	30,219	15,235	0	0	0	64,150
Pacheco Pumping	8,148	12,120	14,024	17,641	18,909	19,898	18,795	17,378	14,118	9,577	3,497	108	154,213
Subtotal	**96,184**	**104,368**	**128,339**	**143,127**	**176,518**	**191,137**	**186,456**	**145,511**	**71,035**	**40,711**	**21,146**	**13,414**	**1,317,946**
Total DMC Deliveries	**152,351**	**201,362**	**210,112**	**221,534**	**327,557**	**372,239**	**389,748**	**303,126**	**190,557**	**135,255**	**56,261**	**34,411**	**2,594,513**

Table 3.1-15. Comparison of Jones Pumping Plant Pumping (cfs) Monthly Distribution for Future No Action and Intertie with Intertie Pumping (cfs)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	1,101	600	2,165	600	800	599	799	799	798	600	597	1,144	1,099
10%	2,639	2,103	3,320	3,647	2,127	1,152	800	800	800	1,195	800	2,057	1,639
20%	2,947	3,919	4,210	4,213	2,855	1,988	1,420	800	1,980	1,987	1,803	2,869	2,034
30%	3,523	4,226	4,214	4,217	3,744	2,373	1,600	800	2,475	2,984	3,278	4,054	2,231
40%	3,997	4,240	4,219	4,222	4,221	2,709	1,926	1,125	2,475	3,569	4,449	4,437	2,453
50%	4,263	4,245	4,220	4,224	4,237	3,171	2,097	1,344	2,650	4,126	4,506	4,457	2,518
60%	4,330	4,247	4,221	4,225	4,241	3,839	2,378	1,500	2,755	4,527	4,518	4,462	2,569
70%	4,337	4,248	4,221	4,226	4,242	4,155	2,547	1,762	2,955	4,553	4,523	4,465	2,618
80%	4,359	4,255	4,223	4,228	4,243	4,252	2,547	1,911	3,000	4,580	4,540	4,474	2,695
90%	4,387	4,264	4,226	4,231	4,247	4,276	2,747	3,000	3,000	4,600	4,571	4,489	2,754
Max	4,387	4,264	4,226	4,231	4,253	4,300	3,518	3,000	3,000	4,600	4,571	4,490	2,899
Avg	3,763	3,806	4,044	3,970	3,647	3,059	2,014	1,499	2,391	3,472	3,516	3,831	2,354
B. Intertie													
Min	1,093	600	1,342	104	800	600	800	797	800	600	600	1,068	1,188
10%	2,478	2,043	3,358	3,600	1,932	1,085	800	800	801	1,049	800	2,056	1,685
20%	2,934	3,724	4,417	4,226	2,360	1,863	1,420	800	2,335	2,073	1,802	2,877	2,047
30%	3,298	4,596	4,600	4,578	2,751	2,160	1,603	800	2,475	3,040	2,770	3,898	2,301
40%	4,036	4,600	4,600	4,600	3,473	2,377	1,922	1,125	2,475	3,559	4,536	4,441	2,467
50%	4,313	4,600	4,600	4,600	4,241	2,651	2,082	1,362	2,650	4,338	4,600	4,600	2,549
60%	4,534	4,600	4,600	4,600	4,485	2,811	2,371	1,500	2,802	4,570	4,600	4,600	2,600
70%	4,600	4,600	4,600	4,600	4,600	3,129	2,546	1,736	2,924	4,600	4,600	4,600	2,669
80%	4,600	4,600	4,600	4,600	4,600	3,772	2,547	1,911	3,000	4,600	4,600	4,600	2,732
90%	4,600	4,600	4,600	4,600	4,600	4,416	2,734	3,000	3,000	4,600	4,600	4,600	2,814
Max	4,600	4,600	4,600	4,600	4,600	4,600	3,745	3,000	3,000	4,600	4,600	4,600	2,924
Avg	3,829	4,022	4,325	4,247	3,580	2,698	2,001	1,496	2,428	3,511	3,540	3,915	2,389
C. Intertie Minus Future No Action													
Min	-9	0	-822	-496	0	1	1	-1	2	0	3	-76	89
10%	-161	-61	38	-47	-196	-68	0	0	1	-146	0	-1	46
20%	-13	-195	207	13	-495	-125	0	0	355	86	-2	8	13
30%	-226	370	386	361	-993	-213	3	0	0	56	-508	-156	70
40%	39	360	381	378	-749	-332	-4	0	0	-11	88	4	14
50%	51	355	380	376	4	-519	-15	18	0	211	94	143	32
60%	204	353	379	375	244	-1,028	-7	0	47	43	82	138	31
70%	263	352	379	374	358	-1,025	-1	-27	-31	47	77	135	52
80%	241	345	377	372	357	-480	0	0	0	20	60	126	36
90%	213	336	374	369	353	140	-13	0	0	0	29	111	60
Max	213	336	374	369	347	300	228	0	0	0	29	110	25
Avg	66	216	282	277	-67	-361	-13	-3	37	39	24	84	35

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
D. Intertie Connection from DMC to CA (cfs)													
Min	0	0	0	0	0	0	0	0	0	0	0	0	5
10%	0	0	0	0	0	0	0	0	0	0	0	0	32
20%	0	0	197	0	0	0	0	0	0	0	0	0	47
30%	0	336	374	347	0	0	0	0	0	0	0	0	64
40%	0	336	376	372	0	0	0	0	0	0	16	44	77
50%	0	345	378	373	4	0	0	0	0	0	29	110	83
60%	188	350	379	374	244	0	0	0	0	0	54	125	91
70%	213	352	379	375	353	0	0	0	0	0	70	132	96
80%	244	354	380	376	357	0	0	0	0	20	77	136	101
90%	259	357	386	383	359	126	0	0	0	43	82	140	105
Max	343	386	391	389	380	383	0	0	0	112	94	304	128
Avg	103	260	307	275	151	34	0	0	0	10	38	80	76

Table 3.1-16. Comparison of Simulated Monthly Distribution of CVP South-of-Delta Deliveries (taf) for Future No Action and Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual
A. Future No Action													
Min	111	61	38	30	42	78	90	129	170	181	172	135	1,326
10%	139	73	47	41	53	93	111	159	216	238	204	164	1,584
20%	158	89	63	64	80	104	140	208	287	321	275	193	2,093
30%	169	96	74	83	101	124	154	242	342	384	324	214	2,388
40%	177	104	83	98	117	139	175	267	382	437	366	226	2,607
50%	181	107	87	104	123	150	184	275	395	456	385	231	2,697
60%	183	108	89	107	126	154	188	281	405	472	398	240	2,752
70%	190	110	91	110	129	158	192	287	413	494	441	253	2,836
80%	199	117	98	122	143	165	195	304	441	529	469	256	2,942
90%	205	124	105	139	161	172	209	338	496	577	472	279	3,130
Max	278	226	142	139	161	190	232	338	496	660	539	316	3,283
Avg	179	107	81	94	112	139	171	258	368	431	368	228	2,536
B. Intertie													
Min	111	61	38	30	41	78	89	128	170	180	146	135	1,314
10%	139	73	48	43	55	93	111	159	217	248	208	164	1,586
20%	159	90	64	66	81	104	140	210	291	338	278	195	2,121
30%	170	97	75	85	103	125	153	245	347	398	306	222	2,449
40%	179	105	85	100	119	142	184	271	387	450	368	228	2,646
50%	182	107	88	105	124	154	189	278	401	464	394	233	2,741
60%	185	109	90	109	128	160	192	285	410	479	413	241	2,824
70%	193	111	93	113	132	163	192	291	420	505	445	253	2,885
80%	199	117	99	122	143	166	195	304	441	529	468	256	2,984
90%	205	130	107	139	161	178	210	338	496	577	469	280	3,156
Max	278	243	149	139	161	190	232	338	496	660	539	318	3,286
Avg	180	109	83	96	114	142	173	261	373	439	370	230	2,571
C. Intertie Minus No Action													
Min	0	0	0	0	0	0	0	0	-1	-1	-26	0	-12
10%	0	0	1	2	3	1	0	0	1	10	4	0	2
20%	1	1	1	1	2	1	1	3	4	16	3	2	29
30%	1	1	1	2	2	1	-1	3	5	14	-18	7	61
40%	1	1	1	2	2	2	9	4	6	13	3	2	39
50%	1	1	1	1	2	5	5	3	6	8	9	2	44
60%	1	1	1	2	2	6	4	4	6	7	15	1	72
70%	3	1	2	3	3	5	0	4	7	11	4	0	48
80%	0	0	1	1	1	1	0	0	0	0	-1	0	41
90%	0	7	2	0	0	6	1	0	0	0	-3	1	26
Max	0	17	8	0	0	0	0	0	0	0	0	2	3
Avg	2	2	1	2	2	3	2	3	5	8	2	2	35

Table 3.1-17. Comparison of Banks Pumping Plant Pumping Monthly Distribution (cfs) for Future No Action and Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	562	300	1,178	228	641	300	300	300	300	513	300	1,280	833
10%	2,095	2,206	3,878	2,923	2,447	2,275	928	607	468	1,115	2,200	2,656	1,969
20%	2,774	2,914	5,204	4,209	4,211	3,800	1,519	800	820	3,051	4,122	3,587	2,797
30%	3,408	3,838	6,629	6,537	5,634	4,310	1,637	875	2,752	4,123	4,668	4,253	2,988
40%	4,178	4,432	6,938	6,954	6,694	5,951	2,067	1,291	3,619	5,333	5,351	4,987	3,478
50%	4,442	5,676	7,014	7,235	7,035	6,743	2,548	2,377	3,903	6,143	5,945	5,315	3,784
60%	5,047	5,911	7,050	7,380	7,352	6,859	3,042	2,976	4,279	6,612	6,692	5,876	3,982
70%	5,424	6,680	7,072	7,489	7,541	6,944	3,919	3,464	4,726	6,923	7,054	6,727	4,103
80%	6,198	6,680	7,163	7,734	7,682	7,045	4,440	4,409	5,234	7,005	7,180	7,179	4,266
90%	6,680	6,680	7,417	8,500	8,430	7,205	5,364	5,501	6,680	7,028	7,180	7,180	4,707
Max	6,680	6,680	7,678	8,500	8,500	7,561	6,125	6,087	6,680	7,180	7,180	7,180	4,922
Avg	4,388	4,867	6,250	6,347	6,191	5,491	2,853	2,553	3,657	5,127	5,444	5,188	3,521
B. Intertie													
Min	362	300	1,139	6	649	300	300	300	300	490	300	1,236	1,003
10%	2,103	2,138	3,383	2,741	2,469	2,283	820	602	468	1,294	2,908	2,663	1,984
20%	2,881	2,778	5,107	4,300	4,182	3,842	1,518	800	908	3,151	4,217	3,615	2,778
30%	3,524	3,318	6,218	6,258	5,048	5,042	1,653	1,131	2,764	4,301	4,628	4,344	3,049
40%	4,020	4,273	6,980	6,566	6,509	6,089	2,067	1,418	3,601	5,767	5,392	4,861	3,464
50%	4,439	5,512	7,020	7,196	6,860	6,805	2,604	2,544	3,906	6,158	6,076	5,273	3,723
60%	4,904	5,854	7,058	7,366	7,301	6,896	3,115	3,043	4,289	6,632	6,749	5,979	3,992
70%	5,454	6,675	7,080	7,457	7,447	6,948	3,919	3,521	4,712	6,997	7,110	6,712	4,092
80%	6,058	6,680	7,163	7,854	7,680	7,054	4,438	4,462	5,239	7,005	7,180	7,180	4,251
90%	6,680	6,680	7,417	8,500	8,494	7,390	5,414	5,581	6,680	7,028	7,180	7,180	4,690
Max	6,680	6,680	7,678	8,500	8,500	7,561	6,125	6,087	6,680	7,180	7,180	7,180	4,924
Avg	4,374	4,735	6,209	6,273	6,081	5,575	2,882	2,621	3,640	5,175	5,552	5,181	3,517
C. Intertie Minus Future No Action													
Min	-200	0	-39	-222	8	0	0	0	0	-23	0	-44	170
10%	9	-68	-494	-182	23	8	-108	-4	0	179	708	7	15
20%	107	-136	-97	91	-29	43	-1	0	89	100	95	28	-19
30%	115	-520	-411	-279	-586	732	16	256	13	178	-40	91	61
40%	-158	-159	42	-387	-186	138	0	126	-18	434	41	-126	-14
50%	-3	-164	7	-38	-175	62	56	167	4	14	131	-42	-61
60%	-143	-57	8	-14	-52	37	73	66	10	20	57	103	10
70%	30	-5	8	-33	-94	4	0	57	-14	74	56	-15	-11
80%	-140	0	0	121	-2	9	-1	53	5	0	0	1	-15
90%	0	0	0	0	63	185	50	79	0	0	0	0	-17
Max	0	0	0	0	0	0	0	0	0	0	0	0	2
Avg	-14	-132	-41	-74	-110	84	30	68	-17	48	108	-7	-3

Table 3.1-18. Comparison of Simulated Monthly Distribution of CVP South-of-Delta Deliveries (taf) for Future No Action and Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
A. Future No Action													
Min	39	31	30	6	10	12	50	72	103	108	93	59	927
10%	88	77	66	16	52	60	114	170	243	261	220	140	2,028
20%	162	144	124	39	111	194	160	228	303	318	263	197	2,674
30%	210	194	201	108	183	268	205	274	345	362	337	239	3,054
40%	233	221	233	143	250	305	268	316	366	381	362	264	3,449
50%	252	243	266	161	260	344	298	349	401	397	388	286	3,684
60%	266	258	281	229	331	381	318	375	437	421	424	311	3,881
70%	287	266	308	255	358	402	334	388	446	450	446	320	4,028
80%	296	293	322	352	373	408	342	401	458	463	456	329	4,114
90%	322	317	421	397	380	422	351	411	468	474	466	344	4,282
Max	414	421	473	442	432	495	427	497	541	551	515	368	5,350
Avg	231	222	244	192	252	300	263	316	376	383	365	264	3,407
B. Intertie													
Min	38	30	29	6	10	12	48	70	101	108	26	58	1,140
10%	91	73	63	16	45	53	114	167	236	253	213	137	1,979
20%	162	144	123	37	111	193	166	229	309	318	267	198	2,674
30%	210	192	202	111	194	288	203	275	342	362	336	237	3,112
40%	236	217	233	137	252	313	267	314	367	376	363	263	3,474
50%	256	238	260	152	262	342	300	349	406	397	392	297	3,669
60%	274	250	279	225	321	383	320	378	439	433	423	313	3,854
70%	286	269	305	254	346	402	332	386	445	450	447	322	4,026
80%	304	293	317	301	370	407	345	400	459	462	451	331	4,110
90%	323	312	403	396	382	422	351	412	469	478	467	343	4,288
Max	414	421	474	442	433	495	427	497	541	551	516	368	5,355
Avg	233	220	242	187	251	301	263	317	377	385	365	264	3,406
C. Intertie Minus Future No Action													
Min	-1	-1	-1	0	0	0	-1	-2	-2	0	-67	-1	213
10%	3	-5	-3	-1	-6	-7	0	-4	-7	-8	-7	-3	-49
20%	0	0	-1	-2	0	-1	6	1	6	0	5	1	0
30%	0	-2	1	4	10	21	-2	0	-3	1	-1	-2	58
40%	3	-4	0	-5	3	8	0	-2	1	-5	0	-1	25
50%	5	-4	-5	-9	2	-2	2	0	5	1	3	11	-15
60%	8	-8	-2	-4	-10	2	3	3	2	12	-1	1	-27
70%	-1	3	-3	-1	-12	0	-2	-2	-1	0	2	1	-2
80%	8	0	-5	-51	-3	-1	2	-1	1	-1	-5	2	-4
90%	0	-5	-19	-1	2	0	0	1	1	4	0	-1	6
Max	0	0	1	0	1	0	0	0	0	0	0	0	5
Avg	2	-2	-2	-5	-1	1	0	1	1	1	0	1	-2

Table 3.1-19. Comparison of Jones Pumping Plant Pumping (cfs) Monthly Distribution for Future No Action and Virtual Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No-Action													
Min	1,101	600	2,165	600	800	599	799	799	798	600	597	1,144	1,099
10%	2,639	2,103	3,320	3,647	2,127	1,152	800	800	800	1,195	800	2,057	1,639
20%	2,947	3,919	4,210	4,213	2,855	1,988	1,420	800	1,980	1,987	1,803	2,869	2,034
30%	3,523	4,226	4,214	4,217	3,744	2,373	1,600	800	2,475	2,984	3,278	4,054	2,231
40%	3,997	4,240	4,219	4,222	4,221	2,709	1,926	1,125	2,475	3,569	4,449	4,437	2,453
50%	4,263	4,245	4,220	4,224	4,237	3,171	2,097	1,344	2,650	4,126	4,506	4,457	2,518
60%	4,330	4,247	4,221	4,225	4,241	3,839	2,378	1,500	2,755	4,527	4,518	4,462	2,569
70%	4,337	4,248	4,221	4,226	4,242	4,155	2,547	1,762	2,955	4,553	4,523	4,465	2,618
80%	4,359	4,255	4,223	4,228	4,243	4,252	2,547	1,911	3,000	4,580	4,540	4,474	2,695
90%	4,387	4,264	4,226	4,231	4,247	4,276	2,747	3,000	3,000	4,600	4,571	4,489	2,754
Max	4,387	4,264	4,226	4,231	4,253	4,300	3,518	3,000	3,000	4,600	4,571	4,490	2,899
Avg	3,763	3,806	4,044	3,970	3,647	3,059	2,014	1,499	2,391	3,472	3,516	3,831	2,354
B. Virtual Intertie													
Min	1,093	600	1,342	104	800	600	800	797	800	600	600	1,068	1,178
10%	2,478	2,043	3,358	3,712	2,085	1,090	800	800	801	1,049	800	2,056	1,639
20%	2,934	3,724	4,210	4,212	2,457	1,940	1,420	800	2,335	2,073	1,802	2,877	2,004
30%	3,298	4,221	4,212	4,215	2,774	2,180	1,603	800	2,475	3,040	2,770	3,898	2,229
40%	4,036	4,231	4,214	4,218	3,601	2,480	1,922	1,125	2,475	3,559	4,536	4,322	2,397
50%	4,278	4,233	4,214	4,219	4,222	2,656	2,082	1,362	2,650	4,338	4,600	4,415	2,480
60%	4,303	4,234	4,215	4,219	4,233	3,006	2,371	1,500	2,802	4,570	4,600	4,428	2,525
70%	4,307	4,235	4,215	4,220	4,234	3,512	2,546	1,736	2,924	4,600	4,600	4,440	2,586
80%	4,320	4,239	4,216	4,221	4,235	3,887	2,547	1,911	3,000	4,600	4,600	4,461	2,648
90%	4,340	4,244	4,217	4,222	4,237	4,257	2,734	3,000	3,000	4,600	4,600	4,516	2,715
Max	4,340	4,244	4,217	4,223	4,241	4,274	3,745	3,000	3,000	4,600	4,600	4,516	2,842
Avg	3,706	3,751	4,018	3,978	3,449	2,757	2,001	1,496	2,428	3,511	3,540	3,824	2,320
C. Virtual Intertie Minus Future No-Action													
Min	-9	0	-822	-496	0	1	1	-1	2	0	3	-76	80
10%	-161	-61	38	65	-42	-62	0	0	1	-146	0	-1	0
20%	-13	-195	0	-1	-398	-48	0	0	355	86	-2	8	-30
30%	-226	-5	-2	-3	-970	-193	3	0	0	56	-508	-156	-2
40%	39	-9	-5	-4	-620	-229	-4	0	0	-11	88	-115	-56
50%	15	-12	-6	-6	-15	-515	-15	18	0	211	94	-42	-37
60%	-27	-13	-6	-6	-9	-833	-7	0	47	43	82	-34	-44
70%	-30	-13	-6	-6	-8	-643	-1	-27	-31	47	77	-25	-31
80%	-39	-16	-7	-7	-8	-365	0	0	0	20	60	-12	-47
90%	-47	-20	-9	-9	-10	-19	-13	0	0	0	29	26	-39
Max	-47	-20	-9	-8	-12	-26	228	0	0	0	29	25	-58
Avg	-56	-55	-26	8	-197	-302	-13	-3	37	39	24	-6	-33

D. Virtual Intertie Minus Intertie

Min	0	0	0	0	0	0	0	0	0	0	0	0	-10
10%	0	0	0	112	153	5	0	0	0	0	0	0	-46
20%	0	0	-208	-14	97	77	0	0	0	0	0	0	-43
30%	0	-375	-388	-363	23	20	0	0	0	0	0	0	-72
40%	0	-369	-386	-382	128	103	0	0	0	0	0	-119	-70
50%	-35	-367	-386	-381	-18	4	0	0	0	0	0	-185	-69
60%	-231	-366	-385	-381	-253	195	0	0	0	0	0	-172	-75
70%	-293	-365	-385	-380	-366	382	0	0	0	0	0	-160	-83
80%	-280	-361	-384	-379	-365	115	0	0	0	0	0	-139	-84
90%	-260	-356	-383	-378	-363	-159	0	0	0	0	0	-84	-99
Max	-260	-356	-383	-377	-359	-326	0	0	0	0	0	-84	-82
Avg	-122	-271	-307	-269	-131	59	0	0	0	0	0	-91	-68

Table 3.1-20. Comparison of Banks Pumping Plant Pumping (cfs) Monthly Distribution for Future No Action and Virtual Intertie

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	taf
A. Future No Action													
Min	562	300	1,178	228	641	300	300	300	300	513	300	1,280	833
10%	2,095	2,206	3,878	2,923	2,447	2,275	928	607	468	1,115	2,200	2,656	1,969
20%	2,774	2,914	5,204	4,209	4,211	3,800	1,519	800	820	3,051	4,122	3,587	2,797
30%	3,408	3,838	6,629	6,537	5,634	4,310	1,637	875	2,752	4,123	4,668	4,253	2,988
40%	4,178	4,432	6,938	6,954	6,694	5,951	2,067	1,291	3,619	5,333	5,351	4,987	3,478
50%	4,442	5,676	7,014	7,235	7,035	6,743	2,548	2,377	3,903	6,143	5,945	5,315	3,784
60%	5,047	5,911	7,050	7,380	7,352	6,859	3,042	2,976	4,279	6,612	6,692	5,876	3,982
70%	5,424	6,680	7,072	7,489	7,541	6,944	3,919	3,464	4,726	6,923	7,054	6,727	4,103
80%	6,198	6,680	7,163	7,734	7,682	7,045	4,440	4,409	5,234	7,005	7,180	7,179	4,266
90%	6,680	6,680	7,417	8,500	8,430	7,205	5,364	5,501	6,680	7,028	7,180	7,180	4,707
Max	6,680	6,680	7,678	8,500	8,500	7,561	6,125	6,087	6,680	7,180	7,180	7,180	4,922
Avg	4388	4867	6250	6347	6191	5491	2853	2553	3657	5127	5444	5188	3521
B. Virtual Intertie													
Min	705	300	1,139	6	649	300	300	300	300	490	300	1,236	1,027
10%	2,103	2,197	3,716	2,853	2,501	2,283	820	602	468	1,294	2,908	2,663	2,046
20%	2,881	2,779	5,367	4,662	4,204	3,842	1,518	800	908	3,151	4,217	3,719	2,816
30%	3,524	3,649	6,662	6,473	5,157	5,106	1,653	1,131	2,764	4,301	4,628	4,462	3,107
40%	4,211	4,367	7,181	6,927	6,724	6,222	2,067	1,418	3,601	5,767	5,392	4,928	3,542
50%	4,439	5,881	7,324	7,246	6,861	6,816	2,604	2,544	3,906	6,158	6,076	5,449	3,798
60%	5,118	6,467	7,376	7,444	7,352	6,946	3,115	3,043	4,289	6,632	6,749	6,053	4,038
70%	5,615	6,680	7,408	7,545	7,629	6,999	3,919	3,521	4,712	6,997	7,110	6,713	4,140
80%	6,360	6,680	7,547	7,957	7,921	7,219	4,438	4,462	5,239	7,005	7,180	7,180	4,282
90%	6,680	6,680	7,678	8,500	8,500	7,480	5,414	5,581	6,680	7,028	7,180	7,180	4,752
Max	6,680	6,680	7,678	8,500	8,500	7,561	6,125	6,087	6,680	7,180	7,180	7,180	4,982
Avg	4459	4894	6473	6405	6173	5634	2882	2621	3640	5175	5552	5234	3568
C. Virtual Intertie minus Future No Action													
Min	142	0	-39	-222	8	0	0	0	0	-23	0	-44	194
10%	9	-9	-162	-70	55	8	-108	-4	0	179	708	7	77
20%	107	-134	162	453	-7	43	-1	0	89	100	95	132	19
30%	115	-189	33	-63	-476	796	16	256	13	178	-40	209	119
40%	33	-64	243	-27	30	271	0	126	-18	434	41	-59	64
50%	-3	205	310	12	-173	73	56	167	4	14	131	134	14
60%	71	556	326	64	0	87	73	66	10	20	57	176	55
70%	191	0	336	55	88	55	0	57	-14	74	56	-13	37
80%	162	0	384	224	239	174	-1	53	5	0	0	1	16
90%	0	0	261	0	70	275	50	79	0	0	0	0	45
Max	0	0	0	0	0	0	0	0	0	0	0	0	60
Avg	71	27	223	59	-18	143	30	68	-17	49	108	46	48

D. Virtual Intertie minus Intertie													
Min	343	0	0	0	0	0	0	0	0	0	0	0	23
10%	0	59	332	112	32	0	0	0	0	0	0	0	62
20%	0	2	260	362	22	0	0	0	0	0	0	104	38
30%	0	331	444	215	110	64	0	0	0	0	0	118	58
40%	190	94	201	360	215	133	0	0	0	0	0	66	78
50%	0	369	304	50	1	11	0	0	0	0	0	176	75
60%	214	614	318	78	52	50	0	0	0	0	0	73	46
70%	161	5	328	88	182	52	0	0	0	0	0	1	48
80%	302	0	384	103	241	165	0	0	0	0	0	0	31
90%	0	0	261	0	6	90	0	0	0	0	0	0	62
Max	0	0	0	0	0	0	0	0	0	0	0	0	58
Avg	85	159	263	132	92	59	0	0	0	0	0	53	51

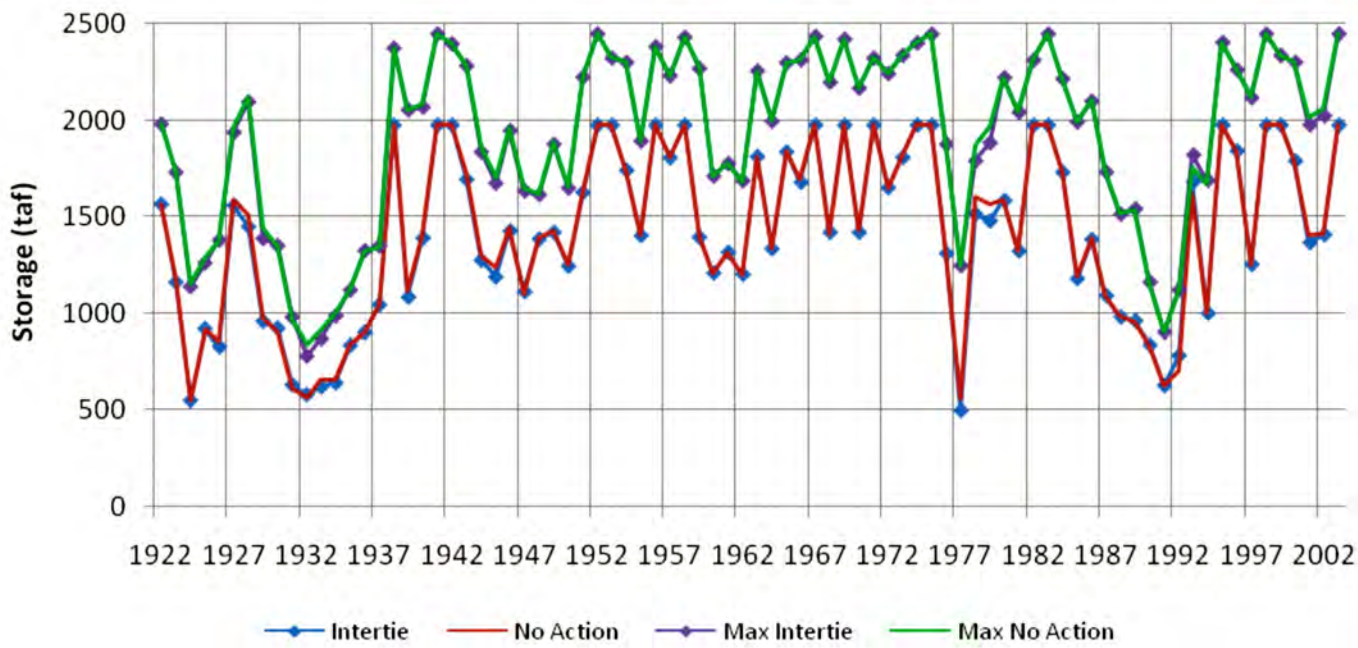

Figure 3.1-1. CALSIM-Simulated Trinity Reservoir Annual Minimum and Maximum Storage for 1922–2003

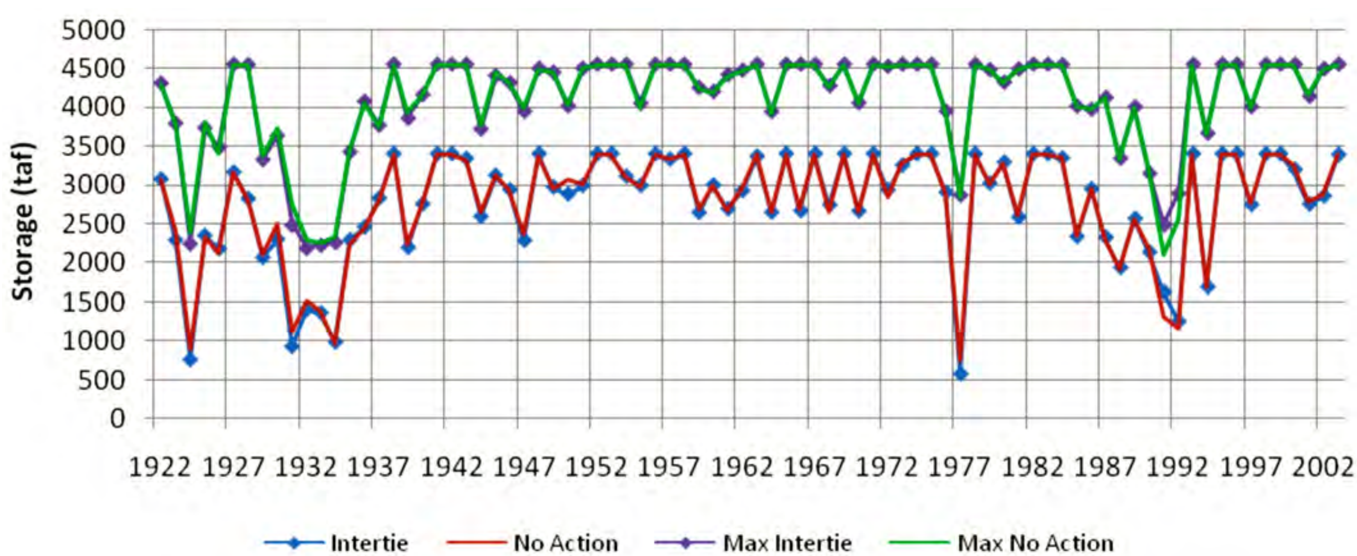

Figure 3.1-2. CALSIM-Simulated Shasta Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

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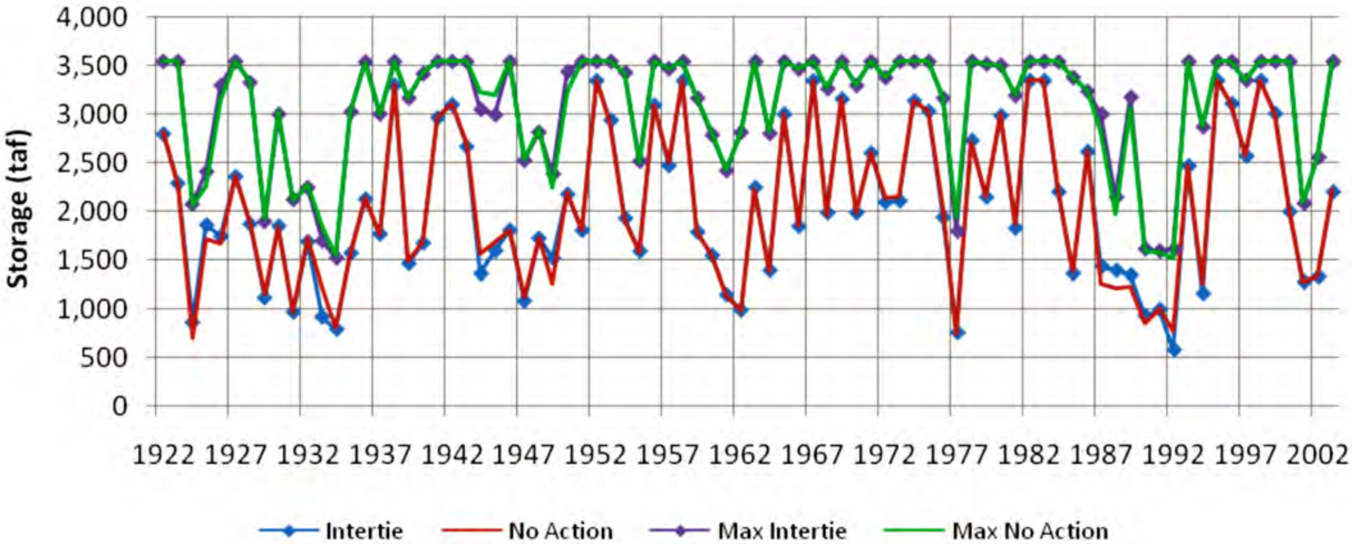

Figure 3.1-3. CALSIM-Simulated Oroville Reservoir Annual Minimum and Maximum Storage for 1922–2003

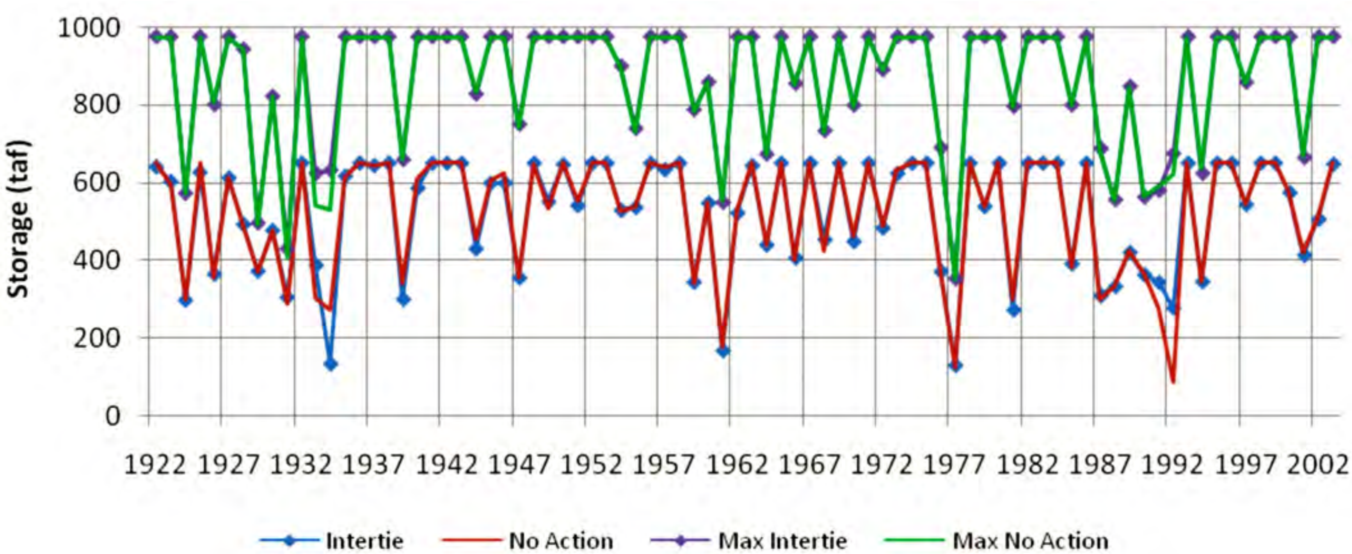

Figure 3.1-4. CALSIM-Simulated Folsom Reservoir Annual Minimum and Maximum Storage for 1922–2003

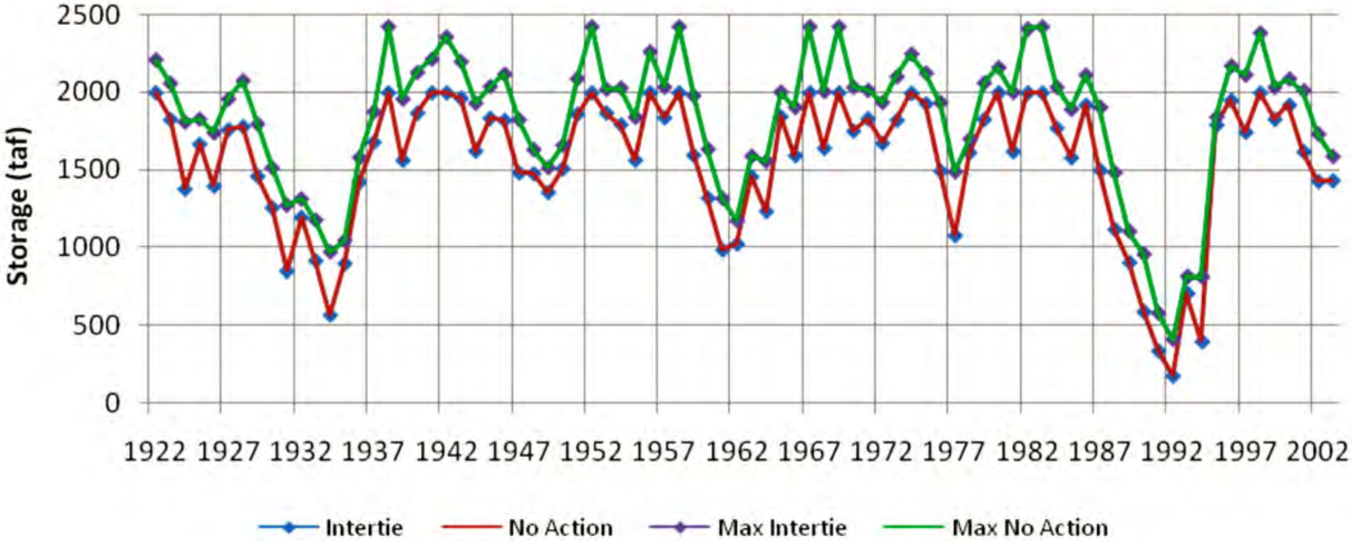

Figure 3.1-5. CALSIM-Simulated New Melones Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

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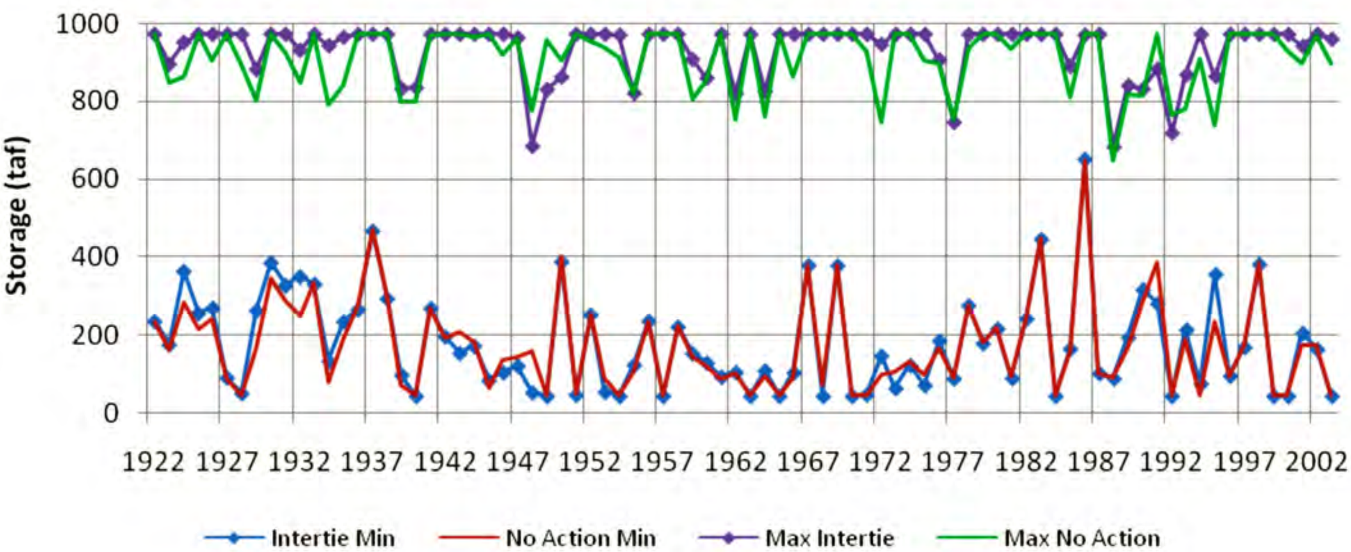

Figure 3.1-6. CALSIM-Simulated CVP San Luis Reservoir Annual Minimum and Maximum Storage for 1922–2003

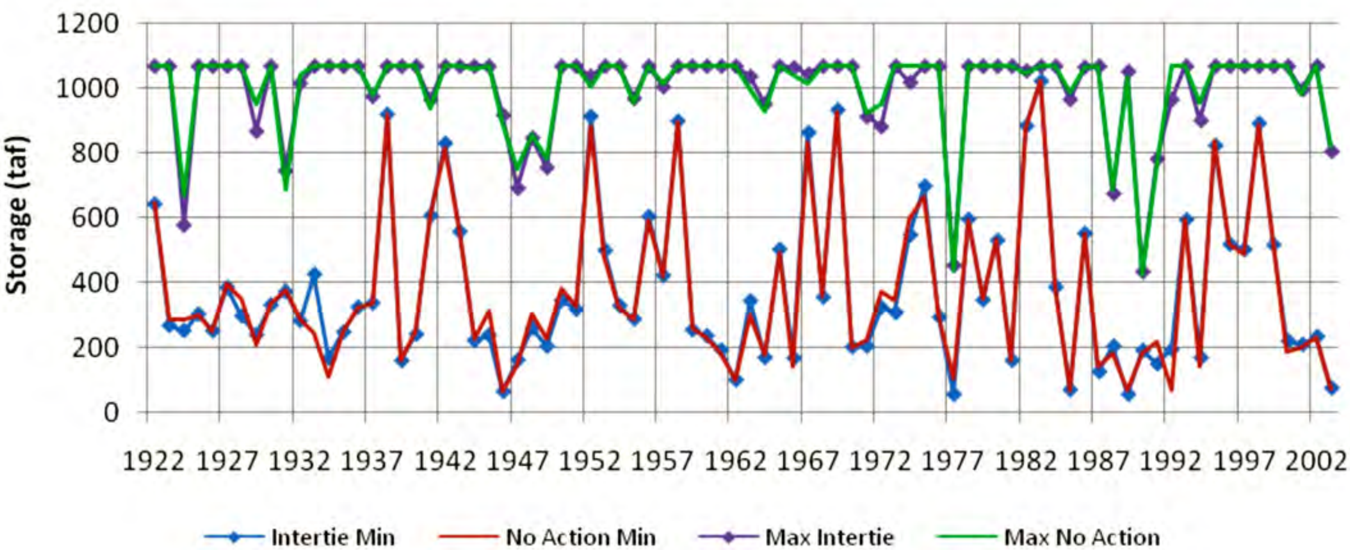

Figure 3.1-7. CALSIM-Simulated SWP San Luis Reservoir Annual Minimum and Maximum Storage for 1922–2003

Graphics … 06688.06 (3-09) tm

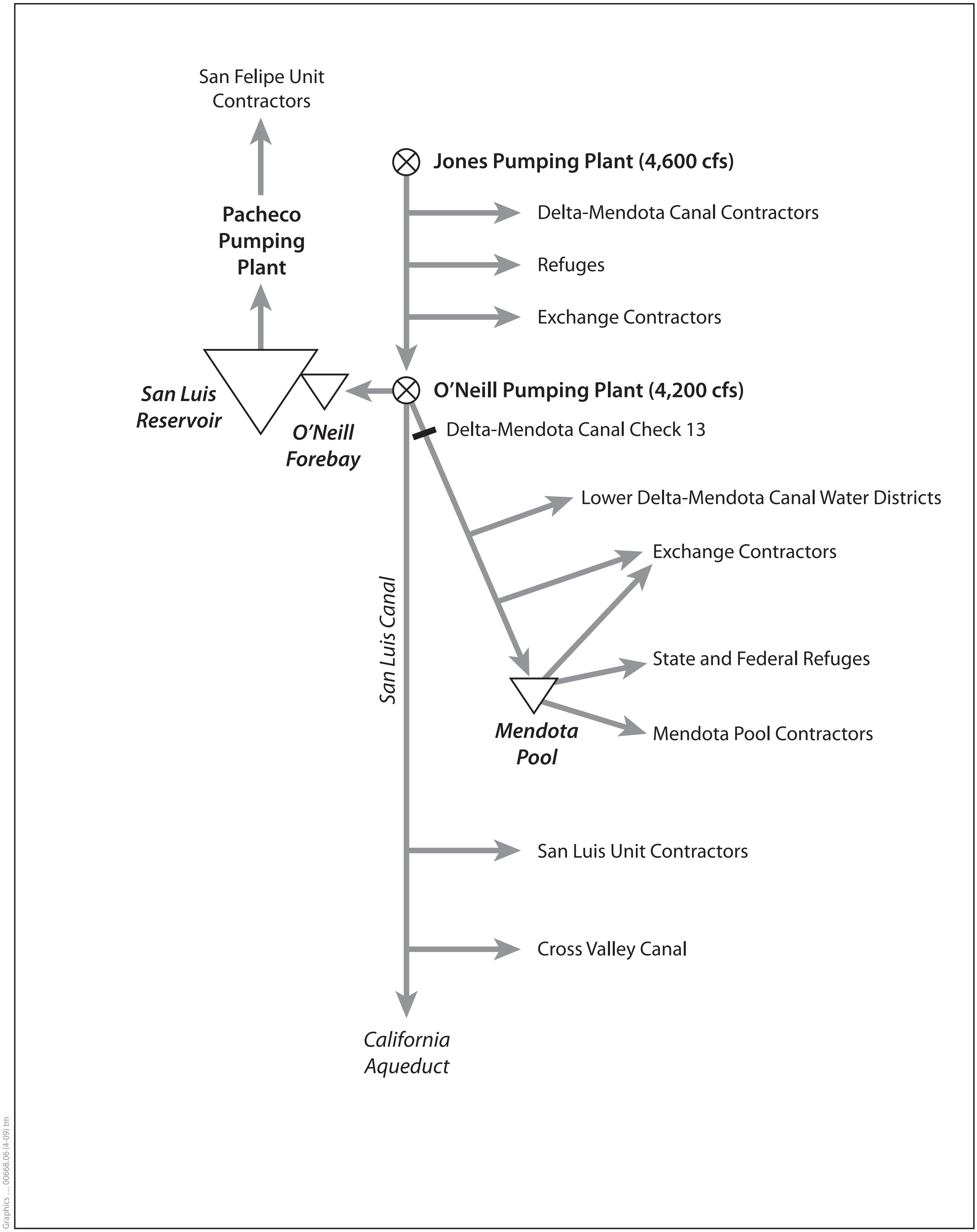

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Figure 3.1-8
Diagram of CVP South-of-Delta Deliveries

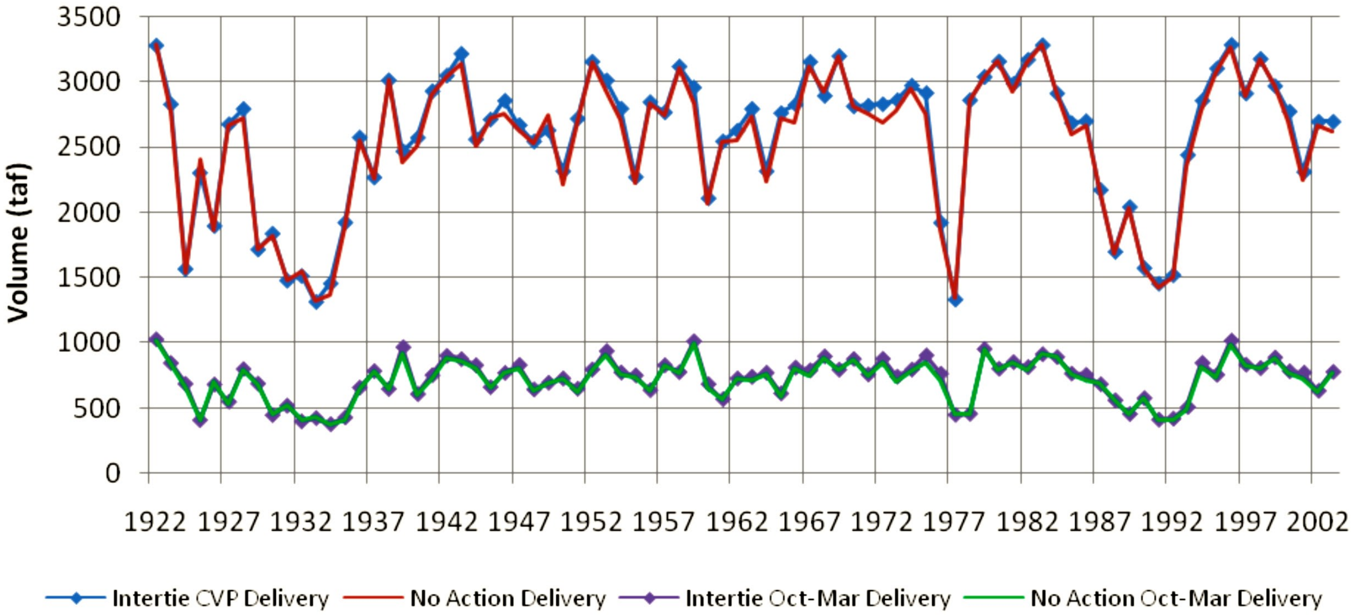

Figure 3.1-9. CALSIM-Simulated CVP South-of-Delta Annual Deliveries for 1922–2003

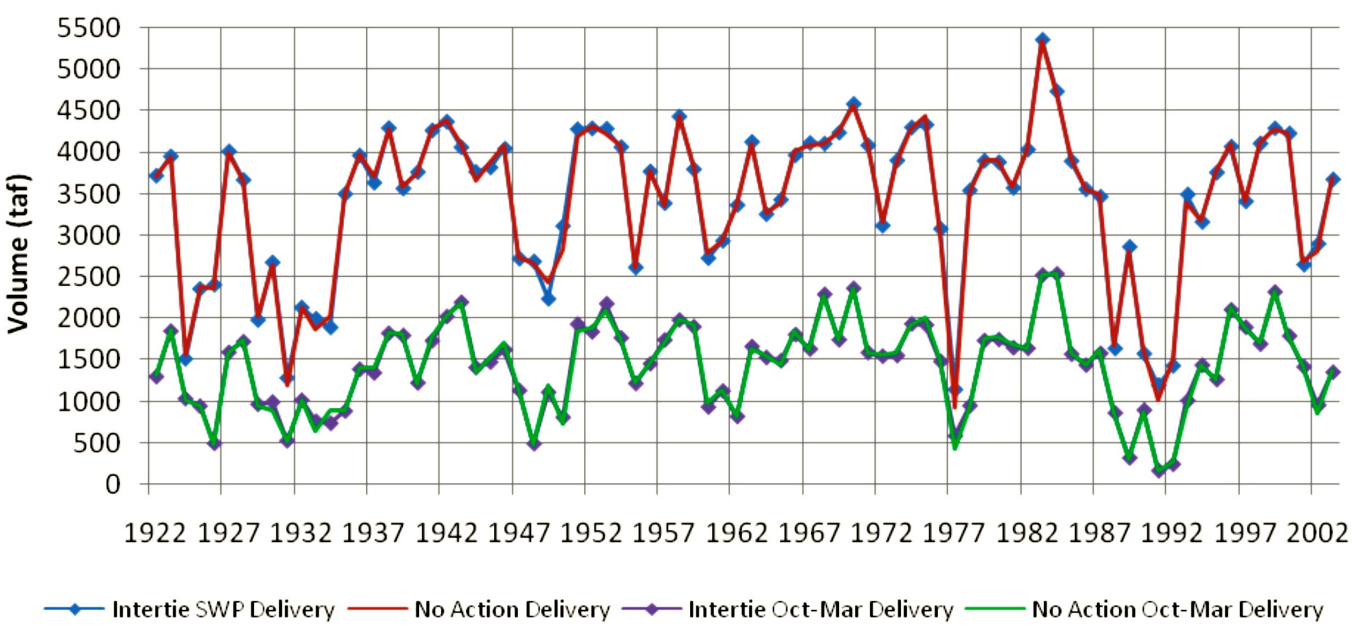

Figure 3.1-10. CALSIM-Simulated SWP South-of=Delta Annual Deliveries for 1922–2003

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3.2 Delta Tidal Hydraulics

3.2.1 Introduction

Delta tidal hydraulic conditions (hydrodynamics) are the results of the tidal movement of water in Delta channels (e.g., changes in channel elevations, velocities, flows) interacting with the net channel flows caused by Delta inflows, exports, and Delta outflows. This section describes Delta tidal hydraulic conditions and discusses potential effects of Intertie operations on tidal elevations, tidal and net channel flows, and tidal velocities in the Delta channels.

3.2.2 Affected Environment

The DMC intake, located on Old River in the south Delta near Tracy, and the Jones Pumping Plant, which pumps water about 200 feet into the upper (upstream) section of the DMC, are directly affected by tidal hydraulic processes. Because the DMC intake is located in the tidal portion of the Old River channel, the water surface elevation varies by about 3-5 feet throughout each day. The Tracy Fish Collection Facility (TFCF) is located at the intake channel on Old River, and the water elevation and approach velocities of the primary louvers (i.e., fish screening facilities) vary considerably with the tides. The Jones Pumping Plant, with a capacity of about 4,600 cfs, produces a constant flow from Old River into the DMC intake channel, while the velocity increases slightly with low tide elevation and decreases slightly with higher tide elevation.

The tidal hydraulic conditions in the Delta with existing CVP and SWP facilities under the D-1641 operations criteria recently have been described and simulated with the DSM2 tidal hydraulic model for the 2008 CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008). The CVP/SWP Longterm Operations Plan future conditions assumed the Intertie and the South Delta Improvements Program (SDIP) permanent operable tidal gates as likely near-future CVP and SWP facilities. This section focuses on the differences between the simulated future conditions with the Intertie and the future No Action conditions without the Intertie Project. The CVP and SWP monthly pumping patterns with and without the Intertie first were simulated with the latest version of the CALSIM II model, as described and summarized in Section 3.1, Water Supply and Delta Water Management. The CALSIM-simulated changes in Delta inflows, CVP and SWP exports, and Delta outflow were used as the inputs for the DSM2 modeling of the 1976–1991 representative study period.

Sources of Information

The major source of information for this section is simulation results from the "hydrodynamic" module of the Delta Simulation Model (DSM2). DSM2 is a one-dimensional hydrodynamic (and water quality) model used to calculate tidal hydraulic conditions in the Delta. The model was developed by DWR and is frequently used to ascertain impacts associated with projects in the Delta, such as changes in exports, diversions, or channel geometry associated with channel dredging or barriers. Monthly flows from CALSIM are used in DSM2 for evaluations of the changes caused by the Intertie from the Future No Action.

Delta hydrodynamic modeling was based on CALSIM II monthly average inflows and exports for the 16-year period of water years 1976–1991, derived from the 2008 OCAP (study 8.0). This standard 16-year simulation is routinely used for impact analysis, including the analysis presented in the CALFED Programmatic EIS/EIR (CALFED Bay-Delta Program 2000) and the SDIP (California Department of Water Resources and U.S. Department of the Interior, Bureau of Reclamation 2005).

The DSM2 simulation results for the No Action (Alternative 1) and the Proposed Intertie (Alternative 2) are fully described and compared in Appendix C, "DSM2 Modeling Studies of the Delta Mendota Canal/California Aqueduct Intertie." The DSM2 was used to analyze Delta tidal hydraulic and water quality conditions for the Future No Action and Intertie alternatives. Like all models DSM2 has limitations, discussed in Appendix C, that need to be kept in mind when interpreting its results. DSM2 is a one-dimensional model which simulates tidal flows in the longitudinal direction. More detailed flows associated with vertical or lateral mixing, flow circulations caused by bends or expansions and contractions of the channels are not simulated. The model uses monthly flows from CALSIM and does not simulate the daily pattern of storm inflows. Despite these limitations, DSM2 has been calibrated to match measured flows and tidal elevations and is appropriate for comparative analyses of the Intertie Alternatives.

3.2.3 Environmental Consequences

Approach

Methodology

Channel tidal flows and stage variations at several Delta locations have been reviewed to describe possible effects of Intertie operations on Delta tidal hydraulics. Because the simulated increases in Jones Pumping Plant pumping are relatively small, no changes are expected in the tidal hydraulic conditions at Delta locations other than channels in the south Delta. The locations reviewed for impact assessment are described below.

- **Old River at Clifton Court Ferry**. This station is between Grant Line Canal and the CCF intake gates. It is just downstream of the Jones Pumping Plant intake canal. The CVP and SWP pumping have the greatest combined effect on tidal elevations and flows at this station.
- **Old River at Tracy Road Bridge**. This station is a traditional tidal elevation and EC monitoring location and is upstream of the Old River at Tracy temporary barrier and proposed SDIP permanent tidal gate structure.
- **Old River downstream of the head of Old River**. This station is located just downstream of the temporary barrier and proposed SDIP permanent tidal gate at the head of Old River and is influenced by the San Joaquin River flows and tidal elevations.
- **Grant Line Canal at Tracy Road Bridge**. This station is just upstream of the temporary barrier on Grant Line Canal and about 4 miles upstream of the proposed permanent tidal gate on Grant Line Canal.
- **Middle River at Tracy Road Bridge**. This station is located just upstream of the temporary barrier near Victoria Canal and the proposed SDIP permanent tidal gate.

The No Action and Proposed Action conditions include SDIP permanent tidal gates operated during the irrigation season of May–October to maintain minimum elevations above 0 feet msl for agricultural diversions upstream of the barriers. The head of Old River tidal gate also is included in the modeling scenarios. The head of Old River gate is closed during the VAMP period of April 15–May 15 for protection of migrating juvenile Chinook salmon and in October and November for protection of migrating adult Chinook salmon.

Regulatory Setting

No state or federal regulatory guidelines or criteria have been established for evaluating effects of tidal hydraulics. There are state and local agreements between DWR and SDWA governing the minimum tidal elevations in south Delta channels during the irrigation season of April through September. The minimum tide elevation of 0.0 feet msl (1929 national geodetic vertical datum [NGVD]) at several locations is included in the State Water Board D-1641 criteria for joint point of diversion approval. The minimum tide elevation criteria have been included in the permanent tidal gate operations assumed for the No Action and Intertie Alternatives.

3.2.4 Environmental Effects

The general effects of increased CVP and SWP pumping on south Delta tidal hydraulics were simulated with a range of representative pumping flows to characterize the changes in tidal hydraulics caused by increased pumping. Tidal elevation and flow variations were simulated with a relatively low San Joaquin River inflow of 1,500 cfs and several constant pumping cases for a typical month of measured tidal elevations at Martinez (August 1997), and adjusted Sacramento River daily inflows to maintain an outflow of about 5,000 cfs. Results for no CVP or SWP pumping were compared both to results with 4,600-cfs Jones Pumping Plant pumping and to results with 6,680-cfs Banks Pumping Plant pumping to identify the maximum tidal effects of the CVP and SWP pumping without south Delta tidal gates or barriers. These model results are considered typical of the maximum potential effects of the Jones Pumping Plant and the maximum allowed Banks Pumping Plant pumping with associated CCF gate operations. Compared to these large changes in CVP and SWP pumping, the Intertie alternatives impact assessment considers only the relatively small CVP pumping change from about 4,200 cfs to about 4,600 cfs.

Review of the DSM2 results for this typical month indicates that the constant Jones Pumping Plant pumping and the tidal diversion of water into CCF for Banks Pumping Plant pumping both will cause an increase in the tidal and net flows moving from the San Joaquin River toward the pumping plants. The increased flow will move along all three pathways from the San Joaquin River:

- from the head of Old River and Grant Line Canal to the DMC,
- from the mouth of Middle River and Columbia Cut and Turner Cut to Victoria Canal and the Old River channel, and
- from the mouth of Old River or Dutch Slough through Franks Tract and down the Old River channel to the CCF gates and the DMC.

The effects of the maximum existing CVP and SWP pumping (11,280 cfs) on tidal elevations in the south Delta can be seen as a change of more than 1 foot at the head of Old River but cannot be detected (less than 1 inch) in the central Delta at the mouth of Middle River or the mouth of Old River.

Figure 3.2-1 provides a summary of the tidal elevation variations during the simulated typical month for Old River at Tracy Road and Grant Line Canal at Tracy Road. The simulated effects of total pumping increasing from 11,280 cfs to 13,100 cfs (an increase of 1,820 cfs) were less than 1 inch reduction in maximum and minimum tidal elevations at both locations. The Intertie would allow the CVP pumping to increase a maximum of about 400 cfs.

Figure 3.2-2 shows the simulated effects of the full range of CVP and SWP export pumping on the tidal elevations in Old River at Clifton Court Ferry and in Middle River at Tracy Road. The simulated effects were greatest at the Clifton Court Ferry location because it is closest to the DMC and CCF intakes. The simulated changes in tidal elevations (low tide and high tide) for increased pumping between 11,280 cfs and 13,100 cfs were less than 1 inch at these locations as well. Therefore the incremental effects of the 400-cfs maximum additional CVP

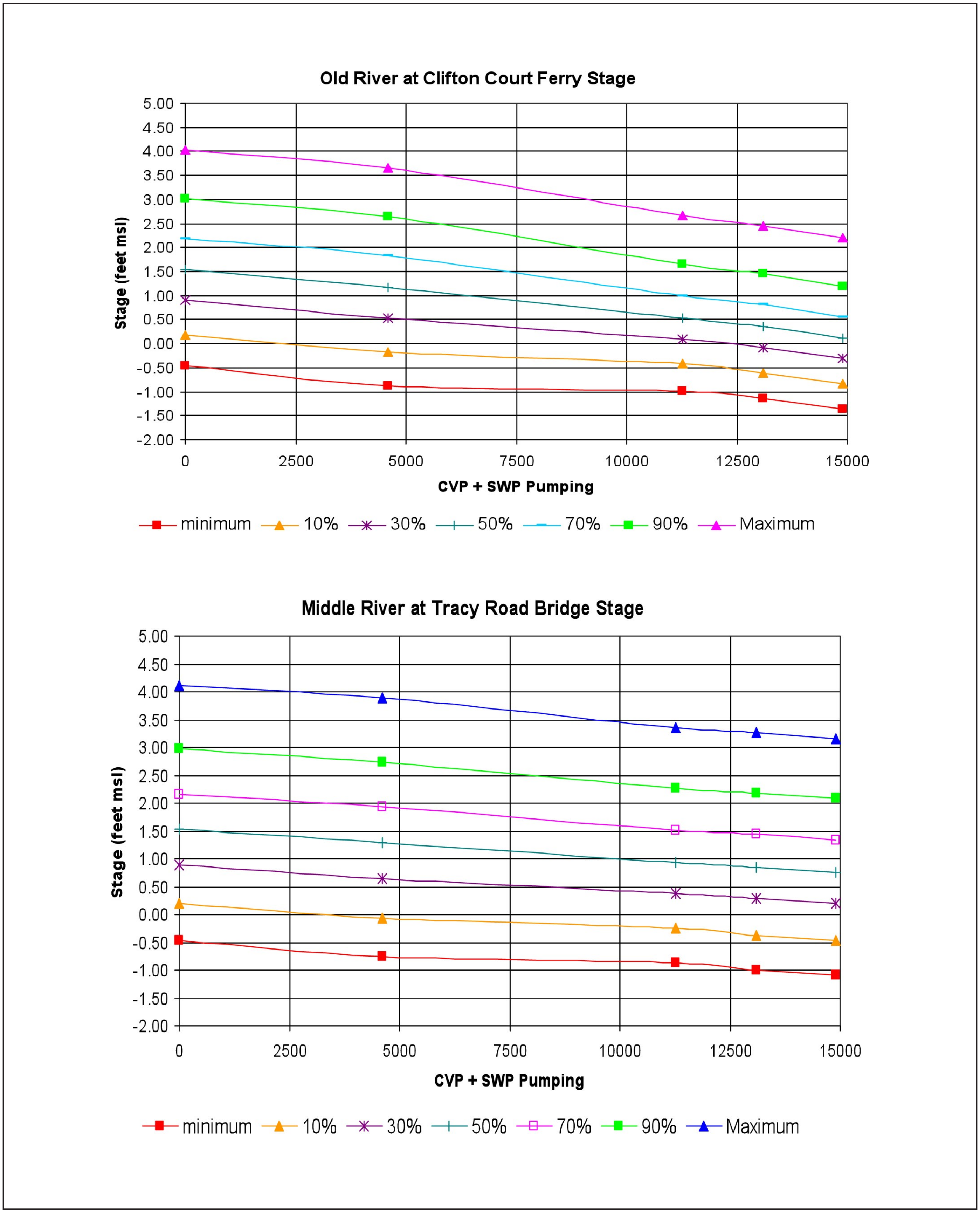

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Figure 3.2-1
Summary of DSM2–Simulated Effects of Export Pumping on the Tidal Stage Ranges in Old River at Tracy Road and in Grant Line Canal at Tracy Road for August 1997 Tides and San Joaquin River Flow of 1,500 cfs

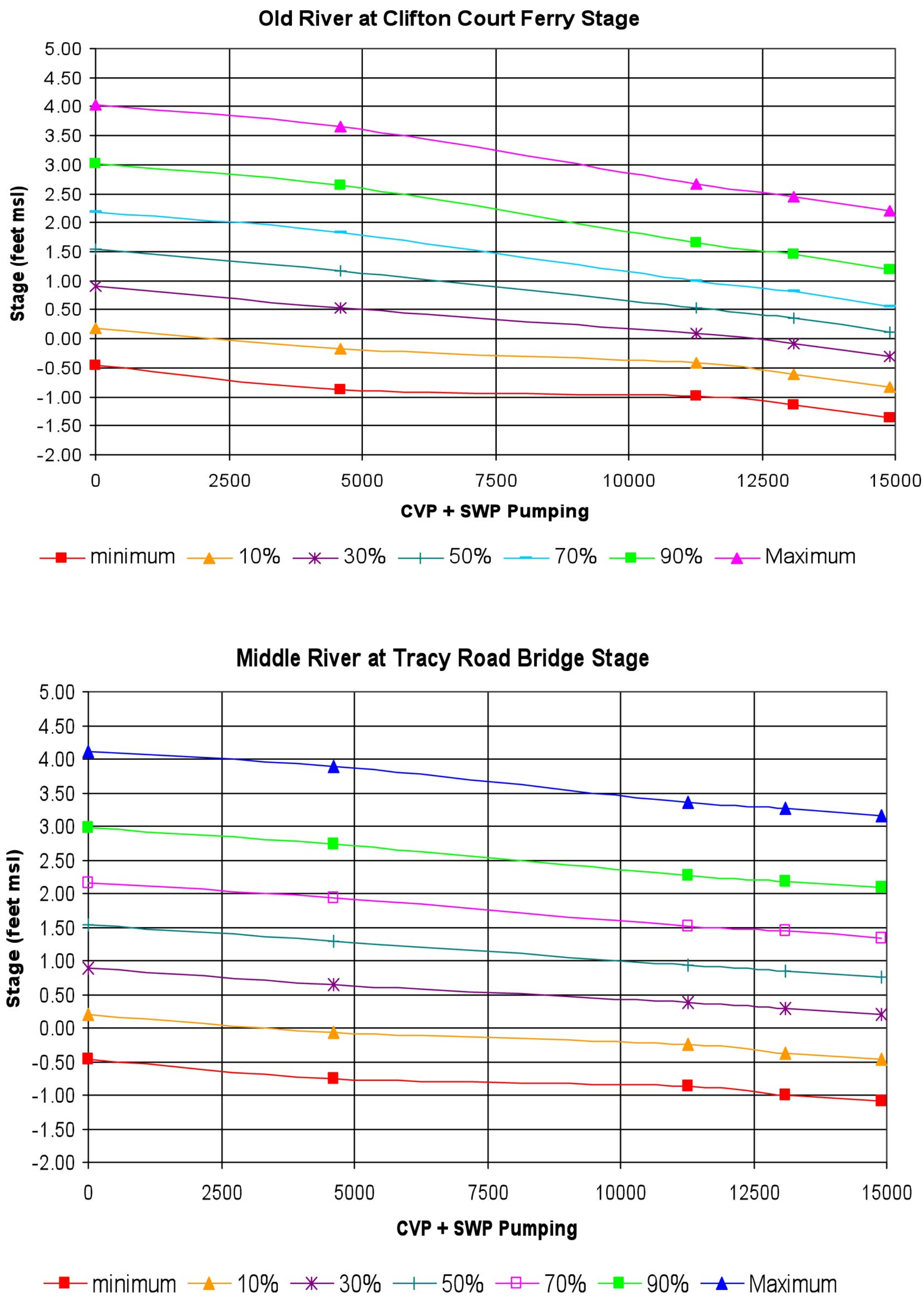

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Figure 3.2-2
Summary of DSM2–Simulated Effects of Export Pumping on the Tidal Stage Ranges in Old River at Clifton Court Ferry and in Middle River at Tracy Road for August 1997 Tides and San Joaquin River Flow of 1,500 cfs

pumping on tidal elevations (low tide and high tide) hardly would be measurable at these south Delta locations, even without the low tide protection provided with the temporary agricultural barriers.

Figure 3.2-3 shows the DSM2-simulated 15-minute interval tidal elevations and tidal flows in Old River at Clifton Court Ferry for November 1975. This month was selected because the SWP pumping was at 6,680 cfs, and the No Action Jones Pumping Plant pumping was about 4,200 cfs. The Intertie Alternative increased the Jones Pumping Plant pumping to 4,600 cfs. This month therefore represents the largest direct effect of the Intertie pumping. The simulated tidal elevations were only slightly lower with the additional Intertie pumping. The difference cannot be identified from the graph, but the Intertie simulated tidal elevations were an average of 0.5 inches (0.045 feet) lower than the No Action tidal elevations. The simulated tidal flows were an average of 400 cfs more than the No action tidal flows. The tidal flows are shifted by the constant CVP pumping and there is almost no downstream tidal flow towards the CCF intake. The tidal flows are always upstream, with the peak upstream flow of about 10,000 cfs during the major flood tide period each day. These DSM2-simulated tidal hydraulic effects are representative of changes that would be expected in other months with the additional 400 cfs of CVP pumping that the Intertie Alternatives would allow.

No Action (Alternative 1)

Under the No Action Alternative, an Intertie would not be constructed or operated, and as a result no change in future Delta tidal hydraulic conditions would occur. There may be some future changes in the Delta channels or gate operations, but hydraulic conditions would remain largely the same as they are today under D-1641 operating criteria with the temporary south Delta barriers. There are no construction or operation effects for the Future No Action.

Proposed Action (Alternative 2)

Construction Effects

There are no tidal hydraulic effects during construction. Construction will be confined to local effects along the DMC and the California Aqueduct and will not change Jones Pumping Plant or Banks Pumping Plant pumping.

Operation Effects

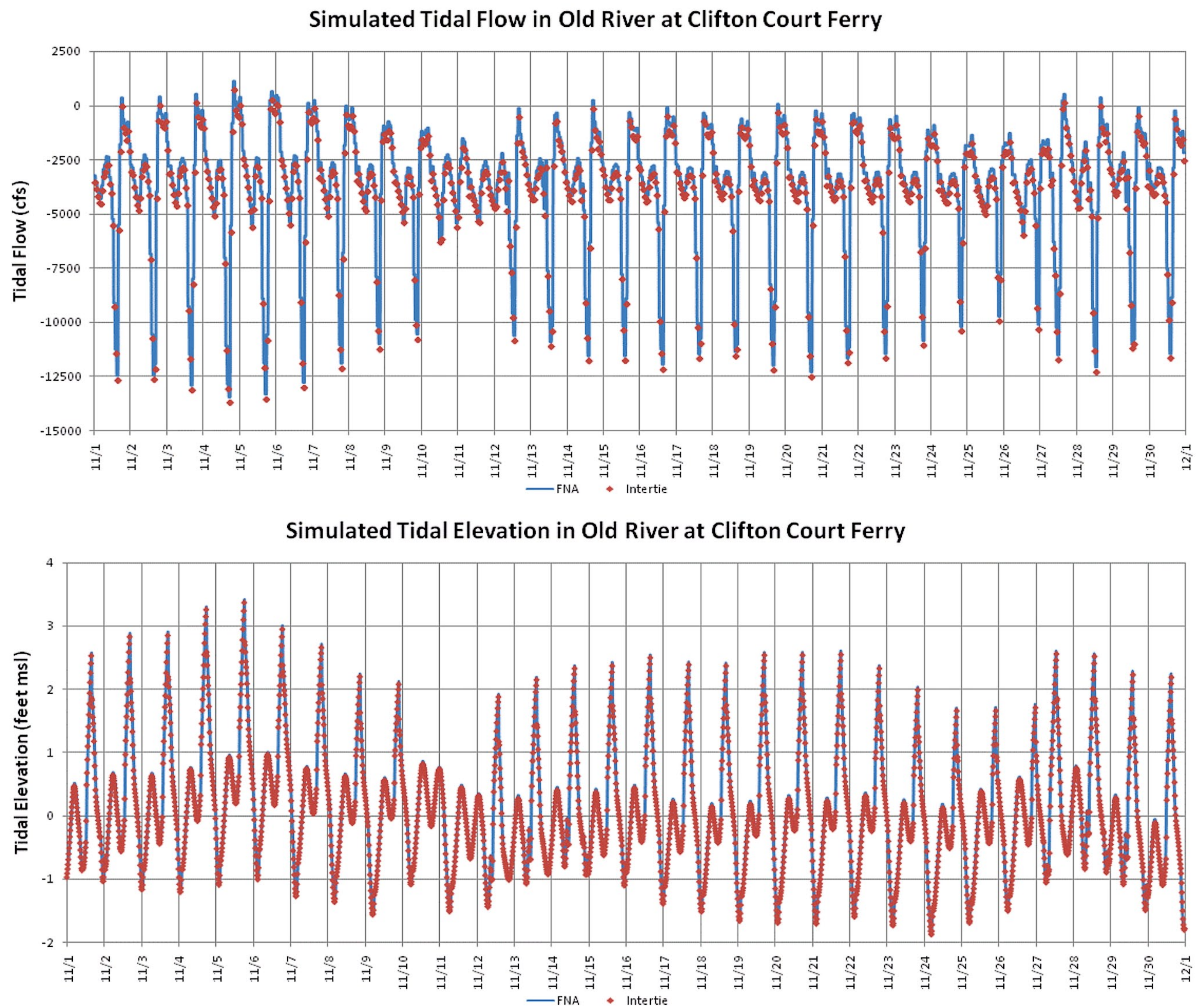
Impact HYD-1: Effects of Intertie Pumping on Tidal Elevations and Flow in Old River at Clifton Court Ferry

The Old River at Clifton Court Ferry station is just downstream of the mouth of Grant Line Canal and about 1 mile north of the Jones Pumping Plant intake canal. The stages at this station are directly influenced by CVP and SWP pumping. The maximum Jones Pumping Plant pumping reduces the stage in Old River about 6 inches uniformly at all tidal stages. This drawdown of 6 inches provides the required change in water surface slope along Old River to supply 4,600 cfs to the Jones Pumping Plant intake. The incremental effects of the 400 cfs of additional pumping that the Intertie would allow therefore would be a 0.5-inch reduction in tidal elevations at the Jones Pumping Plant. Because the full 4,600-cfs pumping currently occurs during the summer months, this slight reduction in tidal elevations is already observed in the Future No Action summer conditions.

The maximum Banks Pumping Plant pumping with CCF gate operations would have an additional effect on the Clifton Court Ferry stage. The low tides are not lowered by as much as the higher tide stages because the diversions into CCF are generally much less during periods of low tide. The 6,680-cfs SWP pumping reduces the high-tide stages by 18–24 inches, depending on the CCF gate diversions. The low tides at Clifton Court Ferry are reduced by less than 6 inches with the maximum CVP pumping. The low-tide reductions at all other south Delta locations would be less than the 6-inch decline that was simulated at Clifton Court Ferry with the maximum CVP and SWP pumping.

Figure 3.2-4 shows the 16-year period of monthly minimum, average, and maximum tidal elevation and tidal flows in Old River at Clifton Court Ferry (just upstream of the CCF intake) for the simulated Future No Action and Proposed Intertie conditions. Figure 3.2-4 graphically represents how small a change in minimum, average, and maximum tidal stage and tidal flow actually occurs as a result of Proposed Action operations. The minimum stage objective of 0 feet msl does not apply at this location, which is downstream of the permanent tidal gates protection zone. There are a few months when the Intertie elevations and tidal flows are slightly more or less than the No Action, because of major changes in simulated CVP or SWP pumping. But these indirect effects from CVP and SWP operations are within the normal range of exports, and are not considered a significant change in south Delta tidal conditions.

Because the maximum change in elevation caused by the Intertie pumping is about 0.5 inches, and because this tidal elevation caused by full Jones Pumping Plant pumping of 4,600 cfs is already observed during the summer period each year, the Intertie impacts on tidal elevation and tidal flow would be minor and are not considered adverse.



Note:
Clifton Court Ferry is located between DMC intake and CCF intake.

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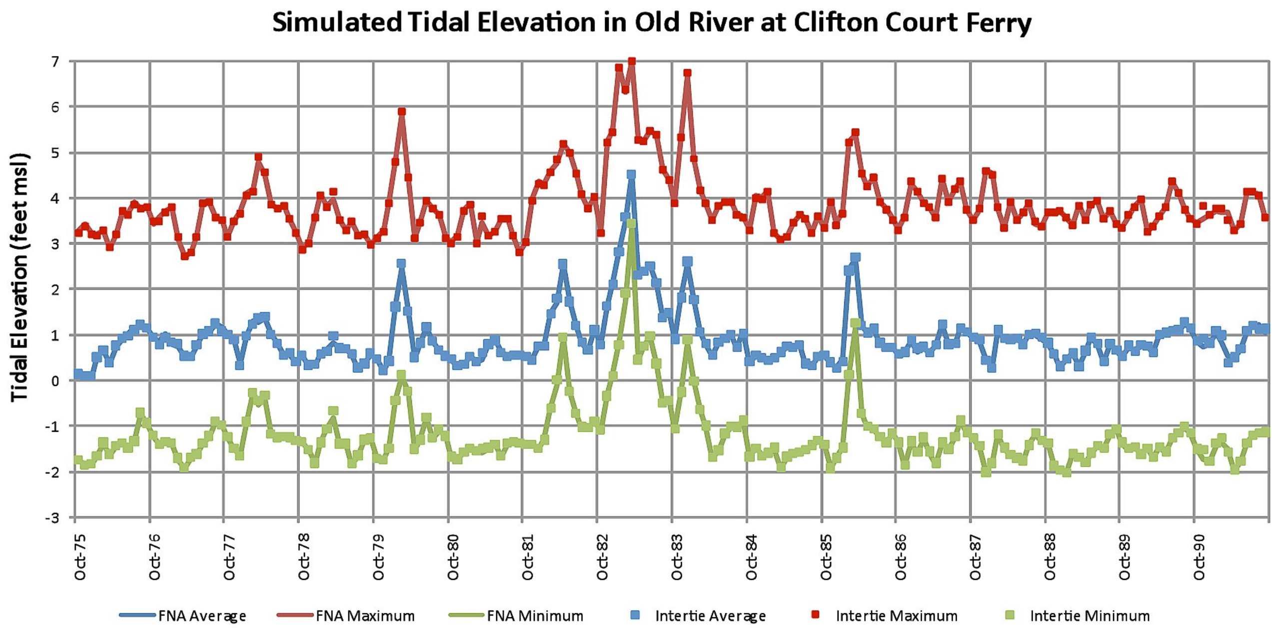
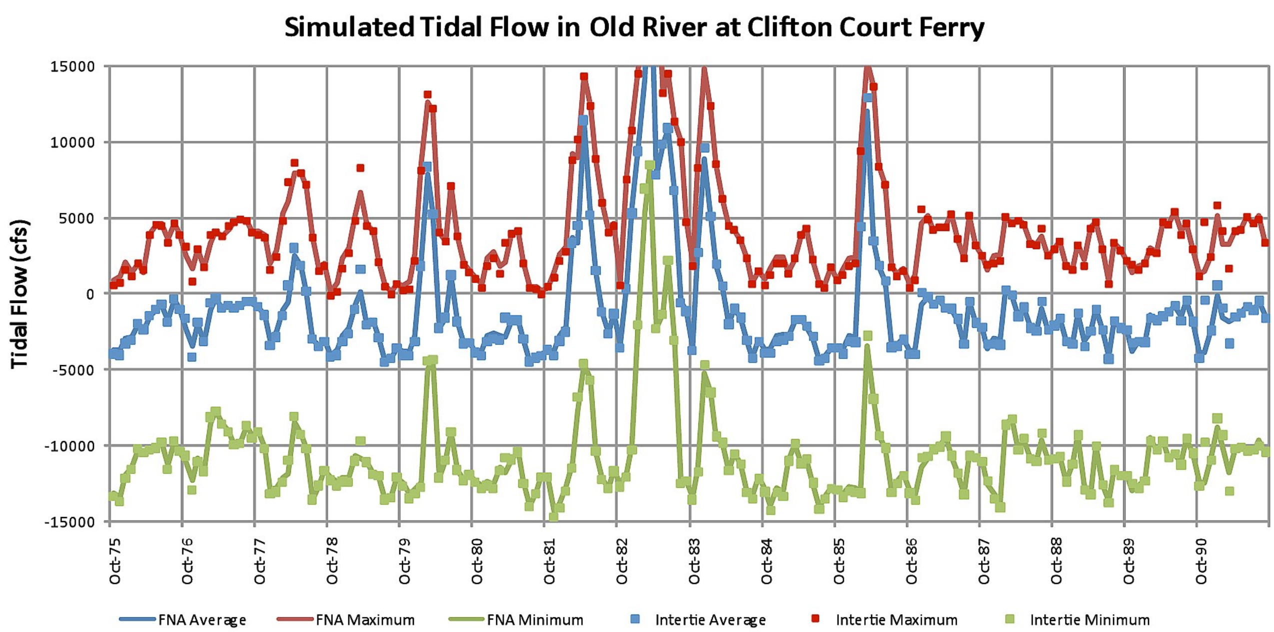
Figure 3.2-3
Comparison of DSM2-Simulated Tidal Elevations and Tidal Flows for the Intertie (4,600 cfs CVP Pumping) and No Action Alternative (4,250 cfs CVP Pumping) in Old River at Clifton Court Ferry for November 1975





Note:
Clifton Court Ferry is located between DMC intake and CCF intake.

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Figure 3.2-4
Comparison of DSM2-Simulated Monthly Range (Maximum, Average, and Minimum) for Tidal Elevations and Tidal Flows for the Intertie and No Action Alternatives in Old River at Clifton Court Ferry for 1976–1991

Alternative 3 (TANC Intertie Site)

Construction Effects

There are no tidal hydraulic effects during construction. Construction will be confined to local effects along the DMC and the California Aqueduct and will not change Jones or Banks Pumping Plant pumping.

Operation Effects

The operational effects are the same as for Alternative 2 (Proposed Action). The operational effects of Alternative 3 on tidal hydraulics are not considered adverse.

Alternative 4 (Virtual Intertie)

Construction Effects

There are no tidal hydraulic effects during grading of the temporary pumping pad for the portable pumps that will be used during emergency operations with the Virtual Intertie Alternative.

Operation Effects

The operational effects of the Virtual Intertie Alternative on tidal hydraulics are less than those described for the Proposed Action because the additional pumping would occur at the Banks Pumping Plant. The CCF intake gates are operated to avoid tidal effects by closing during low tides and also closing during the flood tide (about 4 hours) prior to the higher-high tide each day. The operational effects on hydraulics are minor and are not considered adverse.

3.3 Delta Water Quality

3.3.1 Introduction

This section describes the existing Delta environmental conditions and the consequences of constructing and operating the project alternatives on Delta water quality.

3.3.2 Affected Environment

Beneficial uses of Delta water depend on suitable water quality conditions (e.g., salinity [EC], water temperature, dissolved oxygen [DO], and dissolved organic carbon [DOC]) in Delta waters. This section describes these key water quality variables, the objectives associated with maintaining beneficial uses of Delta waters, existing (i.e., historical) Delta water quality conditions, and potential impacts of Intertie operations on key water quality variables in Delta channels and exports.

Sources of Information

The historical salinity and other water quality data collected in the Delta by Reclamation, DWR, and other Interagency Ecological Program (IEP) agencies are the primary source of information for this section. Comprehensive evaluation of the historical salinity data from Suisun Bay and the western Delta recently has been presented by CCWD:

- *Trends in Hydrology and Salinity in Suisun Bay and the Western Delta*.

DWR Division of Operations and Maintenance recently has reviewed salinity and total organic carbon concentrations in the south Delta and CVP and SWP exports in the following reports:

- *Factors Affecting the composition and salinity of exports from the south Delta* (California Department of Water Resources 2004).
- *Factors Affecting Total Organic Carbon and Trihalomethane Formation Potential in Exports from the South Delta and down the California Aqueduct* (California Department of Water Resources 2005).
- *Sources of Salinity in the South Delta* (California Department of Water Resources 2007).

The DSM2 model results, based on CALSIM monthly Delta inflows, diversions, and exports, for the Future No Action and Intertie Proposed Project conditions are the primary source of potential salinity impact assessment information. These modeling methods and results are presented in Appendix C, "DSM2 Modeling Studies of the Delta-Mendota Canal/California Aqueduct Intertie."

The historical water quality data that provide the basis for calibration of the water quality simulations from the DSM2 model and the existing conditions for the other water quality variables are collected under the following water quality monitoring and sampling programs.

Interagency Ecological Program

The IEP, previously the Interagency Ecological Study Program (IESP), was initiated in 1970 by DWR, DFG, Reclamation, and USFWS to provide information about the effects of CVP and SWP exports on fish and wildlife in the Bay-Delta estuary. Other agencies (e.g., State Water Board, EPA, the USACE, and U.S. Geological Survey [USGS]) have joined the IEP and provide staff members and funding to assist in obtaining biological, chemical, and hydrodynamic information about the San Francisco Bay and Sacramento–San Joaquin Delta estuary.

Agencies participating in the IEP conduct extensive programs of monitoring of tidal stage and flows, salinity (electrical conductivity [EC]) measurements, routine water quality, and fish sampling, as well as more intensive special studies, in the Delta. IEP maintains its data in an extensive centralized database (www.IEP.ca.gov). Technical IEP reports are issued, and newsletters and annual meetings provide participants and the interested public with timely information about study results.

Municipal Water Quality Investigations Program

DWR's Municipal Water Quality Investigations (MWQI) program encompasses the previous Interagency Delta Health Aspects Monitoring Program (IDHAMP) and Delta Island Drainage Investigations (DIDI). IDHAMP was initiated by DWR in 1983 to provide a reliable and comprehensive source of water quality information for judging the suitability of the Delta as a source of drinking water (California Department of Water Resources 1989). The major issue of concern was the potential formation of disinfection byproducts (DBPs) such as trihalomethanes (THMs) and bromate in treated drinking water from the Delta.

MWQI studies have documented that Delta exports contain relatively high concentrations of DOC, a THM precursor. Agricultural drainage discharges containing natural decomposition products of peat soil and crop residues are considered dominant sources of DOC in Delta waters (California Department of Water Resources 1994). Additionally, DOC is contributed to Delta waters by Delta inflows.

The MWQI program has determined that bromide in Delta water contributes significantly to formation of the THMs observed in treated drinking water from the Delta. Sources of bromide in Delta water are seawater intrusion, San Joaquin River inflow containing agricultural drainage, and possibly groundwater. Bromide concentrations have been found to be a relatively constant fraction of chloride concentration in the Delta.

The Delta agricultural drainage component of the MWQI program sampled discharge points of irrigation drainage water in the Delta from 1985 to about 1997. In general, intensive surveys of agricultural drains on Delta islands have shown high DOC concentrations that may represent a significant contribution to DOC concentrations in Delta waters. The salt content and DOC concentrations of the drainage water are found to be greatest during October–March as a result of the leaching of salts from Delta island soils during major rainfall periods. The salt and DOC concentrations tend to accumulate in the soil pore water during the growing season.

Compliance Monitoring Program for Delta Standards

D-1485 (State Water Resources Control Board 1978), issued by the State Water Board in August 1978, amended previous water right permits of DWR and Reclamation for the SWP and CVP facilities, respectively. D-1485 also set numerical water quality objectives and requirements for Delta outflow, export pumping rates, salinity (as measured by EC), and chloride to protect three broad categories of beneficial uses: fish and wildlife, agriculture, and municipal and industrial water supply. The standards included adjustments to reflect hydrologic conditions under different water-year types.

D-1485 has required DWR and Reclamation to conduct comprehensive water quality monitoring of the Delta. Annual reports have been prepared on observed water quality conditions in the Delta and compliance with limits set in D-1485 (State Water Resources Control Board 1978). DWR and Reclamation are responsible for adjusting their operations to satisfy the applicable flow and salinity objectives. Most of these compliance stations have continuous EC monitors; others are sampled routinely for chemical and biological measurements. D-1641, which implements the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento–San Joaquin Delta Estuary (1995 WQCP), provides an update and continuation of the D-1485 monitoring program.

EC monitors at Jersey Point and Emmaton (agricultural salinity compliance stations from April through August) are especially important for managing the linkage between upstream reservoir releases and export pumping that will maintain sufficient Delta outflow to satisfy Delta water quality objectives. The CVP and SWP operations staffs have access to telemetered data (i.e., CDEC) from these and several other EC monitors. The DWR Delta Operations Water

Quality Section prepares and distributes a daily report of data on flows and EC to assist in decision making on Delta CVP and SWP water project operations.

3.3.3 Environmental Consequences

Regulatory Setting

Federal

Clean Water Act

The Clean Water Act (CWA) generally applies to all navigable waters of the United States. However, the CWA is administered in California by the State Water Board and the RWQCBs. The San Francisco RWQCB has jurisdiction for Suisun Marsh and Suisun Bay. The Central Valley RWQCB has jurisdiction in the Delta and in the upstream rivers and tributaries. They issue water quality criteria for beneficial uses, including fish and wildlife. They develop and implement Basin Plans and total maximum daily load (TMDL) plans for specific constituents, chemicals, and pollutants, such as DO, mercury, and selenium.

Public Law 108-361 (CALFED Bay-Delta Authorization Act)

PL 108-361, Section 103(d)(2)(D) requires that Reclamation develop and initiate implementation of a program to meet all existing water quality standards and objectives for which CVP has responsibility prior to increasing deliveries through an intertie between the California Aqueduct and Delta-Mendota Canal. In 2006, Reclamation prepared such a plan. As such, the Intertie is consistent with PL 108-361.

State

Salinity

The State Water Board specified salinity standards for the protection of the Delta beneficial uses, including municipal and agricultural water supply as well as fish and wildlife in the 1978 Delta WQCP and in D-1485. Salinity standards (EC) were established at Emmaton and Jersey Point for agricultural diversions, and at other places in the Delta and in the Suisun Marsh. They also required a Delta outflow of more than 10,000 cfs from February to May of wet water years (i.e., classification based on runoff) and other Delta outflow requirements in other months and water year types. Salinity objectives were established in D-1485 at the CCWD Rock Slough Pumping Plant for chloride.

The 1995 WQCP retained many of the D-1485 monthly standards for the Delta and Marsh. The 1995 WQCP included a new salinity objective in Suisun Bay known as X2. X2 is defined as the location of the 2 parts per thousand (ppt) salinity contour (isohaline), 1 meter off the bottom of the estuary, as measured in kilometers upstream from the Golden Gate Bridge. Biologists have determined that regulating the location of X2 in the months of February–June downstream of Collinsville in Honker Bay or Suisun Bay provides benefits to fish species. The X2 objectives may provide additional benefits to fish habitat in the marsh. Reclamation and DWR are jointly responsible for meeting these salinity objectives throughout the Delta; the major control mechanism is through regulating Delta outflow.

Dissolved Oxygen

DO is important for fish and other aquatic species. The State Water Board and the Central Valley RWQCB established a DO objective for the Stockton Deep Water Ship Channel (DWSC) of 5 mg/l throughout the year and 6 mg/l during the adult Chinook salmon migration season of September–November.

Temperature

The State Water Board WQCP for temperature includes standards for estuaries. For estuaries, the temperature rise of surface water must be less than 4ºF (outside a mixing zone), and the change in 25% of the cross section of a river must be less than 1ºF. These limits were developed to control major thermal power plant cooling discharges. No monthly temperature standards are applied.

Suspended Sediment

The San Francisco and Central Valley Basin Plans each include objectives for turbidity and suspended sediment concentrations. Generally a discharge or dredging activity should not increase the turbidity by more than about 20%.

Other Water Quality Parameters

The San Francisco and Central Valley Basin Plans have many criteria for chemical parameters that protect fish and wildlife and drinking water beneficial uses within San Francisco Bay and the estuary. The assessment of potential impacts on these water quality parameters relies on a qualitative evaluation of likely effects from the programmatic and Step 1 alternatives.

Local

There are no county or local regulations affecting water quality in the Delta or Suisun Marsh. The several municipal wastewater treatment plants that discharge into the Delta channels (i.e., Sacramento, Stockton, Tracy, Delta Diablo) are regulated under State Waste Discharge Reports and National Pollutant Discharge Elimination System (NPDES) discharge permits, which are administered and updated through the RWQCBs.

Approach

Water quality changes generally are caused by the discharge of materials (e.g., treated wastewater, agricultural drainage) into the river inflows or directly to the Delta channels. Agricultural drainage and treated wastewater discharges are the two most common sources of salt, nutrients, DOC, and other water quality constituents. Temperature is the result of heat exchange with the atmosphere, and DO is a balance between decay and photosynthesis processes in the water and aeration from the atmosphere.

There may be indirect effects from river diversions. A water diversion will reduce the river flow downstream of the diversion, and reduce the dilution of any downstream discharge and therefore may indirectly increase the downstream river concentrations of salt, nutrients, or DOC.

In the Delta, increased water diversions reduce the Delta outflow and may cause higher salinity, resulting from increased seawater intrusion during periods of relatively low Delta outflow. Increased water diversions also may draw a slightly different mixture of water from the Delta inflows and Delta channels. For example, increased Jones Pumping Plant pumping may draw slightly more San Joaquin River water or more agricultural drainage into the DMC. The dominant indirect water quality effect of increased Jones Pumping Plant pumping is expected to be the reduced Delta outflow and increased seawater intrusion into the western Delta. The DSM2 modeling was used to fully evaluate these potential impacts.

Water quality conditions in the Delta are influenced by natural hydrology (i.e., runoff) and environmental (geological and chemical and biological) processes, water management operations (reservoir storage and release), agricultural diversions and drainage, and treated wastewater discharge practices. Delta water quality conditions can vary dramatically because of year-to-year differences in runoff and water storage releases and seasonal fluctuations in Delta flows (Contra Costa Water District 2007).

Concentrations of materials in the river inflows often are related to streamflow volume and seasonal conditions. Transport and mixing of materials in the Delta channels are strongly dependent on river inflows, tidal flows, agricultural diversions, drainage flows, wastewater effluents, exports, and cooling water flows. The following Delta water quality variables are included in this analysis:

- EC (salinity),
- DOC (THM and other DBP precursor),
- temperature, and
- suspended solids (turbidity).

Water quality impacts of salinity increases were assessed for Jersey Point, Old River at Rock Slough and SR 4 Bridge (representative of diversions at CCWD Rock Slough and Los Vaqueros intakes), Banks Pumping Plant, and Jones Pumping Plant. DOC changes were evaluated at the two CCWD intake locations and the Banks and Jones Pumping Plants. Temperature and suspended sediments were evaluated qualitatively throughout the Delta. The evaluation of these selected variables may be representative of changes in other specific chemicals and constituents.

Modeling Results

The CALSIM model was used to determine likely future monthly Delta inflows and exports associated with Future No Action and the Intertie Proposed Action. The DSM2 model was used to simulate tidal and net channel flows in the major Delta channels for a 16-year sequence of water years, 1976–1991. This period is considered to be typical of the longer hydrological record used in the CALSIM model, and includes the 1977 drought and the 1987–1991 dry year sequence, as well as the 1983 and 1986 wet years. The DSM2 water quality model was used to simulate EC for this same 16-year sequence. These water quality modeling results are described and compared in this section.

The likely water quality effects of the Intertie were evaluated by comparison of the Future No Action and the Proposed Intertie Alternatives, as simulated by the CALSIM and DSM2 models. There are many unpredictable processes and events that may affect water quality in the Delta that could not be simulated with the assessment models used for evaluating likely water quality effects of the Intertie operations. Examples of unpredictable factors that influence Delta water quality conditions are occasional periods of relatively high-salinity pulses of San Joaquin River inflows, intensive agricultural-salt leaching following periods of drought, and short-term increases in DOC concentrations associated with storm runoff.

Suisun Bay Salinity

Salinity in Suisun Bay and the western Delta (i.e., San Francisco Estuary) is controlled by the effective monthly Delta outflow (Contra Costa Water District 2007). Figure 3.3-1 shows the historical and DSM2-simulated monthly average EC for the Future No Action and Intertie Alternatives at three Suisun Bay stations, including the downstream model boundary at Martinez. There is a strong seasonal pattern corresponding to the Delta outflows, with the highest EC values in the fall and early winter months with relatively low outflow, and the lowest EC values in the winter and spring months with higher outflow. The historical EC was sometimes higher than the simulated Future No Action EC because the minimum outflow objectives for previous water rights decisions (e.g., D-1485 applied in 1978–1994) were lower than current D-1641 outflow criteria.

The historical and DSM2-simulated Delta outflow for the Future No Action and Intertie Alternatives are shown in Figure 3.3-2. The DSM2 results generally are confirmed by comparing observed and simulated EC values, although the simulated sequence of Delta outflow was different from the historical outflows. When the historical outflow was lower than the simulated Future No Action or Intertie Alternative outflows, the corresponding historical EC at Chipps Island and Collinsville (as well as other Suisun Bay and western Delta stations) was higher than the simulated future EC conditions.

This basic salinity gradient within Suisun Bay and the western Delta is controlled by the seasonal Delta outflow and will not be substantially changed by the additional Jones Pumping Plant pumping allowed by the Intertie Proposed Project. Figure 3.3-1 indicates that the seasonal variation in EC at each western Delta station is very large relative to the changes that were simulated for the Intertie pumping compared to the Future No Action. For example, the maximum salinity at the Martinez boundary is simulated to be less than 25,000 microSiemens per centimeter (µS/cm), because the minimum Delta outflow as regulated under D-1641 is greater than 3,000 cfs in the fall months.

The minimum salinity at Martinez (and other locations) depends on the peak winter outflow. In years when the peak monthly outflow was more than 50,000 cfs, the minimum EC at Martinez was about 1,000 µS/cm. This general relationship between outflow and salinity at several Suisun Bay and western Delta locations is described further in the next section.

Salinity Effects from Changes in Delta Outflow

The observed relationships between Delta outflow and salinity at selected locations can be used to describe and summarize the likely effects of changes in Delta outflow caused by Intertie operations compared to the Future No Action. The DSM2 modeling results confirm this basic relationship between Delta outflow and salinity at each Delta location.

The effective Delta outflow is the steady- state outflow that would maintain the observed EC value at a particular monitoring station. This methodology was introduced by CCWD staff (Denton 1993) as an appropriate calculation for understanding the response of salinity in western Delta locations to changes in Delta outflow. It was referred to as the *G-model* by CCWD staff. Calculation of the effective outflow incorporates the sequence of previous Delta outflows (i.e., moving average). The end-of-month effective outflow is calculated as a function of the previous month’s effective outflow and this month’s average outflow:

> End-of-Month Effective Outflow (cfs) = Outflow (cfs) /
> {1 + [Outflow/Previous Effective Outflow – 1] [exp (– Outflow/Response [cfs])]}

A value of 6,600 cfs is the monthly response factor suggested by CCWD staff. A second adjustment is made to calculate the monthly average effective outflow, assuming that the monthly average flow is held constant through the month. A change in the monthly outflow will cause a delayed change in the effective monthly outflow and corresponding EC values.

Figure 3.3-3a compares the monthly average and effective outflow for the Future No Action with the historical effective outflow for 1976–1991. Some of the historical effective outflow values were less than 4,000 cfs. Figure 3.3-3b shows the relationship between the historical EC or simulated No Action EC and the Delta outflow, without calculating the effective outflow. The historical EC at Chipps Island and Collinsville were highest during periods of lowest Delta outflow (e.g., water year [WY] 1977), with a maximum EC of about 17,500 µS/cm at Chipps Island and a maximum of about 12,500 µS/cm at Collinsville. Because the D-1641 outflow objectives maintain the Delta outflow above 3,000 cfs, with the effective outflow above 4,000 cfs, the simulated EC for the Future No Action are limited to a maximum of about 15,000 µS/cm at Chipps Island and a maximum of about 10,000 µS/cm at Collinsville.

The monthly average EC at a selected western Delta station can be estimated from the monthly effective outflow as a negative exponential relationship. The equations for Collinsville, Antioch, Jersey Point, and Rock Slough are similar:

Collinsville EC (µS/cm) = 25,000 [exp (-0.00030 *effective outflow)] + 250

Antioch EC (µS/cm) = 20,000 [exp (-0.00035 *effective outflow)] + 250

Jersey Point EC (µS/cm) =20,000 [exp (-0.00050 * effective outflow)] + 250

Rock Slough EC (µS/cm) = 5,000 [exp (-0.00050 * effective outflow)] + 250

During high outflows, salinity intrusion from the bay will be at a minimum, and the negative exponential equations will approach the assumed background EC value. The higher negative exponent for upstream stations gives lower EC values. The stations farther upstream will reach background Sacramento River EC values at much lower effective outflow than the stations located in Suisun Bay. Comparing the G-model estimates to the DSM2 results provides further confirmation of the DSM2 results, because the G-model equations have been calibrated with historical EC measurements.

Figure 3.3-4a shows the times series of measured monthly EC and estimated EC calculated from the historical effective outflow and the assumed negative exponential equation at Martinez, Chipps Island, and Collinsville for the 1976–1991 period. Figure 3.3-4b shows that the negative exponential shape with effective Delta outflow does describe the majority of the variation in monthly average EC values. Some of the differences between the predicted EC values (G-model estimates) and the measured EC may be caused by uncertainty in the Delta outflow, which must be estimated from measured inflows minus exports and minus approximate net Delta channel depletions.

Figure 3.3-5 shows the historical and DSM2-simulated monthly average EC for the Future No Action and Intertie Alternatives at Antioch and Jersey Point for 1976–1991. The seasonal patterns of simulated monthly EC values generally match the historical measured monthly EC values at each of these stations. The historical monthly EC values at Antioch were greater than 6,000 µS/cm in 1977 and for several months in the 1988–1991 dry period, whereas the simulated Future No Action EC values were limited to a maximum of about 6,000 µS/cm in the fall of these dry years. The DSM2 simulated Future No Action and Intertie EC values at Jersey Point were limited to a maximum of about 3,000 µS/cm. The simulated Future No Action and Intertie EC values at Jersey point were more consistently high in the fall months. The historical data included several years when the EC remained lower than the Future No Action EC values in the fall, presumably because historical effective outflow remained higher (Figure 3.3-3).

Comparison of the simulated Jersey Point EC values for the Future No Action and the Intertie were nearly identical except for December 1997, when the Intertie EC was slightly higher, and in November 1991, when the Intertie EC was lower. This reduced EC value in November 1991 was simulated for all the Suisun Bay and western Delta stations, because the CALSIM-simulated outflow was increased from indirect effects of the Intertie operation.

Figure 3.3-6 shows the historical and DSM2-simulated monthly average EC for the Future No Action at Rock Slough (Contra Costa Canal Intake) and Los Vaqueros Intake (Old River near SR 4) for 1976–1991. There is a general match of the simulated seasonal EC variation with the measured monthly EC values at these two stations. The greatest differences occur in a few specific periods when the historical Delta outflows would not have been permitted under the D-1641 objectives. The historical monthly EC values at Rock Slough were greater than 1,000 µS/cm in 1977 and in a few months during the 1988–1991 dry period, whereas the simulated Future No Action EC values were above 1,000 µS/cm in the fall of several years. The DSM2 simulated Future No Action and Intertie maximum EC values at the Los Vaqueros Intake were about 200 µS/cm lower than the simulated Rock Slough EC values in many years.

The Intertie EC values were slightly different from the Future No Action EC values in a few months, caused by the indirect effects of slightly different CVP and SWP project operations on Delta outflow. Historical EC data from West Canal (at CCF intake) are compared with the Los Vaqueros Intake EC values. Also shown is the historical EC from Victoria Canal (near the new CCWD intake locations). The peak Victoria Canal EC generally was about 100 µS/cm lower than the maximum West Canal EC data, because of the greater fraction of Sacramento River water in Victoria Canal (from Middle River) than in Old River.

Comparison of the simulated Los Vaqueros intake EC values for the Future No Action and the Intertie were nearly identical except for December 1997, when the Intertie EC was slightly higher, and in November of 1991 when the Intertie EC was lower. This reduced EC value in November 1991 was simulated for all the

Suisun Bay and western Delta stations, because the CALSIM-simulated outflow was increased from indirect effects of the Intertie operation on upstream CVP and SWP reservoir releases.

Historical and Simulated South Delta Salinity (EC) Results

The south Delta salinity is most directly influenced by the San Joaquin River inflow and salinity, as well as by the CVP and SWP exports that draw Sacramento River water from the central Delta into the south Delta through Middle River and Old River channels. Although the DCC and Georgiana Slough diversions from the Sacramento River are not changed by CVP or SWP exports, the volume of water flowing upstream in Middle River and Old River toward the pumping plants is controlled by the total pumping. Increasing CVP pumping with the Intertie facility would cause slightly more central Delta water to flow toward the south Delta and would have a slight effect on the SWP and CVP export EC values.

Figure 3.3-7a shows the historical San Joaquin River Vernalis EC for the 1976–1991 study period compared to the DSM2-model input EC values for the Future No Action and Intertie EC. The San Joaquin River Vernalis EC value is actually estimated in CALSIM and is identical for the Future No Action and the Intertie Proposed Alternative. The monthly Vernalis and south Delta EC objectives (D-1641) for 700 µS/cm from April through August and 1,000 µS/cm from September to March are shown for comparison (implemented in 1995). The historical EC values were higher than these objectives because they did not apply in the historical period.

Figure 3.3-7b shows the historical and simulated Future No Action San Joaquin River flows for 1976–1991. New Melones Reservoir was not filled until 1982, so the historical San Joaquin River flows were much lower and the historical EC values were much higher than the simulated values in the 1977 and 1987–1991 dry periods. Comparison of the monthly flow and EC data shown in these graphs indicates that the San Joaquin River EC is reduced substantially during periods of high flow. The historical EC-flow and the simulated EC-flow follow similar EC-dilution patterns. The San Joaquin River EC is less than 200 µS/cm (similar to Sacramento River EC) when the San Joaquin River flow is greater than 10,000 cfs. The simulated Future No Action Vernalis flow is generally lower in the summer period than the historical flows, so the simulated EC approaches the maximum allowed EC of 700 µS/cm in these summer months. However, because the Intertie operations will not change CVP pumping in the summer period, no changes in CVP or SWP export EC are expected during the summer period. Differences between the historical and the Future No Action conditions do not change the potential EC impacts of the Intertie Project, which are evaluated as the difference between the Future No Action and the Intertie simulations.

Figure 3.3-8 shows the historical and simulated EC at the Jones Pumping Plant (Figure 3.3-8a) and the Banks Pumping Plant (Figure 3.3-8b) for WYs 1976–1991. These historical and simulated Future No Action EC conditions at these two nearby pumping intakes are very similar. Although detailed examination shows that there is more San Joaquin River water at the Jones Pumping Plant than at the Banks Pumping Plant, the major variations in the historical and simulated EC values are dominated by the sequence of wet years and dry years, and by the seasonal pattern of seawater intrusion in the fall months.

The simulated Future No Action and simulated Intertie EC values are nearly identical except for a few periods when the simulated Delta outflow was different because of indirect effects of the Intertie on upstream reservoir releases. The effects of these CALSIM-simulated changes in Delta outflow on EC values were described above for the Jersey Point EC results (see Figure 3.3-5). Sometimes the Delta outflow is increased so that the EC is reduced slightly, and sometimes the Delta outflow is reduced, so that the EC is increased slightly. These changes are very small and occurred only in a few months.

3.3.4 Environmental Effects

No Action (Alternative 1)

For EC analysis, DSM2 computer modeling was used as the basis for developing the No Action Alternative. The No Action Alternative was plotted and compared with the Intertie Proposed Action Alternative in several of the figures presented above to describe the historical and No Action salinity conditions in Suisun Bay and the Delta.

For the No Action Alternative, the Intertie would not be constructed or operated and, as a result, water quality conditions would remain similar to recent historical conditions as regulated by D-1641 objectives. The No Action Alternative would not have any significant adverse water quality effects.

Changes in operations would not occur at the Jones Pumping Plant or in the DMC; therefore, the Jones Pumping Plant would remain limited to less than the full 4,600 cfs capacity during the fall and winter months when upper DMC deliveries are less than 400 cfs.

Proposed Action (Alternative 2)

There would be no substantial water quality effects during construction of the Intertie facilities. Temporary cofferdams would be used to isolate the DMC and California Aqueduct from the intakes and gate structures that would be constructed at the edge of these two canals. Dewatering of shallow groundwater for the foundation of the pumping plant, if necessary, would be discharged as local drainage and infiltrate to the shallow groundwater, with no expected water quality effects. The only possible water quality effects would result from changes in Delta flows as a direct or indirect effect of Intertie operations, as described below.

Electrical Conductivity

Proposed Action impacts were evaluated based on changes in the simulated Intertie Alternative monthly EC values compared to the monthly values simulated for the No Action Alternative. The monthly EC results for the 1976–1991 period simulated by the DSM2 model are used for the assessment. The most accurate monthly changes are considered to be those simulated by DSM2, which is able to evaluate effects from outflow changes as well as shifts in the contributions from agricultural drainage and San Joaquin River inflows. Monthly changes in Delta outflow for the entire 1922–2003 period simulated by the CALSIM model also were evaluated because the relationship between EC and effective Delta outflow has been well established at the Delta locations with EC objectives.

Impact WQ-1: Delta Salinity Changes at Jersey Point

Figure 3.3-5 shows the monthly EC value comparison between the Proposed Action and No Action conditions for 1976–1991 as simulated by the DSM2 model. Applicable EC objectives for Jersey Point for April to August range from 450 µS/cm to 2,200 µS/cm, depending on water-year type. Many months (September–March) have no EC objectives at Jersey Point.

Table 3.3-1 indicates that the average Existing Condition EC at Jersey Point for the 16-year period simulated with the DSM2 model was 1,111 µS/cm. In comparison, the average simulated EC for the Proposed Action was 1,116 µS/cm. The average increase at Jersey Point therefore was 5 µS/cm (0.5% of the simulated No Action average). There were 10 months (out of 192) with EC changes greater than 100 µS/cm, but these were in the fall months when there is no EC objective at Jersey Point. Because this long-term increase is much less than 5% of the simulated No Action average, the change is minor and there would be no adverse effect.

Table 3.3-1. DSM2-Simulated Average EC (µS/cm) for Intertie and No Action Alternatives for 1976–1991 at Jersey Point, CCWD Rock Slough and Los Vaqueros Intakes, and Banks and Jones Pumping Plants

	Jersey Point	Rock Slough Intake	Los Vaqueros Intake	Banks Pumping Plant	Jones Pumping Plant
Intertie	1,116	570	487	473	495
Future No Action	1,111	571	485	471	494
Increase	5	-1	2	1	1
Maximum increase	274	49	126	136	100
Number of months with increase >100 µS/cm	10	0	1	1	1
Number of months with increase >10 µS/cm	47	21	29	19	17

Impact WQ-2: Delta Salinity Changes at Rock Slough

Figure 3.3-6 shows the monthly EC values at Rock Slough for the Proposed Action and No Action condition for 1976–1991 as simulated by DSM2. The applicable EC objective at Rock Slough is 1,000 µS/cm.

Table 3.3-1 indicates that the average simulated No Action EC at Rock Slough was 571 µS/cm. This is about half of the average EC at Jersey Point. In comparison, the average simulated EC for the Proposed Action was 570 µS/cm. The average Rock Slough EC would decrease by about 1 µS/cm (0.5% of the No Action average). There was no months with a simulated change of more than 100 µS/cm. The largest change of about 50 µS/cm occurred during 1991 when CALSIM-simulated Delta outflow was reduced from indirect upstream reservoir release changes. There were other months with reductions in EC. Any changes are generally minor and major changes would occur infrequently. There would be no adverse effect.

Impact WQ-3: Delta Salinity Changes at Los Vaqueros Intake

Figure 3.3-6 shows the monthly EC values at the Los Vaqueros intake on Old River for the Proposed Action and No Action condition for 1976–1991 as simulated by DSM2. There is no applicable EC objective at Los Vaqueros Intake, but the EC objective of 1,000 µS/cm for other water supply intakes is assumed as appropriate.

Table 3.3-1 indicates that the average simulated No Action EC at the Los Vaqueros intake was 485 µS/cm. This was about 100 µS/cm less than the average at Rock Slough. The average simulated EC for the Proposed Action was 487 µS/cm. The average simulated EC increase at Los Vaqueros intake was about

2 µS/cm (0.5% of the No Action average). The largest increase was one month with an increase of 126 µS/cm, caused by a CALSIM-simulated reduction in Delta outflow in 1991. There would be no substantial change in EC at the Los Vaqueros intake.

Impact WQ-4: Delta Salinity Changes at Banks Pumping Plant

Figure 3.3-8b shows the monthly EC values comparison between the simulated Intertie and No Action, for 1976–1991 as simulated by DSM2. The applicable EC objective at the Banks Pumping Plant is 1,000 µS/cm.

Table 3.3-1 indicates that the average No Action EC at Banks Pumping Plant was 471 µS/cm. In comparison, the average simulated EC for the Proposed Action was 473 µS/cm. The average increase at the Banks Pumping Plant therefore was only about 2 µS/cm (0.5% of the simulated Future No Action average). Changes in average monthly EC values also were small, and there would be no adverse effect.

Impact WQ-5: Delta Salinity Changes at Jones Pumping Plant

Figure 3.3-8a shows the monthly EC values comparison between the Proposed Action and No Action conditions for 1976–1991 as simulated by DSM2. The applicable EC objective at the Jones Pumping Plant is 1,000 µS/cm.

Table 3.3-1 indicates that the simulated average No Action EC at Jones Pumping Plant was 494 µS/cm. This EC is slightly higher than the average Banks Pumping Plant EC because the Jones Pumping Plant facility pumps more of the San Joaquin River water that is diverted down Old River and Grant Line Canal. In comparison, the average simulated EC for the Proposed Action was 495 µS/cm. The average increase at the Jones Pumping Plant therefore was only 1 µS/cm (0.2% of the simulated Future No Action average), which would not result in an adverse effect on CVP water quality.

Dissolved Organic Carbon

The DOC concentrations in the Delta will be higher than the river inflow concentrations because of the contribution of agricultural drainage DOC. The DOC in the CVP exports is often very similar to the San Joaquin River inflow DOC. Periods with high agricultural drainage contributions in the winter will raise the CVP and SWP export DOC concentrations to above the San Joaquin River concentration.

The DOC concentrations at the SWP and CCWD water supply intakes will be higher than the river inflow concentrations because of the agricultural drainage DOC. The DOC in the Rock Slough intake is closer to the Sacramento River inflow DOC than the SR 4 intake. Both of these CCWD intakes can have a high contribution from the San Joaquin River DOC at times of high San Joaquin River flow. Periods with high agricultural drainage contributions in the summer will raise the Rock Slough and SR 4 DOC concentrations to above the San Joaquin River concentration.

Impact WQ-6: Increases in Dissolved Organic Carbon at CCWD, SWP, or CVP Intakes

DOC concentrations at the CCWD, SWP, or CVP intakes depend on the sources of DOC (river inflows and Delta drainage or vegetation sources) in combination with the water transport from these DOC source locations to the Delta diversions. Because of the relatively small changes in CVP and SWP exports under the Proposed Intertie Alternative compared to the No Action, there are no substantial changes in the water transport patterns within the Delta. Therefore, the DOC concentrations at the Rock Slough, Los Vaqueros, SWP, and CVP intakes in the south Delta are not expected to change, and there would be no adverse effect.

Temperature

Water temperatures are determined predominantly by surface heat exchange processes, which are a function of weather. Delta temperatures are influenced only slightly by water management activities, which have a very small effect on water travel times. The most common environmental impacts associated with water temperatures are localized effects of discharges of water at substantially elevated temperatures (e.g., thermal shock). Historical temperature measurements from several locations within the Delta channels are consistently similar to each other, following the seasonal weather conditions. Only at Freeport and Vernalis are there periods when the river temperatures are lower than (i.e., still warming) the measured Delta temperatures which are in equilibrium with the seasonal meteorology. Therefore, no significant temperature impacts are expected from the Proposed Action, because most changes in Sacramento River inflow, CVP and SWP exports, and Delta outflow are relatively small. Large (>1,000 cfs) simulated changes in Sacramento inflow and Delta outflow occur in only a few months because of indirect changes in CVP and SWP reservoir operations. These potential temperature changes will be within the normal seasonal variability of water temperatures in the Delta.

Suspended Sediments

Higher suspended sediments (SS) concentrations, often measured as turbidity, are a general indicator of surface erosion during runoff or re-suspension of bottom sediment materials. Following major storms, water quality often is degraded by inorganic and organic solids and associated adsorbed contaminants, such as metals, nutrients, and agricultural chemicals, which are re-suspended or introduced in runoff. Such runoff and re-suspension episodes are relatively infrequent and persist for only a limited time; therefore, they are not often detected in regular sampling programs.

The attenuation of light in Delta waters is controlled by SS concentrations (with some effects from chlorophyll concentrations). SS concentrations often are elevated as a result of increased flocculation (i.e., aggregation of particles) in the estuarine salinity gradient (i.e., freshwater-saltwater interface). High winds and tidal currents also contribute to higher SS concentrations in Suisun Bay. The Proposed Action will not change these storm-related and entrapment zone effects of SS concentrations and associated contaminants. No substantial change in SS concentrations is expected from the Proposed Action.

Alternative 3

The water quality effects of Alternative 3 would be identical to the effects of Alternative 2, described above, because the same Intertie facility would be used in the same manner. The only difference between Alternatives 2 and 3 is the location of the Intertie, which does not affect operations or related water quality changes. There would be no adverse effects on water quality.

Alternative 4 (Virtual Intertie)

The water quality effects from Alternative 4 would be nearly identical to those simulated by CALSIM for Alternative 2 because the periods of Intertie pumping with concurrent increases in Jones Pumping Plant pumping would be replaced with pumping of the same magnitude at Banks Pumping Plant. Because CVP San Luis Reservoir would fill earlier in the same years, there would be the same reduction in Jones Pumping Plant pumping in those years. More indirect effects on upstream CVP operations would also remain the same. The Banks Pumping Plant pumping limits only occasionally would limit the ability to pump the Intertie increment, and these months of slightly reduced SWP Article 21 pumping often would be recovered in subsequent months when Jones Pumping Plant pumping was reduced. Spreadsheet calculations of the Virtual Intertie pumping at Jones and Banks Pumping Plants indicated that the pattern of total Intertie pumping changes and Virtual Intertie pumping changes were nearly identical.

Therefore, the changes in Delta inflows and outflows for Alternative 4, which might cause small salinity changes, are assumed to be nearly identical to the changes in Delta inflow and outflow simulated for Alternative 2. Thus, there are no adverse effects on water quality.

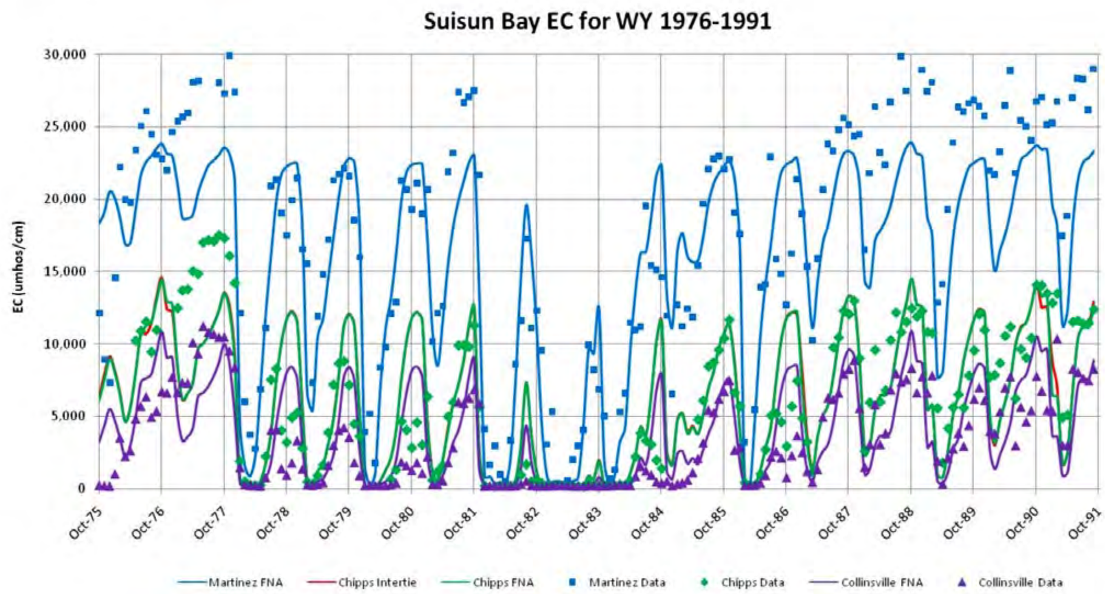

Figure 3.3-1. The Historical and Simulated Monthly Average EC for the No Action and Intertie Alternatives at Three Suisun Bay Stations for Water Years 1976–1991

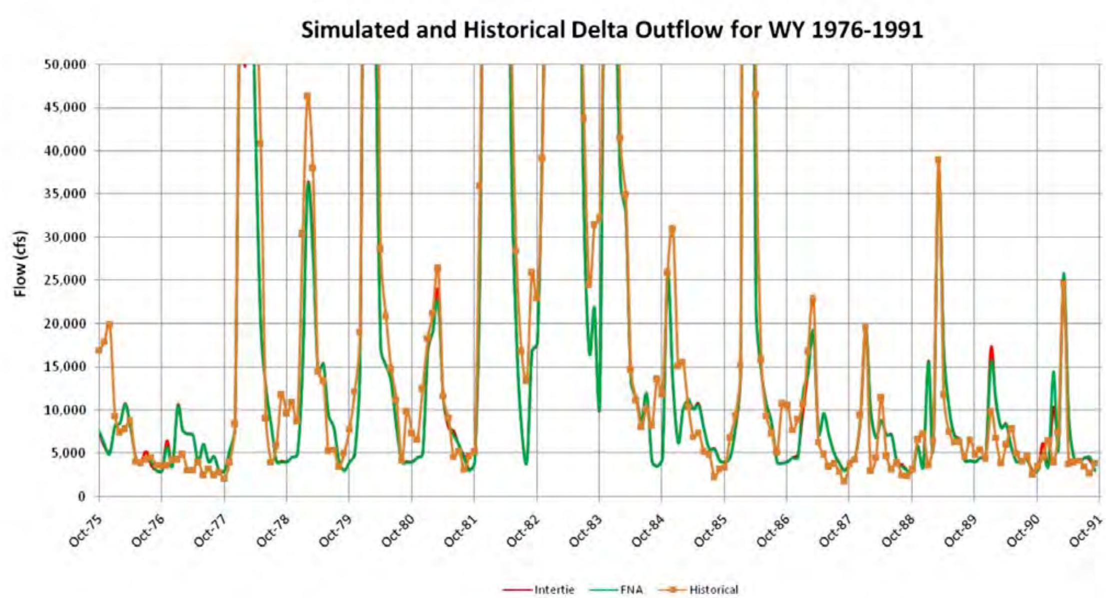

Figure 3.3-2. Simulated and Historical Delta Outflow for Water Years 1976–1991

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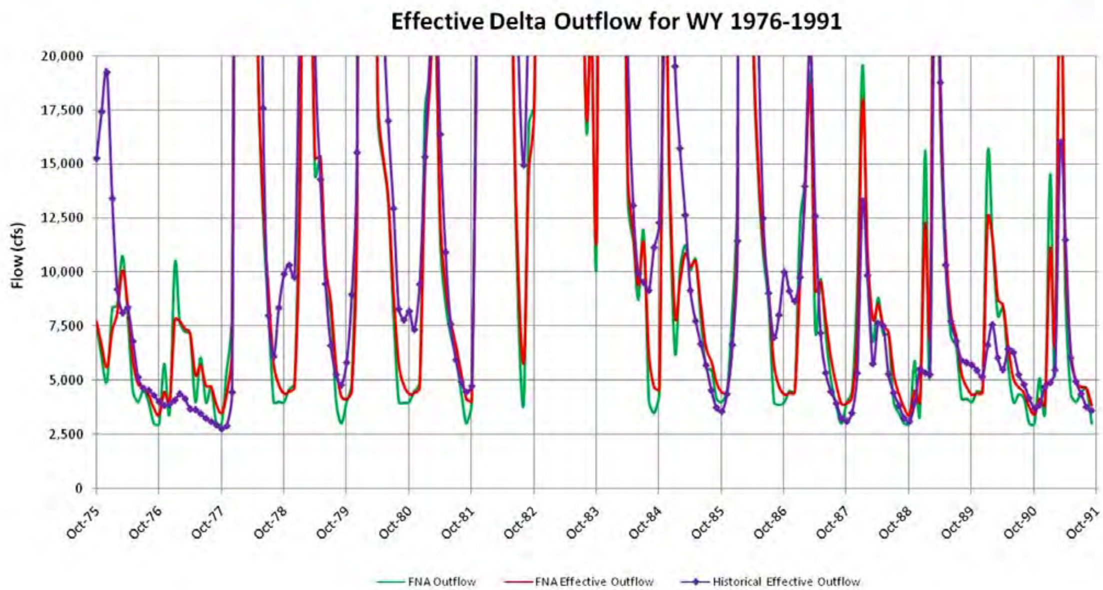

Figure 3.3-3a. Simulated No Action Outflow and Effective Outflow Compared to Historical for Water Years 1976–1991

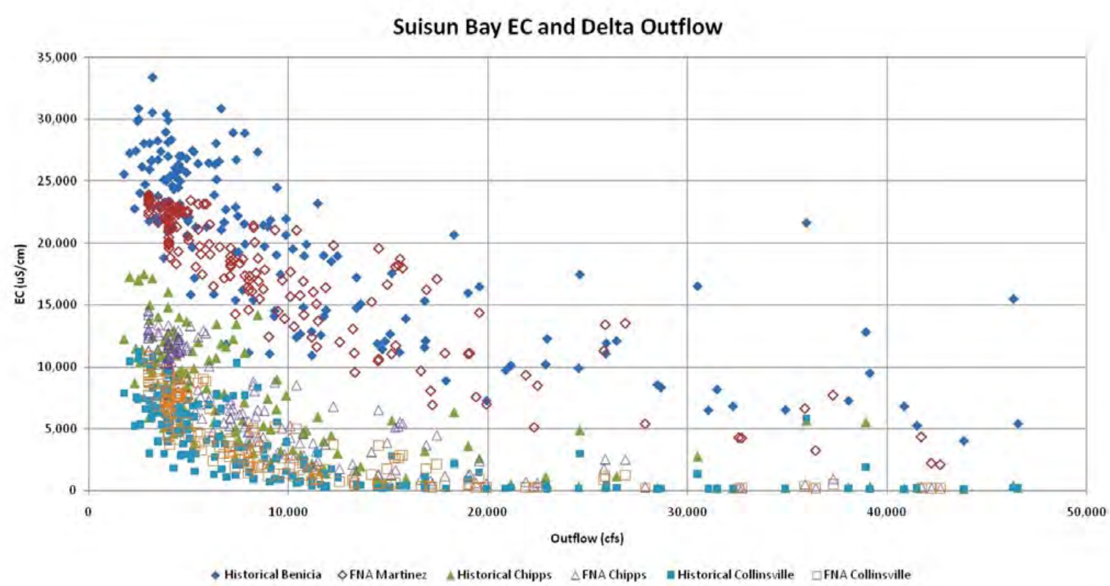

Figure 3.3-3b. Relationship between Delta Outflow and EC at Martinez, Chipps Island and Collinsville

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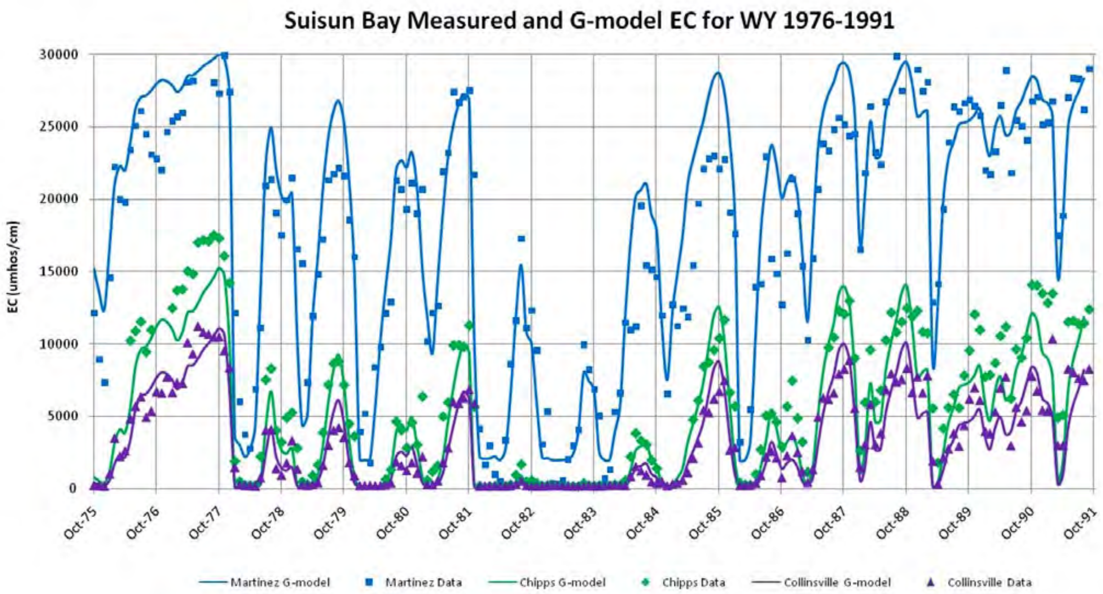

Figure 3.3-4a. Comparison of Measured and G-model Estimated EC for Suisun Bay Stations for Water Years 1976–1991

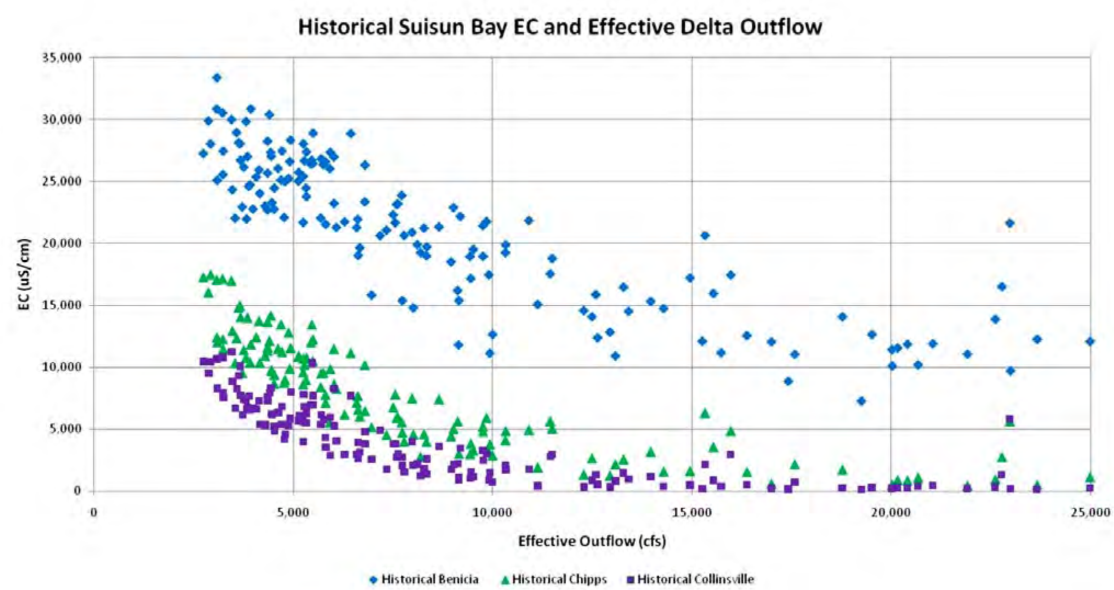

Figure 3.3-4b. Relationship between Effective Delta Outflow and Historical EC at Suisun Bay Stations

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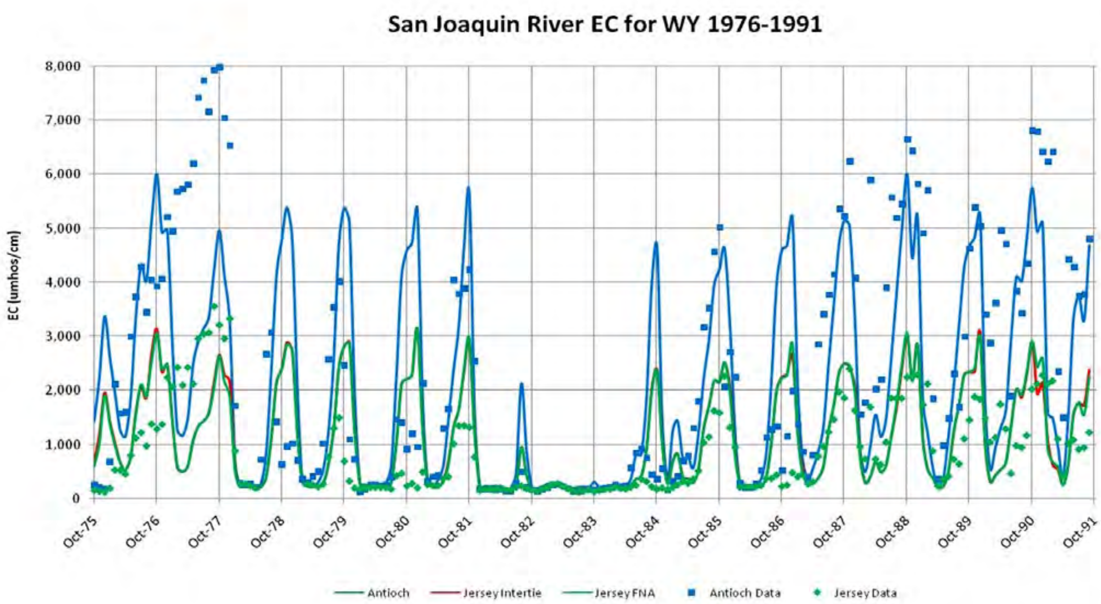

Figure 3.3-5. Comparison of Historical and Simulated No Action and Intertie EC at Antioch and Jersey Point for Water Years 1976–1991

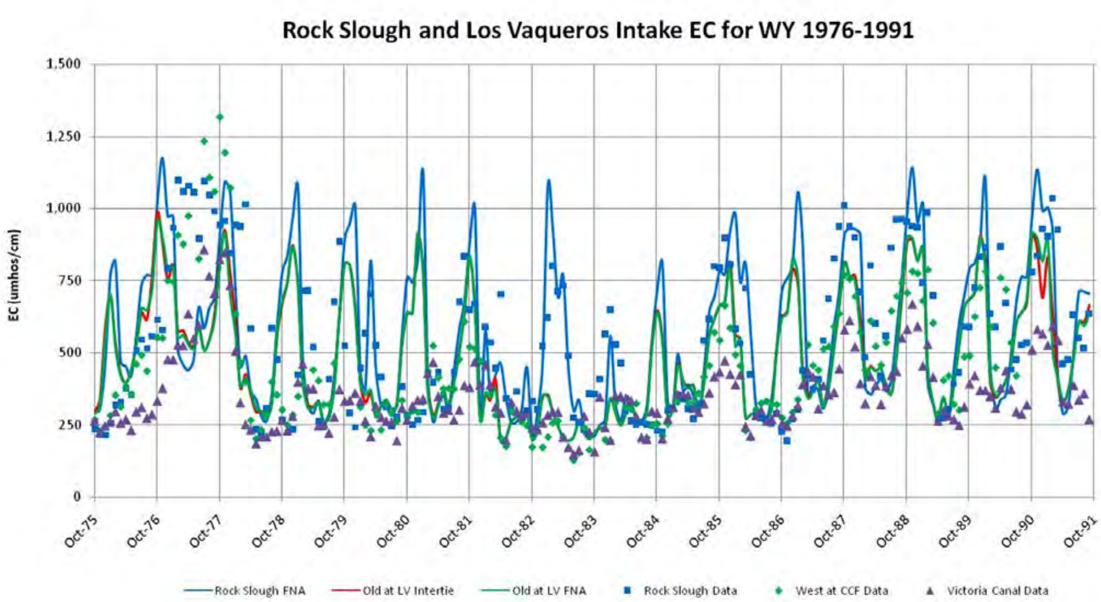

Figure 3.3-6. Comparison of Historical and Simulated No Action and Intertie EC at Rock Slough and Los Vaqueros Intake for Water Years 1976–1991

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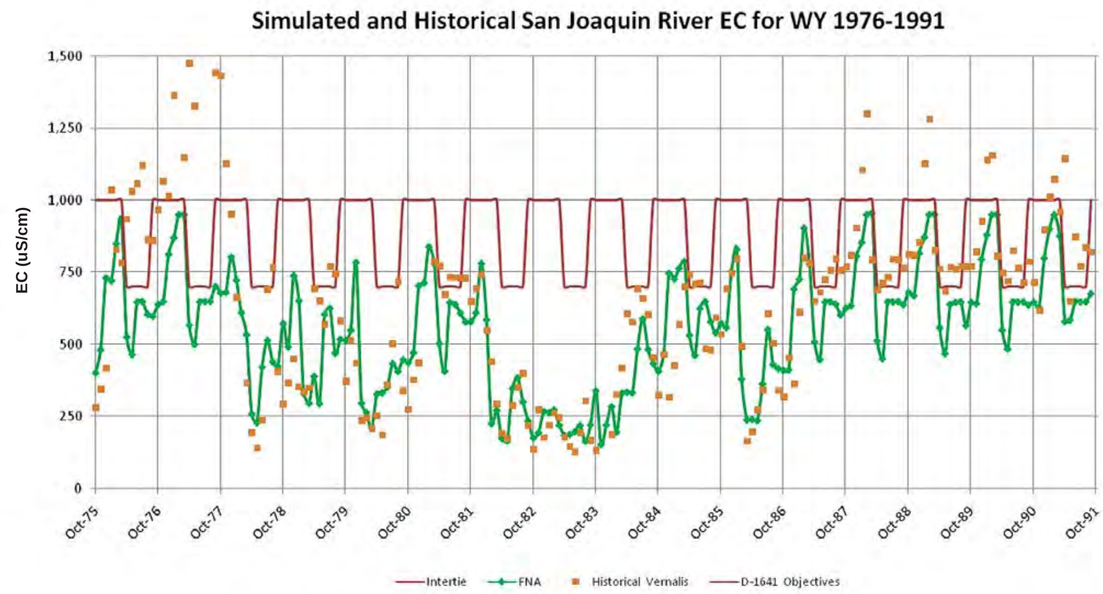

Figure 3.3-7a. Historical and Simulated No Action and Intertie EC at Vernalis for Water Years 1976–1991

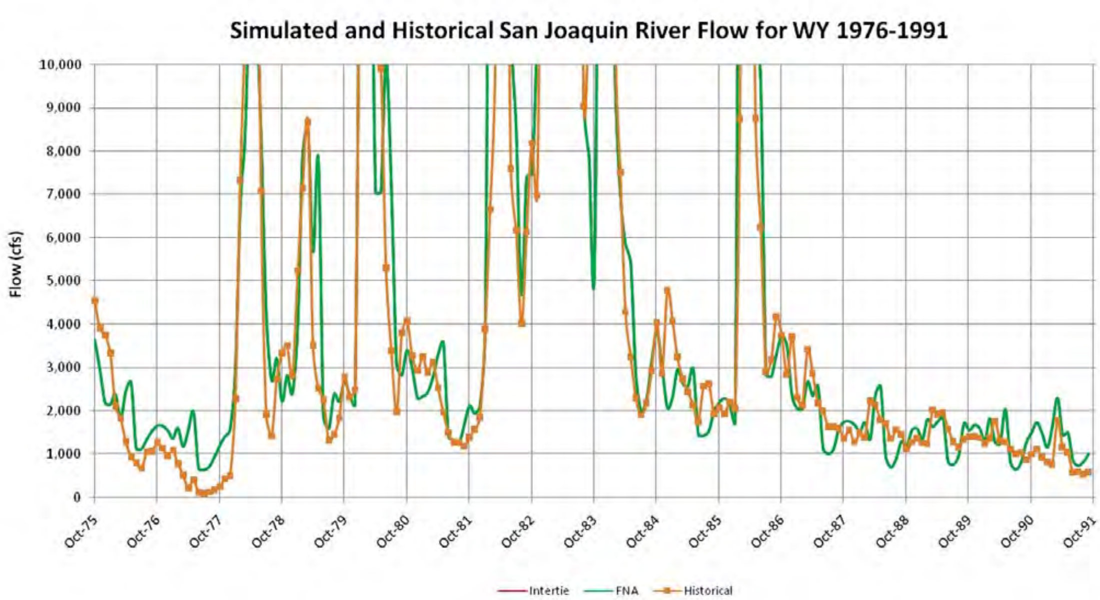

Figure 3.3-7b. Historical and Simulated No Action and Intertie Flow at Vernalis Flow for Water Years 1976–1991

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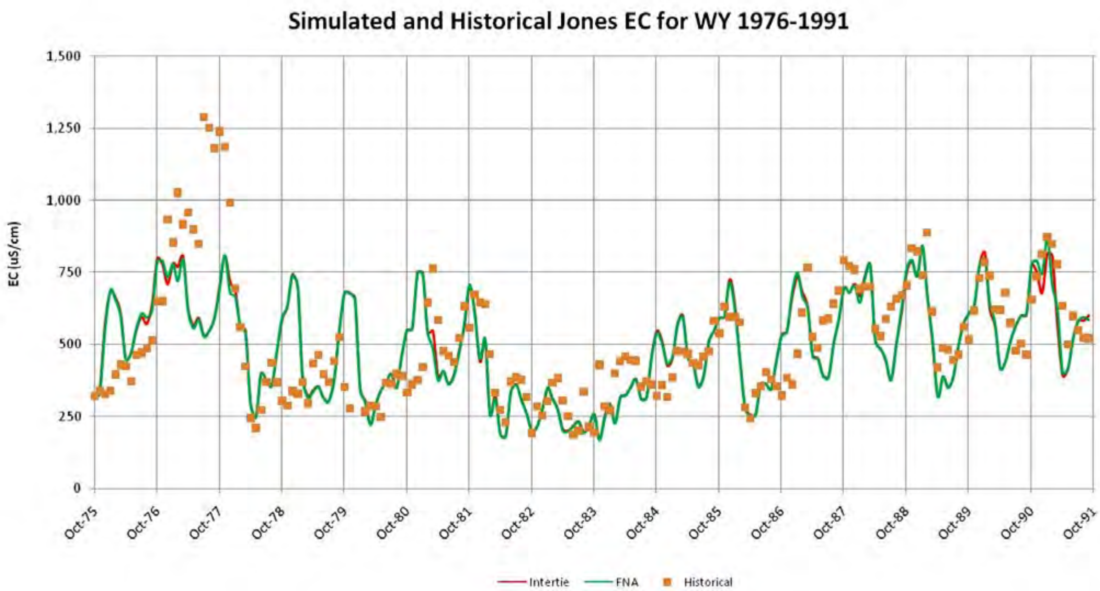

Figure 3.3-8a. Historical and Simulated No Action and Intertie EC at CVP Jones Pumping Plant for Water Years 1976–1991

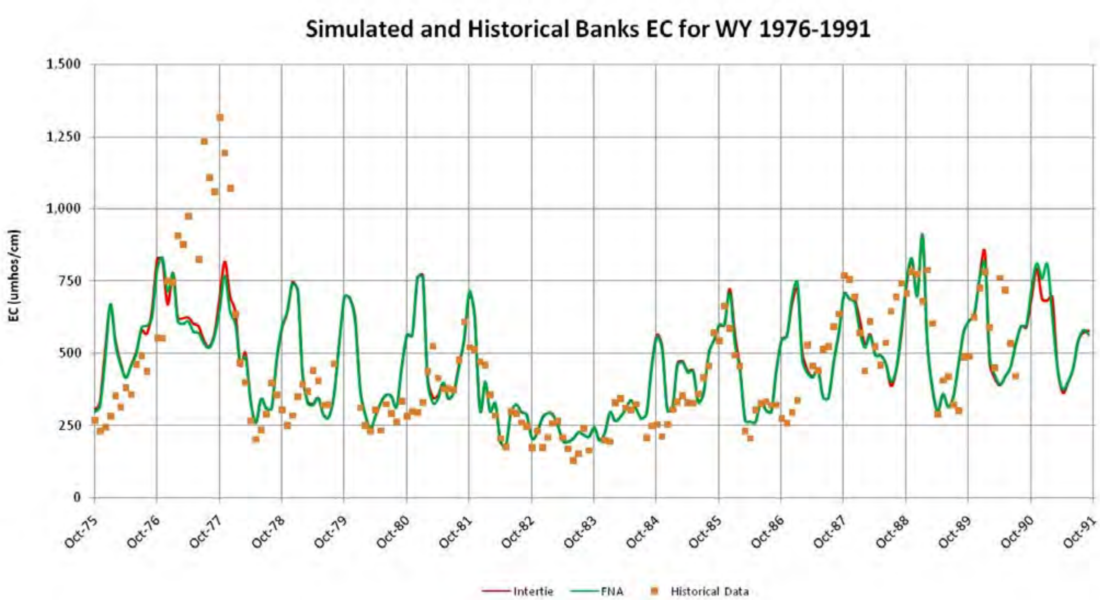

Figure 3.3-8b. Historical and Simulated No Action and Intertie EC at SWP Banks Pumping Plant for Water Years 1976–1991

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3.4 Geology and Soils

3.4.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on geology and soils. Mineral resources are not discussed because the Proposed Action and alternatives would not affect mineral resources in the area.

3.4.2 Affected Environment

Sources of Information

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

- maps and reports by the USGS,
- maps and reports by the California Geological Survey (CGS),
- maps and report by Natural Resources Conservation Service (NRCS),
- maps and reports by the International Conference of Building Officials, and
- geotechnical investigations conducted by Reclamation.

Regional Geology and Stratigraphy

This section addresses the regional and project area geology and topography. Quaternary sediments and geologic hazards pertaining to the project area are emphasized. The project area is located in the westernmost edge of the Great Valley geomorphic province adjacent to the Coast Ranges geomorphic province.

Regional and Project Area Topography

The project area is located at the boundary of the Great Valley and Coast Ranges geomorphic provinces. The Great Valley of California, also called the Central Valley of California, is a nearly flat alluvial plain extending from the Tehachapi Mountains at the south to the Klamath Mountains at the north, and from the Sierra Nevada on the east to the Coast Ranges on the west. The valley is about 450 miles long and has an average width of about 50 miles. Elevations of the alluvial plain are generally just a few hundred feet msl, with extremes ranging from a few feet below msl to about 1,000 feet above msl (Hackel 1966).

The Coast Ranges geomorphic province includes many separate ranges; coalescing mountain masses; and several major structural valleys of sedimentary, igneous, and metamorphic origin. The southern Coast Ranges extend from the San Francisco Bay area south to the northern edge of the Transverse Ranges geomorphic province. On average, they extend from the coastline to 50–75 miles inland. The southern Coast Ranges parallel the Great Valley geomorphic province throughout their length. The main topographic features of the region consist of dissected uplands, low alluvial plains and fans, constructed canals, and the Delta to the north. At the proposed intertie sites, both the DMC and the California Aqueduct are located in and along the eastern foothills of the Diablo Range in the central Coast Ranges on the west side of the San Joaquin Valley. The topography of the project area is typical of an alluvial fan setting and is influenced by sediment introduction from the Coast Ranges to the west. Between the DMC and the California Aqueduct, elevations presently range from approximately 260 feet to approximately 200 feet.

Regional and Project Area Geology

Geologically, the Great Valley geomorphic province is a large, elongated, northwest-trending asymmetric structural trough that has been filled with an extremely thick sequence of sediments ranging in age from Jurassic to Recent. This asymmetric geosyncline has a long stable eastern shelf supported by the subsurface continuation of the granitic Sierran slope and a short western flank expressed by the upturned edges of the basin sediments (Hackel 1966).

The Coast Ranges geomorphic province includes many separate ranges, coalescing mountain masses, and several major structural valleys. Typical tectonic, sedimentary, and igneous processes of the Circum-Pacific orogenic belt have influenced the evolution of the Coast Ranges. The Coast Ranges geomorphic province is characterized by the presence of two entirely different core complexes, one being a Jurassic-Cretaceous eugeosynclinal assemblage (the Franciscan rocks) and the other consisting of Early Cretaceous granitic intrusives and older metamorphic rocks. The two unrelated, incompatible core complexes lie side by side, separated from each other by faults. A large sequence of Cretaceous and Cenozoic clastic deposits covers large parts of the province. The rocks in the province are characterized by many folds, thrust faults, reverse faults, and strike-slip faults that have developed as a consequence of Cenozoic deformation (Page 1966). The canal alignments traverse rolling hills consisting of folded eastward-dipping Cretaceous and Tertiary sedimentary rocks overlain by flat-lying Holocene alluvium and/or colluviums. Sedimentary rock units consist of thick Holocene (early Quaternary) non-marine (continental) sedimentary alluvial fan deposits, including variably indurated shale, claystone, sandstone, and siltstone (Sherer 2003; Wagner et al. 1990). These sediments were deposited from former streams emerging from highlands surrounding the Great Valley geomorphic province, specifically the Coast Ranges.

The dominant subsurface geologic formation encountered during geotechnical investigations is the Neroly formation. This unit is a Miocene-Pliocene, moderately well indurated and jointed, massive sandstone with interbedded claystone and siltsone (Sherer 2003).

Project Area Soils

The soils in the project area have been mapped by the Natural Resources Conservation Service and are described in the Soil Survey of Alameda Area (Welch et al. 1966). The Altamont-Diablo soil association occurs in the project area (Table 3.4-1).

Table 3.4-1. Soil Association of the Project Area

Soil Association	Soil Description
Altamont-Diablo	Moderately sloping to very steep, brownish and dark-gray, moderately deep soils on soft sedimentary rocks

Source: Welch et al. 1966.

According to the soil survey, soils in the project area comprise predominantly clay loams. Table 3.4-2 summarizes soil characteristics for the project area. The soils generally have a variable runoff rate and variable erosion hazard. Moderate to high shrink-swell potential (i.e., expansive soils) in the Rincon clay loam, and severe erosion hazard in Linne clay loam are the most limiting factors.

No information is available about the corrosivity of the soil to coated steel or plastic pipes, but other soils in the region have high or very high corrosivity to uncoated steel (Welch 1977). Standard engineering design practices dictate the selection of a pipe material that could resist corrosion from the soil.

Table 3.4-2. Detailed Soil Characteristics of the Project Area

Soil Map Unit	Shrink-Swell Potential	Erosion Hazard[a]	Runoff Rate
Linne clay loam, 30%–45% slopes, eroded	Low	Severe	Medium to rapid
Rincon clay loam, 0%–3% slopes	Moderate	Slight to moderate	Slow to medium

Note:

[a] Erosion hazard consists of susceptibility to water and wind erosion. The Soil Survey of the Alameda Area (Welch et al. 1966) does not differentiate between the two.

Source: Welch et al. 1966.

Three drill holes were completed along the Intertie alignment near Mile 7.7 of the DMC. The purpose of the associated geotechnical investigation was to determine foundation conditions along the alignment. In brief, depth of the drill holes was approximately 40 to 50 feet below the ground surface. Subsurface soils range from clay to silty sand. Refer to Reclamation's 2003 *Delta-Mendota Canal, California Aqueduct Intertie Project, Geologic Design Data Report, Central Valley Project Delta Division* (Sherer 2003).

Six drill holes were completed along the Intertie alignment near Mile 7.2 of the DMC. The purpose of the associated geotechnical investigation was to determine foundation conditions along the alignment. In brief, depth of the drill holes was approximately 50 feet below the ground surface. Subsurface soils range from clay to gravel. Refer to Reclamation's 2004 *Addendum to the Geologic Report for Central Valley Project, Delta Division, Delta-Mendota Canal, California Aqueduct Intertie Project* (Mongano 2004).

Potential Geologic Hazards

Seismic Conditions

Seismic hazards are earthquake fault ground rupture and ground shaking (primary hazards) and liquefaction and earthquake-induced slope failure (secondary hazards). Ground shaking is the most significant seismic hazards in the project area.

Alameda County is located in one of the most seismically active regions in the United States. Major earthquakes have occurred in the vicinity of the project area in the past and can be expected to occur again in the near future. The 2002 Working Group on California Earthquake Probabilities estimated that there is a 62% probability of at least one earthquake, magnitude 6.7 or greater, to occur on one of the major faults in the San Francisco Bay region before 2030 (Working Group on California Earthquake Probabilities 2003). Furthermore, in a previous study, it was determined that there is a 30% chance of one or more magnitude 6.7 or greater earthquakes occurring somewhere along the Calaveras, Concord, Green Valley, Mount Diablo Thrust, or Greenville faults before 2030, faults very close to the project area (Working Group on California Earthquake Probabilities 1999).

Surface Rupture and Faulting

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) is to regulate development near active faults to mitigate the hazard of surface rupture. Faults in an Alquist-Priolo Earthquake Fault Zone are typically active faults. As defined under the Alquist-Priolo Act, an active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). An early Quaternary fault is one that has had surface displacement during Quaternary time (the last 1.6 million years). A pre-Quaternary fault is one that has had surface displacement before the Quaternary period. Only faults officially recognized by the State of California under the Alquist-Priolo Act or faults recognized by the Uniform Building Code (UBC) are subject to mitigation (Hart and Bryant 1997).

The project area is subject to seismic hazards because of its proximity to active faults, fault systems, and fault complexes. Some of the officially recognized (e.g., by the State of California or UBC) active faults are located within a 20-mile radius of the project area. Active faults within a 20-mile radius of the project area include the Greenville, Marsh Creek, Pleasanton, and Calaveras faults (Hart and Bryant 1997; International Conference of Building Officials 1997; Jennings 1994). All of these faults except the Pleasanton fault are in Alquist-Priolo Earthquake Fault Zones[1] (Hart and Bryant 1997).

Other Quaternary faults within a 20-mile radius of the project area are the San Joaquin, Williams, Las Positas, Midway, Black Butte, and Vernalis faults (Jennings 1994; Wagner et al. 1990). None of these faults are in Alquist-Priolo Earthquake Fault Zones (Hart and Bryant 1997). Various pre-Quaternary faults are also present within an approximately 20-mile radius, including the Stockton fault and the Midland fault zone. Finally, there are a series of unnamed pre-Quaternary faults present within an approximately 20-mile radius of the project area. None of these are in Alquist-Priolo Earthquake Fault Zones (Hart and Bryant 1997). Of all faults described above, the Midway fault is closest to the project area, located within a few miles of it.

Ground-Shaking Hazard

The project area is located in UBC Seismic Hazard Zone 3. Structures must be designed to meet the regulations and standards associated with Zone 3 hazards. Furthermore, the project area is located in a region of California characterized by locally moderate to very high historical seismic activity. The UBC recognizes active seismic sources in the project area vicinity (International Conference of Building Officials 1997), including the Calaveras fault (Type A seismic source) and the Greenville fault (Type B seismic source).

Accordingly, earthquake-induced ground shaking poses a significant hazard. The measurement of the energy released at the point of origin, or epicenter, of an earthquake is referred to as the magnitude, which is generally expressed in the Richter Magnitude Scale or as moment magnitude. The scale used in the Richter Magnitude Scale is logarithmic so that each successively higher Richter magnitude reflects an increase in the energy of an earthquake of about 31.5 times. Moment magnitude is the estimation of an earthquake magnitude by using seismic moment, which is a measure of an earthquake size using rock rigidity, amount of slip, and area of rupture.

The greater the energy released from the fault rupture, the higher the magnitude of the earthquake. Earthquake energy is most intense at the fault epicenter; the

[1] The Marsh Creek fault is partially zoned.

farther an area from an earthquake epicenter, the less likely that ground shaking will occur there. Geologic and soil units comprising unconsolidated, clay-free sands and silts can reach unstable conditions during ground shaking, which can result in extensive damage to structures built on them (see Liquefaction and Related Hazards below).

Ground shaking is described by two methods: ground acceleration as a fraction of the acceleration of gravity (g) or the Modified Mercalli scale, which is a more descriptive method involving 12 levels of intensity denoted by Roman numerals. Modified Mercalli intensities range from I (shaking that is not felt) to XII (total damage).

The intensity of ground shaking that would occur in the project area as a result of a nearby earthquake is related to the size of the earthquake, its distance from the project area, and the response of the geologic materials within the project area. As a rule, the earthquake magnitude and the closer the fault rupture to the site, the greater the intensity of ground shaking. When various earthquake scenarios are considered, ground-shaking intensities will reflect both the effects of strong ground accelerations and the consequences of ground failure.

Estimates of Earthquake Shaking

The project area is located in a region of California characterized by a moderate ground-shaking hazard. Based on a probabilistic seismic hazard map that depicts the peak horizontal ground acceleration values exceeded at a 10% probability in 50 years (Cao et al. 2003; California Geological Survey 2006), the probabilistic peak horizontal ground acceleration values in the project area range from 0.3 to 0.4 g, where one g equals the force of gravity, thus indicating that the ground-shaking hazard in the project area is moderate. Furthermore, based on shaking intensity maps and information from the Association of Bay Area Governments (ABAG), ground-shaking hazard in the project area is moderate (Association of Bay Area Governments 2003). Farther to the west, the ground-shaking hazard increases, coinciding with the increase in abundance of associated faults and fault complexes (Cao et al. 2003; California Geological Survey 2006).

Liquefaction and Related Hazards

Liquefaction is a phenomenon in which the strength and stiffness of unconsolidated sediments are reduced by earthquake shaking or other rapid loading. Poorly consolidated, water-saturated fine sands and silts having low plasticity and located within 50 feet of the ground surface typically are considered to be the most susceptible to liquefaction. Soils and sediments that are not water-saturated and that consist of coarser or finer materials are generally less susceptible to liquefaction (California Division of Mines and Geology 1997). Based on the composition of the soils and sediments and proximity to groundwater, liquefaction susceptibility is expected to be relatively low in the vicinity of the project area. Liquefaction susceptibility maps produced by the ABAG (2005) verify that the project area is not highly susceptible to liquefaction.

Two potential ground failure types associated with liquefaction in the region are lateral spreading and differential settlement (Association of Bay Area Governments 2001). Lateral spreading involves a layer of ground at the surface being carried on an underlying layer of liquefied material over a gently sloping surface toward a river channel or other open face. Lateral spreading is not a significant concern in the project area.

Another common hazard in the region is differential settlement (also called ground settlement and, in extreme cases, ground collapse) as soil compacts and consolidates after the ground shaking ceases. Differential settlement occurs when the layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills. Settlement can range from 1% to 5%, depending on the cohesiveness of the sediments (Tokimatsu and Seed 1984). In the project area, differential settlement is not expected to be a significant hazard.

Slope Stability

The portion of the project area beyond the canals is not prone to landslides or slope instability because of its moderately sloping topography. The canals themselves, however, are more prone to localized slope instability (at least during the construction process). Thirty-one slope failures occurred in the vicinity of the project area during the construction of the California Aqueduct. All failures occurred on the west cutslope of the canal prism and were associated with east-dipping bedding planes. Nearly all failures occurred above the existing water table along bedding planes dipping into the west canal prism cutslope at angles flatter than the prism slope (Sherer 2003).

Regulatory Setting

Federal Regulations

Clean Water Act

Section 402 of the CWA is directly relevant to excavation. Amendments in 1987 to the CWA added Section 402p, which establishes a framework for regulating municipal and industrial stormwater discharges under the NPDES program. The EPA has delegated to the State Water Board the authority for the NPDES program in California, which is implemented by the state’s nine RWQCBs. Under the NPDES Phase II Rule, construction activity disturbing 1 acre or more must obtain coverage under the state’s General Permit for Discharges of Storm Water Associated with Construction Activity (General Construction Permit). General Construction Permit applicants are required to prepare a notice of intent and a

SWPPP and implement and maintain BMPs to avoid adverse effects on water quality as a result of construction activities, including earthwork.

The Proposed Action construction activities would disturb more than 1 acre and therefore would be subject to NPDES requirements. The Central Valley RWQCB administers the stormwater permit program in the project area.

Uniform Building Code (International Building Code)

The design and construction of engineered facilities in the state of California must comply with the requirements of the Uniform Building Code. The International Code Council (ICC) was established in 1994 as a nonprofit organization dedicated to developing a single set of comprehensive and coordinated national model construction codes, or Uniform Building Codes. The founders of the ICC are Building Officials and Code Administrators International, Inc. (BOCA), International Conference of Building Officials (ICBO), and Southern Building Code Congress International, Inc. (SBCCI). Since the early twentieth century, these nonprofit organizations developed the three separate sets of model codes used throughout the United States. Although regional code development has been effective and responsive in the past, a single set of codes was developed. The nation's three model code groups responded by creating the ICC and by developing codes without regional limitations, the International Codes.

State Regulations

Alquist-Priolo Earthquake Fault Zoning Act

California's Alquist-Priolo Act (PRC 2621 et seq.), originally enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and renamed in 1994, is intended to reduce the risk to life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy across the traces of active faults and strictly regulates construction in the corridors along active faults (Earthquake Fault Zones). It also defines criteria for identifying active faults, giving legal weight to terms such as *active* and establishes a process for reviewing building proposals in and adjacent to Earthquake Fault Zones.

Under the Alquist-Priolo Act, faults are zoned, and construction along or across them is strictly regulated if they are "sufficiently active" and "well-defined." A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during Holocene time (defined for the purposes of the act as within the last 11,000 years). A fault is considered well-defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment (Hart and Bryant 1997).

Seismic Hazards Mapping Act

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 (PRC 2690–2699.6) is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act addresses surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act: The state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards, and cities and counties are required to regulate development within mapped Seismic Hazard Zones.

Under the Seismic Hazards Mapping Act, permit review is the primary mechanism for local regulation of development. Specifically, cities and counties are prohibited from issuing development permits for sites in Seismic Hazard Zones until appropriate site-specific geologic or geotechnical investigations have been carried out, and measures to reduce potential damage have been incorporated into the development plans.

California Building Code Commission

Established in 1953 by the California Building Standards Law, the California Building Standards Commission (BSC) is an independent commission within the State and Consumer Services Agency. The BSC's mission is to produce sensible and usable state building standards and administrative regulations that implement or enforce those standards. As provided in established laws and rules, the BSC is charged with:

- assisting state agencies in producing high-quality amendments;
- working to repeal unnecessary building regulations and see that ambiguous regulations are more clearly written;
- assisting various constituents and special interest groups in making their needs known to various code-writing departments;
- administering a public appeal process;
- educating the public about the state's building code and helping them understand and comply with it; and
- ensuring a high-quality CCR, Title 24, with minimal errors.

The State of California's minimum standards for structural design and construction are given in the CBSC (CCR Title 24). The CBSC is based on the UBC (International Code Council 1997), which is used widely throughout the United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations. The CBSC requires that "classification of the soil at each building site will be determined when required by the building official" and that "the classification will be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity will be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss. In accordance with California law, certain aspects of the Proposed Action would be required to comply with all provisions of the CBSC.

Local Regulations

Geotechnical Investigations

Local jurisdictions typically regulate construction activities through a multistage permitting process that may require the preparation of a site-specific geotechnical investigation. The purpose of a site-specific geotechnical investigation is to provide a geologic basis for the development of appropriate construction design. Geotechnical investigations typically assess bedrock and Quaternary geology, geologic structure, soils, and the previous history of excavation and fill placement.

The Alameda County General Plan (Alameda County 1982) requires all new development to be designed and constructed to minimize risk from geologic and seismic hazards, with geotechnical investigations to be performed prior to any planning or construction activities.

Two site-specific geotechnical investigations providing a geologic basis for the development of appropriate construction design have been completed for the project area (Mongano 2004; Sherer 2003). All relevant recommendations from these reports are incorporated into the project design. See the Impact Analysis section for further information.

Local Grading and Erosion Control Ordinances

Many counties have grading and erosion control ordinances. These ordinances are intended to control erosion and sedimentation caused by construction activities. A grading permit typically is required for construction-related projects. As part of the permit, the project applicants usually must submit a grading and erosion control plan, vicinity and site maps, and other supplemental information. Standard conditions in the grading permit include a description of BMPs similar to those contained in a SWPPP.

As per the Alameda County General Ordinance Code (Alameda County 2006), the County's Grading Ordinance, Chapter 15.36, "Grading, Erosion and Sediment

Control," outlines regulations and practices relevant to construction and grading activities within the county. Typically, a grading permit is required for all construction and grading activities within the county (Chapter 15.36.050 explains the exemptions for grading permits).

3.4.3 Environmental Consequences

Assessment Methods

Evaluation of the geology, seismicity, and soils impacts in this section is based on the results of technical maps, reports, and other documents that describe the geologic, seismic, and soil conditions of the project area, and on professional judgment. The analysis assumes that the project applicants will conform to the latest UBC standards, CBSC standards, County grading ordinance, NPDES requirements, and geotechnical investigations.

3.4.4 Environmental Effects

Alternative 1 (No Action)

The No Action Alternative would not include any direct ground-disturbing activities or operational changes that could result in changes in geology, seismicity, soils, or mineral resources. Therefore, there would be no effects on these resources attributable to implementation of this alternative.

Alternative 2 (Proposed Action)

Construction Effects

Impact GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction

Grading, excavation, removal of vegetation cover, and loading activities associated with construction activities could temporarily increase erosion, runoff, and sedimentation. Construction activities also could result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at the construction sites and staging areas.

However, as mentioned in the Environmental Commitments section of the Project Description (Chapter 2), a SWPPP will be developed by a qualified engineer or erosion control specialist and implemented before construction. The SWPPP will be kept on site during construction activity and will be made available upon request to representatives of the RWQCB. The objectives of the SWPPP will be to: (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity; and (2) identify, construct, and implement stormwater pollution prevention measures to reduce pollutants in stormwater discharges during and after construction. Therefore, the SWPPP will include a description of potential pollutants, the management of excavated soils, and hazardous materials present on the site during construction (including vehicle and equipment fuels). The SWPPP also will include details of how the sediment and erosion control practices, referred to as BMPs, will be implemented. Implementation of the SWPPP will comply with state and federal water quality regulations.

Furthermore, compliance with the County's Grading Ordinance also would minimize any negative effects associated with erosion and sedimentation. The County's Grading Ordinance, Chapter 15.36, "Grading, Erosion and Sediment Control," outlines regulations and practices relevant to construction and grading activities in the county. Typically, a grading permit is required for all construction and grading activities in the county.

The inclusion of these environmental commitments would ensure that there are no adverse effects related to erosion.

Impact GEO-2: Potential Slope Failure along Canals Resulting from Project Construction

The portion of the project area beyond the canals is not prone to landslides or slope instability because of its moderately sloping topography. The canals themselves, however, are more prone to localized slope instability (at least during the construction process). Thirty-one slope failures occurred in the vicinity of the project area during the construction of the California Aqueduct. All failures occurred on the west cutslope of the canal prism and were associated with east-dipping bedding planes. Nearly all failures occurred above the existing water table along bedding planes dipping into the west canal prism cutslope at angles flatter than the prism slope (Sherer 2003). Additionally, the drainage ditches may be prone to localized slope instability, especially the human-made drainage ditch, with 30- to 40-foot-high cutslopes, that was constructed to channelize and divert a natural drainage beneath the California Aqueduct and over the DMC. However, the proposed intertie is approximately 100 feet away from this drainage ditch while still maintaining the required 100-foot setback from the overhead high-tension power lines (Mongano 2004). Furthermore, the excavated sideslopes would be shored using sheet piling, and a dewatering system would be installed outside as necessary to maintain reduced groundwater levels in the construction area. These measures would ensure the stability of the excavation, allow construction to proceed in dry conditions, and minimize slope failure.

These design features would ensure that there are no adverse effects related to slope instability.

Impact GEO-3: Potential Structural Damage from Fault Displacement and Ground Shaking during a Seismic Event

Based on available knowledge of fault locations and locations of earthquake epicenters, the risk of surface fault rupture in the project area is generally high because of its proximity to active faults. Fault rupture has the potential to compromise the structural integrity of proposed new facilities (including the proposed pumping plant and pipelines) and cause injury to workers and operators. Furthermore, a large earthquake on a nearby fault could cause moderate ground shaking in the project area, potentially resulting in liquefaction and associated ground failure, such as lateral spreading or differential settlement, which in turn could increase the risk of structural loss, injury, and death.

However, the project applicant is required to implement UBC Seismic Hazard Zone 3 and CBSC standards into the project design for applicable features to minimize the potential fault rupture hazards on associated project features. Structures must and will be designed to meet the regulations and standards associated with UBC Seismic Hazard Zone 3 hazards. Accordingly, there would be no adverse effect related to fault displacement and ground shaking.

Impact GEO-4: Potential Structural Damage from Development on Materials Subject to Liquefaction

Liquefaction susceptibility maps compiled by ABAG and professional judgment indicate that the project area is not susceptible to liquefaction. Nonetheless, as part of the design process described above, the project applicants are required to implement UBC Seismic Hazard Zone 3 and CBSC standards into the project design for applicable features to minimize the potential liquefaction hazards on associated project features. Structures must and will be designed to meet the regulations and standards associated with UBC Seismic Hazard Zone 3 hazards. Accordingly, there would be no adverse effect related to liquefaction.

Impact GEO-5: Potential Structural Damage from Development on Expansive Soils

Moderate shrink-swell potential (i.e., expansive soils) in the Rincon clay loam is a limiting factor for development within the project area. Expansive soils have the potential to compromise the structural integrity of proposed new facilities (including the proposed pumping plant and new roadway). However, as part of the design process described above, the project applicants are required to implement UBC Seismic Hazard Zone 3 and CBSC standards into the project design for applicable features to minimize the potential shrink-swell hazards on associated project features. Structures must and will be designed to meet the regulations and standards associated with UBC Seismic Hazard Zone 3 hazards. Accordingly, there would be no adverse effect related to expansive soils.

Impact GEO-6: Potential Rupture of Pipelines Caused by Expansive Soils and Pipeline Corrosion

As mentioned above, moderate shrink-swell potential (i.e., expansive soils) in the Rincon clay loam is a limiting factor for development in the project area. Furthermore, the soils of the area may be highly corrosive to uncoated steel and moderately corrosive to concrete. This corrosivity poses a threat to the long-term viability of the pipelines.

The project pipelines and other facilities would be constructed to reduce the potential for corrosion and eventual failure, to the extent feasible. Measures to avoid that potential could be to:

- construct pipelines and other project facilities to withstand the effects of soil corrosion using standard and tested methods of pipeline protection, such as pipeline coating; and
- conduct regular inspections of the pipelines during operation at an interval that is in accordance with safe and standard operating practices (visual inspection or inspection with specialized equipment used to detect potential damage and leaks).

Because the project facilities would be constructed to minimize damage to pipelines from corrosion, there would be no adverse effect.

Operation

Operation of the Intertie would have no effects on geology or soils.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction

Alternative 3 is the same as Alternative 2 but would be constructed in a location just south of Alternative 2. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. As described above, environmental commitments for erosion control would be implemented. The inclusion of these environmental commitments would ensure that there are no adverse effects related to erosion.

Impact GEO-2: Potential Slope Failure along Canals Resulting from Project Construction

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. As described above, the excavated sideslopes would be shored using sheet piling, and a dewatering system would be installed outside as necessary to maintain reduced groundwater levels in the construction area. These measures would ensure the stability of the excavation, allow construction to proceed in dry conditions, and minimize slope failure.

These design features would ensure that there are no adverse effects related to slope instability.

Impact GEO-3: Potential Structural Damage and Threat to Public Safety from Fault Displacement and Ground Shaking during a Seismic Event

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. Thus, inclusion of the same environmental commitments would ensure that there would be no adverse effect related to fault displacement and ground shaking.

Impact GEO-4: Potential Structural Damage from Development on Materials Subject to Liquefaction

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. Thus, inclusion of the same environmental commitments would ensure that there would be no adverse effect related to liquefaction.

Impact GEO-5: Potential Structural Damage from Development on Expansive Soils

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. Thus, inclusion of the same environmental commitments would ensure that there would be no adverse effect related to expansive soils.

Impact GEO-6: Potential Rupture of Pipelines Caused by Expansive Soils and Pipeline Corrosion

Alternative 3 is the same as Alternative 2 but would be constructed in a different location. It is assumed that the soils and other geographic features are the same or similar. As such, this impact is the same as described for Alternative 2. The project pipelines and other facilities would be constructed to reduce the potential for corrosion and eventual failure, to the extent feasible. Because the project facilities would be constructed to minimize damage to pipelines from corrosion, there would be no adverse effect.

Operation

Operation of the Intertie would have no effects on geology or soils.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact GEO-1: Potential Short-Term Increase in Erosion Resulting from Project Construction

Alternative 4 involves the placement of an emergency temporary pipeline connecting the DMC and California Aqueduct. During placement of the pipeline, pumps, and other structures, there is an increased risk of erosion. As described above and in Chapter 2, erosion control would be implemented. Accordingly, there would be no adverse effect.

Impact GEO-3: Potential Structural Damage from Fault Displacement and Ground Shaking during a Seismic Event

If ground shaking or other consequences of a seismic event occur while the temporary pipeline is in place, there is potential for structural damage to the pipelines, pumps, and other associated structures. However, the risk for a seismic event to occur at the same time that the emergency pipeline is in place is low. Additionally, the structures are intended to be temporary and could be easily replaced if damaged. Accordingly, there would be no adverse effect.

Operation

Operation of the temporary intertie would have no effects on geology or soils.

3.5 Transportation

3.5.1 Introduction

This section describes the existing transportation conditions within the immediate project area, discloses the potential changes in transportation that could occur as a result of constructing and operating the Intertie, and recommends mitigation for substantial adverse changes. Changes in transportation are not expected to occur outside the immediate project area; therefore, regional transportation is not discussed.

This section describes: (1) the existing condition of the roadways that make up the routes that are expected to be used during project construction and the potential effects on those roadways from construction vehicles; and (2) the potential changes in capacity on those roads.

Changes in vehicle/capacity ratios and levels of service (LOS) of affected roadways, and potential impacts on LOS, were not evaluated in this document because construction impacts would be minimal and short-term; permanent changes resulting from roadway modifications and facility operations also would be minimal and would be confined to private roads currently used for O&M activities.

Additionally, aviation, navigation, and public transportation are not evaluated because the Proposed Action and alternatives would have no effect on these transportation modes. Bikeways are described and evaluated because there are paths near or in the project area.

3.5.2 Affected Environment

Sources of Information

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

- Roadway maps of the project area; and
- Information provided in Chapter 2, *Proposed Action and Alternatives*.

Roadways

The immediate project area is rural in character and generally is served by two-lane roads. The routes used to access the project area consist of major transportation facilities (Interstate 5 [I-5], Interstate 205 [I-205], Interstate 580 [I-580]); major rural circulation roads (Grant Line Road, Altamont Pass Road);

and connector roads (narrower county and private roadways). The condition of these roadways is shown in Table 3.5-1.

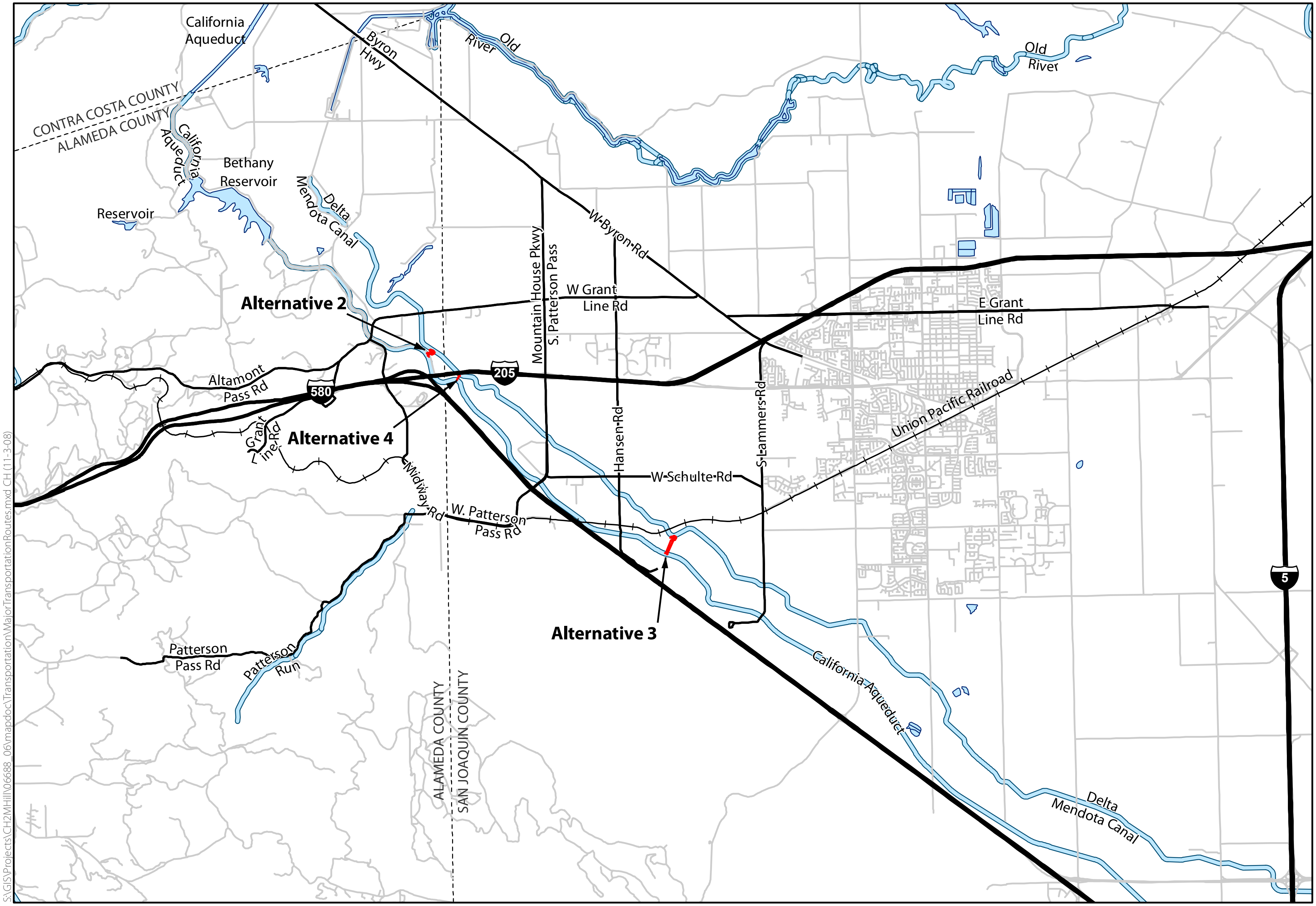
Table 3.5-1. Existing Roadway Condition of Roads Used to Access Project Area

Roadway	Number of Lanes	Shoulders	Existing Road Condition[a]
Interstate 5	6–10	Yes	Excellent
Interstate 205	4–6	Yes	Excellent
Interstate 580	8	Yes	Excellent
Grant Line Road (Alameda County)	2	No	Good/Excellent[c]
W. Grant Line Road (San Joaquin County)	2	No	Poor [b]
Altamont Pass Road	2	No	Fair/Good[c]
Midway Road	2	No	Excellent[c]
Mountain House Parkway	2	Yes	Excellent[b]
W. Patterson Pass Road—from Alameda County line to 4,120 feet east of Alameda County Line (San Joaquin County)	2	No	Very Poor[b]
W. Patterson Pass Road—from 4,120 feet east of Alameda County line to I-580 (San Joaquin County)	2	No	Excellent [b]
W. Schulte Road	4	Yes	Good
Hansen Road	2	No	Fair
Kelso Road	2	No	Fair

[a] Roadway Condition Ratings:
Excellent—pavement in good condition, exhibits good geometrics (i.e., the road is straight and it has large curves to allow cars to maintain their speed while going around the curves), and it has good shoulders.
Good—pavement in pretty good shape, some patching of the roadway, shoulders not well-maintained, road able to handle project traffic.
Fair—very patched road is starting to deteriorate, could potentially be affected by the project.
Poor—many visible potholes and would definitely be adversely affected by the project.
[b] Source: Shellie Aldama pers. comm.
[c] Source: Paul Crawford pers. comm.

These rural roads provide local access to individual properties, and access to I-580 and I-205. I-580 and I-205 are both east-west trending roadways. I-5 is just east of the project area and is a major north-south trending transportation corridor (Figure 3.5-1). Locally important roads in the project area are Grant Line Road, Altamont Pass Road, Midway Road, Patterson Pass Road, South Patterson Pass Road, and Mountain House Parkway. In addition to these public roadways, DWR and Reclamation maintain roads along the SWP and CVP, respectively, for O&M activity purposes. These roads generally run alongside the aqueducts in a north-south direction.

Access to the CVP side of the proposed Intertie from I-5 is via I-205, Grant Line Road, Midway Road, and private CVP roads. Access to the SWP side would be from SWP private roads via Midway Road. Access to the temporary pipeline,



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0 0.5 1 2 Miles

Figure 3.5-1
Major Transportation Routes

which would be installed periodically under Alternative 4, from I-580 or I-205 is via Mountain House Parkway/South Patterson Pass Road (Figure 3.5-1). The intersection of Mountain House Parkway/South Patterson Pass Road and the DMC is the only entrance to the site. At this location, the DMC operation and maintenance road (an unimproved roadway) provides the only access to the site.

Bikeways

A Class I[1] bike route, the California Aqueduct Bikeway, exists along the California Aqueduct at Bethany Reservoir in Alameda County. An additional Class II and Class III[1] bikeway extends along Midway Road, crosses the DMC and California Aqueduct, intersects I-580, and then joins a bikeway along Patterson Pass Road.

Rail

A Union Pacific rail line crosses the project study area northwest of the proposed TANC (Alternative 3) site (Figure 3.5-1).

3.5.3 Environmental Consequences

Assessment Methods

For the purposes of analysis, the types of potential transportation changes were divided into two categories: changes to roadways, safety, and roadway surface conditions as a result of truck and commute trips during construction and changes in transportation patterns caused by the creation of new roadways; and operation of the alternatives.

3.5.4 Environmental Effects

Alternative 1 (No Action)

Under the No Action alternative, there would be no new facilities constructed or operated and there would be no construction or operation effects on transportation or circulation.

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[1] Class I—a completely separated right-of-way for the exclusive use of bicycles or pedestrians with cross-flow minimized. Class II—a striped lane for one-way bike travel in each direction within the paved area (typically on the shoulder) on a street or highway. Class III—shared use of lanes with pedestrian or motor vehicle traffic (typically at the right edge of the traveled way without a bike lane stripe).

Alternative 2 (Proposed Action)

Construction Effects

Impact TN-1: Changes in Roadway Capacity as a Result of Truck and Commute Trips

Several truck trips for delivering construction materials and commute trips for construction workers would be required during construction of the Intertie and appurtenant structures. These trips would occur on both local roads (likely Grant Line Road, Altamont Pass Road and/or Mountain House Parkway/S. Patterson Pass Road, Kelso Road) and highways (I-205 and I-580). It is expected that there would be a maximum of 48 round-trip commute trips and two round-trip truck trips per day of construction. Because the regional highways are designed to accommodate high traffic volumes and the local roads are rural, it is not expected that these commute and truck trips would result in a substantial change in circulation. However, as part of the environmental commitments described in Chapter 2, a Traffic Control Plan would be implemented to minimize the potential for road hazards, maintain access for emergency services, and maintain access for landowners adjacent to affected areas. Incorporation of this environmental commitment would ensure that there would be no adverse effects on roadway capacity.

Impact TN-2: Damage to Roadways during Construction

The operation of heavy construction vehicles and equipment on rural roads could result in damage to roadways during construction. During construction of project components (e.g., pumping plant and intake structure, California Aqueduct turnout, pipeline and pipeline structures) various materials would be transported to the construction area in load-bearing trucks. Haul routes would be limited to major roads where feasible. In general, roadways used for hauling construction materials to the Alternative 2 site are assumed to include I-205, I-580, Grant Line Road, Altamont Pass Road, Kelso Road, Mountain House Parkway/S. Patterson Pass Road, and the DMC access road. Major highways such as I-205 and I-580 are designed to handle wear from large vehicles. However, local roadways may not be, and damage may occur during construction of the Intertie. As described in Chapter 2, if damage to the local roadways occurs as a result of the truck trips, Reclamation will compensate for that damage. Therefore, no adverse effects are expected to occur.

Impact TN-3: Disruption to Bikeways during Construction

Construction equipment may need to traverse designated bikeways. This could result in minor temporary disruptions to the bikeways. This disruption would affect primarily the California Aqueduct Bikeway. As described in Chapter 2, a Traffic Control Plan would be implemented to ensure continued safety on roadways and bikeways. Additionally, construction would occur over a period of

12 to 15 months, 6 days a week, and overall bike path usage is minimal during weekdays. No adverse effects on bike paths would occur.

Operation Effects

Impact TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility

New roadways and existing roadway improvements would be constructed to accommodate the construction equipment necessary for Intertie construction. This would result in an improvement to the overall transportation system in the local area. However, because this area is rural, it is not expected that these changes would result in substantial changes in roadway patterns or circulation.

Operation of the Intertie may require vehicular trips to the Intertie during its initial start-up phases. Approximately one trip would occur every week. Once the Intertie is able to function remotely, only routine maintenance trips would be necessary. These rare trips would not result in any substantial changes to the circulation patterns on existing roadways, and there would be no adverse effect.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact TN-1: Changes in Roadway Capacity as a result of Truck and Commute Trips

Under Alternative 3, the changes in roadway capacity during construction activities would be similar to impacts identified for Alternative 2. Similar to Alternative 2, several truck trips would be required to deliver construction materials, and commute trips for construction workers would be required during construction of the TANC Intertie and appurtenant structures. These trips would occur on both local roads and highways. Local roads used to access the TANC Intertie site could include Mountain House Parkway/S. Patterson Pass Road, Hansen Road, and W. Schulte Road. It is expected that there would be no more than 48 commute trips daily and no more than 2 daily truck trips. Because the regional highways are designed to accommodate high traffic volumes and the local roads are rural, it is not expected that these commute and truck trips would result in a substantial change in circulation. Implementation of a Traffic Control Plan (described in Chapter 2) would ensure that there would be no adverse effects on roadway capacity.

Impact TN-2: Damage to Roadways during Construction

Under Alternative 3, damage to roadway surfaces from construction activities would be similar to impacts identified for Alternative 2. However, with the exception of I-205, I-280, and Mountain House Parkway/S. Patterson Pass Road, the roadways used for hauling construction materials would be different. Local roadway haul routes would likely include Hansen Road and W. Schulte Road. Should damage to local roadways occur as a result of truck trips, Reclamation will compensate for that damage (refer to Traffic Control Plan, Chapter 2). Therefore, no adverse effects are expected to occur.

Impact TN-3: Disruption to Bikeways during Construction

Under Alternative 3, minor temporary disruptions to bikeways could result from construction-related trucks using roadways. As described in Chapter 2, a Traffic Control Plan would be implemented to ensure continued safety on roadways and bikeways. Construction would occur over a period of 12 to 15 months, and overall bike path usage in the area is minimal during weekdays. No adverse effects on bike paths would occur.

Impact TN-5: Disruption of Railroad Line or Service during Construction

Alternative 3 is located just south of an existing Union Pacific rail line, and the associated transmission line would cross the railroad to connect to the Tracy substation. As described in Chapter 2, Reclamation would consult with Union Pacific to ensure that adequate vertical clearance from the transmission line is established and that no ground-disturbing activities occur within the railroad right-of-way or in areas determined to be unsafe. It is not expected that rail service would be disrupted as construction of the transmission line would be timed to avoid such effects. With the incorporation of measures outlined in the permit and through consultation with Union Pacific, it is not expected that there would be any adverse effects on the railroad line or service.

Impact TN-6: Disruption to I-205 during Construction

Installation of the segment of transmission line crossing I-205 could result in temporary disruptions to traffic on I-205. As described in Chapter 2, as part of the Traffic Control Plan, Reclamation would coordinate with Caltrans and the California Highway Patrol prior to and during installation of this segment of the transmission line to avoid or minimize adverse effects to I-205 traffic circulation, especially during peak travel times. Additionally, Implementation of Mitigation Measure TN-MM- would reduce any adverse effects to traffic circulation on I-205.

Mitigation Measure TN-MM-1: Non-Peak Hour Installation of I-205 Transmission Line Segment

Using non-peak hour scheduling for delivery of equipment and materials, as well as for construction activities associated with the installation of the transmission line segment crossing I-205, would reduce the potential for project-related traffic congestion on I-205.

Operation Effects

Impact TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility

Under Alternative 3, changes in transportation patterns from facility operations would be similar to the impacts identified for Alternative 2, except the roadways created under Alternative 3 would be different and different roadways would be used to access the facility for routine maintenance. Similar to Alternative 2, operation of the TANC Intertie may require vehicle trips to the facility during its initial start-up phases. Approximately one trip would occur every week. Once the TANC Intertie is able to function remotely, only routine maintenance trips would be necessary. These occasional trips would not result in any substantial changes to the circulation patterns on existing roadways, and there would be no adverse effect.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact TN-1: Changes in Roadway Capacity as a Result of Truck and Commute Trips

When the temporary pipeline is installed under this alternative, some truck trips and commute trips for construction workers would be required. These trips would occur on both local roads and highways (I-205 and I-580). The intersection of the Mountain House Parkway/S. Patterson Pass Road and the DMC (Figure 3.5-1) provides the only entrance to the site.

It is not expected that the installation of the temporary pipeline will require a substantial number of trips. Because the regional highways are designed to accommodate high traffic volumes and Mountain House Parkway/S. Patterson Road south of I-205 is rural, it is not expected that these commute and truck trips would result in a substantial change in circulation. However, as part of the environmental commitments, described in Chapter 2, a Traffic Control Plan would be implemented to ensure that safety on these roadways is maintained; incorporation of this environmental commitment would ensure that there would be no adverse effect on roadway capacity.

Impact TN-2: Damage to Roadways during Construction

The operation of heavy construction vehicles and equipment on rural roads could result in damage to roadways during construction. However, activities associated with the installation of the temporary intertie likely would occur over a period of 5 to 7 days and would occur infrequently. Additionally, should damage to local roadways occur as a result of truck trips, Reclamation will compensate for that damage (refer to Traffic Control Plan, Chapter 2). Therefore, there would be no adverse effect.

Impact TN-3: Disruption to Bikeways during Construction

Minor temporary disruptions to bikeways could result from construction-related trucks using roadways. As described in Chapter 2, a Traffic Control Plan would be implemented to ensure continued safety on roadways and bikeways. Construction would occur over a period of 12 to 15 months, and overall bike path usage in the area is minimal during weekdays. No adverse effects on bike paths would occur.

Operation Effects

Impact TN-4: Changes in Transportation Patterns Caused by the Creation of New Roadways and Operation of the Intertie Facility

Once installed, operation of the temporary Intertie would require a daily vehicle trip in order to refuel the fuel storage tanks of the pumps. It is possible that occasional vehicle trips may be required for inspection and maintenance of the temporary intertie; however, neither these rare trips nor the daily refueling trips would result in any substantial changes to the circulation patterns on existing roadways, and there would be no adverse effect.

3.6 Air Quality

3.6.1 Introduction

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

3.6.2 Affected Environment

The Intertie would be located within the boundary of Alameda County, which is in the San Francisco Bay Area Air Basin (SFBAAB). The primary factors that determine air quality are the locations of air pollutant sources, the amount of pollutants emitted, and meteorological and topographical conditions affecting their dispersion. Atmospheric conditions, including wind speed, wind direction, and air temperature gradients, interact with the physical features of the landscape to determine the movement and dispersal of air pollutants. The following paragraphs briefly describe the existing environment as it relates to climate, meteorological conditions, and ambient air quality conditions.

Sources of Information

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

- ARB Databases: Aerometric Data Analysis and Management System (ADAM) (California Air Resources Board 2008b),
- AirData (U.S. Environmental Protection Agency 2008), and
- 40 CFR 51.853.

Climate and Topography

The Delta is transitional between the coastal and inland climatic extremes. The topography of the Delta is characterized as two distinct geographic components: the lowlands and the uplands. The lowlands consist of generally flat lands ranging in elevation from below sea level to about 10 feet above mean sea level, and the uplands, a gently sloping alluvial plain rising from about 10 to 100 feet above mean sea level. Some lands in the central and western Delta are more than 15 feet below sea level. The effects of the local topography and the continuous interaction of maritime and continental air masses provide a varied climate.

The prevailing winds in the Bay Area during summer are from the west and northwest, reinforced by an inland movement of air caused by the solar heating of the air masses in the Central Valley. This heating effect is greatest during the day and causes a marked diurnal, as well as a seasonal, pattern in wind speed. These prevailing winds are strongest at Carquinez Strait. In the Delta, such winds often blow continuously day and night and are generally from the west-southwest. Winds reach peak speeds of 10–15 miles per hour in the early evening. The summer air flow at Stockton is also strongest in the afternoon and throughout the day and generally blows from the west-northwest.

The topography and climate have great effects on the area's air quality. Relatively light winds, surrounding higher terrain, and frequent warm temperatures are conducive to the creation of ozone. In winter months, high atmospheric stability, calm winds, and cold temperatures combine to create ideal conditions for the buildup of pollutants such as carbon monoxide (CO) and particulate matter (particulate matter smaller than 10 microns or less in diameter [PM10] and particulate matter 2.5 microns or less in diameter [PM2.5]).

Criteria Pollutants

The federal and state governments have established ambient air quality standards for the following six criteria pollutants: ozone, CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM10 and PM2.5), and lead. Ozone, NO_2, and particulate matter generally are considered to be regional pollutants, as these pollutants or their precursors affect air quality on a regional scale. Pollutants such as CO, SO_2, lead, and particulate matter are considered to be local pollutants that tend to accumulate in the air locally. In the Proposed Action area, CO, PM10 and ozone are considered pollutants of concern. Toxic air contaminants are also discussed below, although no state or federal ambient air quality standards exist for these pollutants. Brief descriptions of these pollutants are provided below, and a complete summary of California ambient air quality standards (CAAQS) and national ambient air quality standards (NAAQS) is provided in Table 3.6-1.

Table 3.6-1. Ambient Air Quality Standards Applicable in California

			Standard (ppm)		Standard (μg/m^3)		Violation Criteria	
Pollutant	Symbol	Average Time	California	National	California	National	California	National
Ozone*	O_3	1 hour	0.09	NA	180	NA	If exceeded	NA
		8 hours	0.070	0.075	137	147	If exceeded	If fourth highest 8-hour concentration in a year, averaged over 3 years, is exceeded at each monitor within an area
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
(Lake Tahoe only)		8 hours	6	NA	7,000	NA	If equaled or exceeded	NA
Nitrogen dioxide	NO_2	Annual arithmetic mean	0.030	0.053	57	100	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.18	NA	339	NA	If exceeded	NA
Sulfur dioxide	SO_2	Annual arithmetic mean	NA	0.030	NA	80	NA	If exceeded
		24 hours	0.04	0.14	105	365	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.25	NA	655	NA	If exceeded	NA
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	If equaled or exceeded	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.01	NA	26	NA	If equaled or exceeded	NA
Inhalable particulate matter	PM10	Annual arithmetic mean	NA	NA	20	NA	NA	NA
		24 hours	NA	NA	50	150	If exceeded	If exceeded on more than 1 day per year
	PM2.5	Annual arithmetic mean	NA	NA	12	15	NA	If 3-year average from single or multiple community-oriented monitors is exceeded
		24 hours	NA	NA	NA	35	NA	If 3-year average of 98th percentile at each population-oriented monitor within an area is exceeded
Sulfate particles	SO_4	24 hours	NA	NA	25	NA	If equaled or exceeded	NA
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	If exceeded no more than 1 day per year
		30-day average	NA	NA	1.5	NA	If equaled or exceeded	NA
		Rolling 3-Month average	NA	NA	NA	0.15	If equaled or exceeded	Averaged over a rolling 3-month period

Notes: All standards are based on measurements at 25ºC and 1 atmosphere pressure. National standards shown are the primary (health effects) standards.
NA = not applicable.

* The EPA recently replaced the 1-hour ozone standard with an 8-hour standard of 0.08 part per million. The EPA issued a final rule that revoked the 1-hour standard on June 15, 2005. However, the California 1-hour ozone standard will remain in effect.

Source: California Air Resources Board 2008a.

Ozone

Ozone is a respiratory irritant that increases susceptibility to respiratory infections. It is also an oxidant that can cause substantial damage to vegetation and other materials. Ozone is a severe eye, nose, and throat irritant. Ozone also attacks synthetic rubber, textiles, plants, and other materials. Ozone cause causes extensive damage to plants by leaf discoloration and cell damage.

Ozone is not emitted directly into the air but is formed by a photochemical reaction in the atmosphere. Ozone precursors—reactive organic gases (ROG) and oxides of nitrogen (NO_X)—react in the atmosphere in the presence of sunlight to form ozone. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, ozone is primarily a summer air pollution problem. The ozone precursors, ROG and NO_X, are emitted mainly by mobile sources and by stationary combustion equipment.

Carbon Monoxide

CO is essentially inert to plants and materials but can have significant effects on human health. CO is a public health concern because it combines readily with hemoglobin and reduces the amount of oxygen transported in the bloodstream. CO can cause health problems such as fatigue, headache, confusion, dizziness, and even death.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light winds combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

Inhalable Particulates

Particulates can damage human health and retard plant growth. Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates also reduce visibility and corrode materials. Particulate emissions are generated by a wide variety of sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic and construction equipment, and secondary aerosols formed by reactions in the atmosphere.

Toxic Air Contaminants

Toxic air contaminants (TACs) are pollutants that may be expected to result in an increase in mortality or serious illness or that may pose a present or potential hazard to human health. Health effects of TACs include cancer, birth defects, neurological damage, damage to the body's natural defense system, and diseases that lead to death. In October 2000, California Air Resources Board (ARB) identified diesel exhaust particulate matter as a TAC.

Existing Air Quality Conditions

Monitoring Data

Existing air quality conditions in the project area can be characterized in terms of the ambient air quality standards that the federal and state governments have established for various pollutants (Table 3.6-2) and by monitoring data collected in the region. Monitoring data concentrations typically are expressed in terms of ppm or $\mu g/m^3$. The nearest air quality monitoring stations in the vicinity of the project area that have2005–2007 data are the Tracy-Airport monitoring station and the Stockton–Hazelton Street monitoring station. The Tracy-Airport station monitors ozone, and the Stockton-Hazelton station monitors ozone, CO, PM10 and PM2.5. Air quality monitoring data from these stations are summarized in Table 3.6-2. These data represent air quality monitoring for the last 3 years (2005–2007) in which complete data are available.

As shown in Table 3.6-2, the Tracy-Airport monitoring station has experienced 26 violations of the state 1-hour ozone standard, and 44 violations of the national 8-hour ozone standard. The Stockton-Hazelton Street station has experienced no violations of the federal PM10 standard, 132.9 violations of the state PM10 standard, and 69.7 violations of the national PM2.5 standard. While these monitoring stations are located in San Joaquin County, they were used because they represent the nearest monitoring stations that have the same physical characteristics as the action area. The nearest monitoring station in Alameda County is located in Livermore. However, the Altamont Hills separate Livermore from the project area, so air quality conditions at the Livermore station would not be representative of conditions in the action area.

Table 3.6-2. Ambient Air Quality Monitoring Data Measured at the Tracy-Airport Monitoring Station and the Stockton–Hazelton Street Monitoring Station

Pollutant Standards	2005	2006	2007
Ozone (Tracy-Airport Station)			
Maximum 1-hour concentration (ppm)	0.121	0.097	0.123
Maximum 8-hour concentration (ppm)	0.103	0.083	1.103
Number of days standard exceeded[a]			
NAAQS 1-hour (>0.12 ppm)	0	0	0
CAAQS 1-hour (>0.09 ppm)	14	1	11
NAAQS 8-hour (>0.08 ppm)	22	6	16
Carbon Monoxide (CO) (Stockton-Hazelton St. Station)			
Maximum 8-hour concentration (ppm)	2.86	2.25	2.31
Maximum 1-hour concentration (ppm)	4.3	4.4	3.6
Number of days standard exceeded[a]			
NAAQS 8-hour (≥9.0 ppm)	0	0	0
CAAQS 8-hour (≥9.0 ppm)	0	0	0
NAAQS 1-hour (≥35 ppm)	0	0	0
CAAQS 1-hour (≥20 ppm)	0	0	0
Particulate Matter (PM10)[b] (Stockton-Hazelton St. Station)			
National[c] maximum 24-hour concentration (µg/m³)	79.0	82.0	71.0
National[c] second-highest 24-hour concentration (µg/m³)	76.0	80.0	68.0
State[d] maximum 24-hour concentration (µg/m³)	84.0	85.0	75.0
State[d] second-highest 24-hour concentration (µg/m³)	79.0	85.0	73.0
National annual average concentration (µg/m³)	28.9	32.6	26.6
State annual average concentration (µg/m³)[e]	29.8	33.4	27.7
Number of days standard exceeded[a]			
NAAQS 24-hour (>150 µg/m³)[f]	0	0	0
CAAQS 24-hour (>50 µg/m³)[f]	46.5	62.9	23.5
Particulate Matter (PM2.5) (Stockton-Hazelton St. Station)			
National[c] maximum 24-hour concentration (µg/m³)	63.0	47.0	52.0
National[c] second-highest 24-hour concentration (µg/m³)	46.0	47.0	50.0
State[d] maximum 24-hour concentration (µg/m³)	70.0	53.3	66.8
State[d] second-highest 24-hour concentration (µg/m³)	68.0	51.7	59.4
National annual average concentration (µg/m³)	12.5	13.1	12.9
State annual average concentration (µg/m³)[e]	12.5	13.5	13.5
Number of days standard exceeded[a]			
NAAQS 24-hour (>65 µg/m³)	14.8	20.8	34.1

Sources: California Air Resources Board 2008b; U.S. Environmental Protection Agency 2008.
CAAQS = California ambient air quality standards. NAAQS = national ambient air quality standards.

[a] An exceedance is not necessarily a violation.

[b] Measurements usually are collected every 6 days.

[c] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.

[d] State statistics are based on local conditions data, except in the South Coast Air Basin, for which statistics are based on standard conditions data. In addition, State statistics are based on California approved samplers.

[e] State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.

[f] Mathematical estimate of how many days concentrations would have been measured as higher than the level of the standard had each day been monitored.

Air Quality Standards and Attainment Status

The federal and state governments have established ambient air quality standards for seven criteria pollutants: ozone, CO, NO_2, SO_2, PM10, PM2.5, and lead. Ozone, PM10, and PM2.5 generally are considered regional pollutants because they or their precursors affect air quality on a regional scale. Pollutants such as CO, NO_2, SO_2, PM10, PM2.5, and lead are considered local pollutants that tend to accumulate in the air locally. In the area where the proposed project site is located, suspended particulate matter is a primary concern.

The EPA has classified Alameda County as an extreme nonattainment area with regard to the federal 1-hour ozone standard under 23 USC Sec. 104 (b)(2) and a marginal nonattainment area with regard to the federal 8-hour ozone standard. The EPA revoked the 1-hour ozone standard on June 15, 2005. The EPA has classified Alameda County as a moderate (≤ 12.7 ppm) maintenance area for the federal CO standard and an unclassified/attainment area with regard to the federal PM10 and PM2.5 standards.

ARB has classified Alameda County as a serious nonattainment area for the state 1-hour ozone standard and an attainment area for the state CO standard. ARB has classified Alameda County as a nonattainment area for the state PM10 and PM2.5 standards.

Sensitive Receptors

Sensitive populations (sensitive receptors) are more susceptible to the effects of air pollution than is the population at large. Sensitive receptors that are near localized sources of toxics and CO are of particular concern. For the purposes of impact assessment, the definition of sensitive receptors typically is expanded to include residences, playgrounds, rehabilitation centers, and athletic facilities. The closest residence is at least 2,000 feet away from the site of the Proposed Action.

Regulatory Setting

Federal

Federal Clean Air Act

The federal Clean Air Act (CAA), promulgated in 1970 and amended twice thereafter (including the 1990 amendment), establishes the framework for modern air pollution control. The act directs the EPA to establish ambient air standards for six pollutants: ozone, CO, lead, NO_2, particulate matter, and SO_2. The standards are divided into primary and secondary standards; the former are set to protect human health within an adequate margin of safety and the latter to protect environmental values, such as plant and animal life.

The primary legislation that governs federal air quality regulations is the Clean Air Act Amendments of 1990 (CAAA). The CAAA delegates primary responsibility for clean air to the EPA. The EPA develops rules and regulations to preserve and improve air quality, as well as delegating specific responsibilities to state and local agencies.

Federal Conformity Requirements

The CAAA require that all federally funded projects come from a plan or program that conforms to the appropriate State Implementation Plan (SIP). Federal actions are subject to either the transportation conformity rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the general conformity rule.

The purpose of the general conformity rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the NAAQS. The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants and in some areas designated as maintenance areas. The rule applies to all federal projects except:

- programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule,
- projects with associated emissions below specified *de minimis* threshold levels, and
- certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed action's total direct and indirect emissions fail to meet the following two conditions:

- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are below the *de minimis* levels indicated in Tables 3.6-3 and 3.6-4, and
- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant). Emissions inventory data were obtained from the ARB's Emissions Inventory database (California Air Resources Board 2009).

If the two conditions above are not met, a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

However, if the above two conditions are met, the requirements for general conformity do not apply, as the proposed action is presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required.

Table 3.6-3. Federal *de Minimis* Threshold Levels for Criteria Pollutants in Nonattainment Areas

Pollutant	Emission Rate (Tons per Year)
Ozone (VOC or NO_X)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Other ozone nonattainment areas outside an ozone transport region	**100**
Marginal and moderate nonattainment areas inside an ozone transport region	
VOC	50
NO_X	100
CO: All nonattainment areas	100
SO_2 or NO_2: All nonattainment areas	100
PM10	
Moderate nonattainment areas	100
Serious nonattainment areas	70
Pb: All nonattainment areas	25

Source: 40 CFR 51.853.

Note: *de minimis* threshold levels for conformity applicability analysis. Bolded text indicates pollutants for which the region is in nonattainment, and a conformity determination must be made.

Table 3.6-4. Federal *de Minimis* Threshold Levels for Criteria Pollutants in Maintenance Areas

Pollutant	Emission Rate (Tons per Year)
Ozone (NO_X), SO_2 or NO_2	
All maintenance areas	100
Ozone (VOCs)	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100
CO: All maintenance areas	**100**
PM10: All maintenance areas	100
Pb: All maintenance areas	25

Source: 40 CFR 51.853.

Note: *de minimis* threshold levels for conformity applicability analysis. Bolded text indicates pollutants for which the region is a maintenance area, and a conformity determination must be made.

Ozone Attainment Plan

The Ozone Attainment Plan (OAP) is the Bay Area's portion of California's SIP to achieve the national ozone standard.

In 1999 the Bay Area Air Quality Management District (BAAQMD), ABAG, and the Metropolitan Transportation Commission (MTC) adopted the 1999 OAP, which was submitted to the ARB in June 1999. The 1999 OAP was approved by the ARB in July 1999 and was then submitted to the EPA for approval. The EPA proposed to partially approve and partially disapprove (the reasonably available control measures [RACM] demonstration, the attainment demonstration, and the motor vehicle emissions budgets [MVEBs]) portions of the 1999 OAP on March 30, 2001. This disapproval action by the EPA started a sanctions clock, and the Bay Area became subject to the imposition of a 2 to 1 offset sanction.

In response, the BAAQMD, ABAG, and MTC began preparation of the 2001 OAP to correct the deficiencies in the 1999 OAP. On October 24, 2001, the BAAQMD, ABAG, and MTC adopted the 2001 OAP. The 2001 OAP was approved by the ARB on November 1, 2001, and submitted to the EPA for approval as a revision to the California SIP on November 30, 2001. The 2001 OAP included two commitments for further planning—a commitment to conduct a mid-course review of progress toward attaining the national 1-hour ozone standard by December 2003, and a commitment to provide a revised ozone attainment strategy to the EPA by April 2004. On April 22, 2004, the EPA approved the following elements of the 2001 OAP: emissions inventory; RACM; commitments to adopt and implement specific control measures; MVEBs; and commitments for further study measures. The EPA's approval of RACM and the MVEBs in the 2001 OAP terminates the sanctions clock for those plan elements.

The EPA made a final finding in April 2004 that the BAAQMD had attained the national 1-hour ozone standard. As a result, certain planning commitments outlined in the 2001 OAP no longer were required. While the EPA has prepared a finding of attainment for the region, the Bay Area has not been formally reclassified as an attainment area for the 1-hour standard. In order to be reclassified as an attainment area, the region must submit a redesignation request to the EPA.

State

Responsibility for achieving California's standards, which are more stringent than federal standards, is placed on the ARB and local air districts and is to be achieved through district-level air quality management plans that will be incorporated into the SIP. In California, the EPA has delegated authority to prepare SIPs to the ARB, which, in turn, has delegated that authority to individual air districts.

The ARB traditionally has established state air quality standards, maintaining oversight authority in air quality planning, developing programs for reducing emissions from motor vehicles, developing air emission inventories, collecting air quality and meteorological data, and approving SIPs.

Responsibilities of air districts include overseeing stationary source emissions, approving permits, maintaining emissions inventories, maintaining air quality stations, overseeing agricultural burning permits, and reviewing air quality–related sections of environmental documents required by CEQA.

California Clean Air Act

The California Clean Air Act (CCAA) of 1988 substantially added to the authority and responsibilities of air districts. The CCAA designates air districts as lead air quality planning agencies, requires air districts to prepare air quality plans, and grants air districts authority to implement transportation control measures. The CCAA focuses on attainment of the CAAQS, which, for certain pollutants and averaging periods, are more stringent than the comparable federal standards.

The CCAA requires designation of attainment and nonattainment areas with respect to CAAQS. The CCAA also requires that local and regional air districts expeditiously adopt and prepare an air quality attainment plan if the district violates state air quality standards for CO, SO_2, NO_2, or ozone. These clean air plans are designed specifically to attain these standards and must be designed to achieve an annual 5% reduction in district-wide emissions of each nonattainment pollutant or its precursors. No locally prepared attainment plans are required for areas that violate the state PM10 standards.

The CCAA requires that the CAAQS be met as expeditiously as practical but, unlike the federal CAA, does not set precise attainment deadlines. Instead, the act established increasingly stringent requirements for areas that will require more time to achieve the standards.

Local

Bay Area Clean Air Plan

The Bay Area Clean Air Plan (CAP) is a plan to reduce ground-level ozone levels in the San Francisco Bay Area and attain the state 1-hour ozone standard. It was developed by the BAAQMD, in cooperation with ABAG and MTC, in response to the CCAA of 1988, as amended. The CCAA requires all air districts exceeding the state ozone standard to reduce pollutant emissions by 5% per year, calculated from 1987, or achieve emission reductions through all feasible measures. The CCAA further requires that the CAP be updated every 3 years. As the Bay Area attained the state CO standard in 1993, the CCAA planning requirements for CO nonattainment areas no longer apply to the Bay Area. The first CAP, prepared in 1991, includes a comprehensive strategy to reduce air pollutant emissions by focusing on control measures to be implemented during the periods from 1991 to 1994 and 1995 through 2000 and beyond.

The update to the 1991 CAP, the 1994 CAP, continues the comprehensive strategy established by the 1991 CAP and continues its goals of reducing health impacts from ozone levels above the state ambient standard to compliance with the CCAA. The 1994 CAP has eight new proposed control measures for stationary and mobile source in addition to changes in the organization and scheduling some of the control measures from the 1991 CAP. The control measures proposed in the 1994 CAP constitute all feasible ozone-reducing measures in the Bay Area. In addition, the 1994 CAP projects pollutant trends and possible control activities beyond 1997.

The BAAQMD adopted the most recent update of the CAP on December 20, 2000. It is the third triennial update of the district's original 1991 CAP. The 2000 CAP reviews control strategies to ensure that "all feasible measures" to reduce ozone are incorporated into the CAP. In addition, the 2000 CAP updates the district's emission inventory, estimates emission reductions resulting from the CAP, and assesses air quality trends in the region.

New Source Review

The BAAQMD adopted the New Source Review (Regulation 2 Rule 2) on June 15, 2005. The purpose of this rule is to provide for the review of new and modified sources and provide mechanisms, including the use of Best Available Control Technology (BACT), Best Available Control Technology for Toxics (TBACT), and emission offsets, by which authority to construct such sources may be granted. Projects in excess of 35 tons per year of ROG or NO_X emissions must offset these emissions on at a 1.15 to 1.0 ratio. Projects in excess of 15 tons per year of PM10 emissions must offset emissions increases in excess of 1.0 tons per year at a 1.0 to 1.0 ratio.

New Source Review of Toxic Air Contaminants

The BAAQMD adopted the New Source Review of Toxic Air Contaminants (Regulation 2 Rule 5) on June 15, 2005. The purpose of this rule is to evaluate potential public exposure and health risk, to mitigate potentially significant health risks resulting from these exposures, and to provide net health risk benefits by improving the level of control when existing sources are modified or replaced. The rule applies preconstruction permit review to new and modified sources of TACs and contains health risk limits and requirements for TBACT.

According to this rule, a project applicant must apply TBACT to any new or modified source of TACs where the source risk is a cancer risk greater than 1.0 in 1 million, and/or a chronic hazard index greater than 0.20. In addition, an

Authority to Construct or Permit to Operate will be denied for any new modified source of TACs if the project risk exceeds any of the following project risk limits:

- A cancer risk of 10.0 in one million,
- A chronic hazard index of 1.0, or
- An acute hazard index of 1.0.

3.6.3 Environmental Consequences

Assessment Methods

Construction of the Intertie would generate pollutant emissions from a variety of emission sources and activities. All phases of project construction—project mobilization, site preparation, site clearing and grubbing, and construction of the pipelines—would generate air emissions.

The primary pollutant-generating activities associated with these phases include:

- exhaust emissions from off-road construction vehicles and equipment;
- exhaust emissions from vehicles used to deliver supplies to the project site or to haul materials from the site;
- exhaust emissions from worker commute trips;
- fugitive dust from excavation of the pipe alignment; and
- fugitive dust from equipment operating on exposed earth and from the handling of sand, gravel, aggregate, and associated construction materials.

Construction of the Intertie may generate considerable air emissions. Terrestrial construction-related emissions are generally short-term but still may cause adverse air quality impacts. PM10 is the pollutant of greatest concern with respect to terrestrial construction activities. PM10 emissions can result from a variety of construction activities, including excavation, grading, demolition, vehicle travel on paved and unpaved roads, and emission of vehicle and equipment exhaust. Terrestrial construction-related emissions of PM10 can vary greatly depending on the level of activity, the specific operations taking place, the equipment being operated, local soils, weather conditions, and other factors. Construction-related emissions can cause substantial increases in localized concentrations of PM10. Particulate emissions from construction activities can lead to adverse health effects, as well as nuisance concerns such as reduced visibility and soiling of exposed surfaces.

General Conformity

Because the proposed action is being pursued by Reclamation, preparation of a General Conformity Analysis is required. As such, a quantitative evaluation of construction emissions was conducted.

The quantification of construction emissions was performed using the URBEMIS 2007 (Version 9.24) model. URBEMIS 2007 relies on ARB, EPA, and air district emission factors to estimate typical emissions (construction, area source, and vehicular) associated with land use development projects. This ARB-approved model is widely recommended and used by many California air districts for calculating emissions from a variety of projects.

3.6.4 Environmental Effects

Alternative 1 (No Action)

Under the No Action Alternative, the Intertie would not be constructed or operated. There would be no effects on air quality.

Alternative 2 (Proposed Action)

Construction Effects

Impact AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities

Project construction would result in short-term emissions of diesel exhaust from on-site heavy-duty equipment. Construction of the project would result in the generation of diesel PM emissions from the use of off-road diesel equipment required for site grading and excavation, paving, and other construction activities.

Various construction activities are anticipated to involve the operation of diesel-powered equipment. In October 2000, the ARB identified diesel exhaust as a TAC. Cancer health risks associated with exposures to diesel exhaust typically are associated with chronic exposure, in which a 70-year exposure period often is assumed. Although elevated cancer rates can result from exposure periods of less than 70 years, acute exposure (i.e., exposure periods of 2 to 3 years) to diesel exhaust typically are not anticipated to result in an increased health risk because acute exposure typically does not result in the exposure to concentrations that result in a health risk. No adverse change in health associated with exposure to diesel exhaust from project construction is anticipated because construction activities would occur over approximately 9 months and in phases at different locations throughout the site, rather than being concentrated in any one location for a long period. Therefore, the project would not result in long-term emissions of diesel exhaust at any one location on the project site. In addition, the nearest sensitive receptor would be located in excess of 2,000 feet from construction activities, and this would help to limit and minimize any exposure to diesel exhaust from construction activities. There would be no adverse effect.

Impact AQ-2: Comply with General Conformity

As shown in Table 3.6-5 below, Alternative 2 would result in a net increase in ROG, NO_X, CO, PM10, and CO_2 emissions. However, these increases in emissions are below the federal *de minimis* threshold levels, as well as the regionally significant threshold. Consequently, implementation of Alternative 2 is found to be a conforming project, and there would be no adverse effect.

Table 3.6-5. Alternative 2 Emissions for 2009 (Tons per Year)

Component	ROG	NO_X	CO	PM10	CO_2 (metric tons)
Grading for Pumping Plant and Intake Structure	0.13	1.14	0.46	0.24	110.43
Construction of Pumping Plant and Intake Structure	0.90	8.26	3.02	0.35	768.80
Grading for California Aqueduct Turnout Structure	0.07	0.53	0.25	0.06	51.40
Construction of California Aqueduct Turnout Structure	0.35	3.24	1.19	0.14	301.83
Grading for Pipeline	0.03	0.25	0.10	0.06	26.01
Grading for Transmission Line	0.05	0.47	0.15	0.82	42.88
Installation of Pipeline	0.10	0.80	0.37	0.04	81.18
Installation of Transmission Line	0.35	3.18	1.16	0.13	296.13
Coating of California Aqueduct Turnout Structure	0.00	0.00	0.00	0.00	0.00
Coating of Pumping Plant and Intake Structure	0.00	0.00	0.00	0.00	0.00
Final Site Grading	0.01	0.09	0.05	0.30	7.11
Construct Roads and Parking Lot	0.05	0.41	0.19	0.02	40.34
Total Emissions	2.04	18.38	6.94	2.16	1,726.13
Federal *de minimis* Threshold Levels	100	100	100	NA	NA
Regionally Significant Threshold (10% threshold)	13,475.8	17,958.0	70,404.9	7,767.2	NA

Operation Effects

Alternative 2 would require the use of four electrically powered pumps for water conveyance. However, these pumps will be powered by the transmission line that hooks into Tracy Substation, which delivers power from Reclamation's hydroelectric plants on upstream reservoirs. There would be no operational effects on air quality as a result of this alternative.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities

Construction of the Alternative 3 Intertie would be similar to what was described for Alternative 2. The only difference is that there are scattered rural residences located within ¼ mile of this location, and this alternative may take slightly longer to construct as the pipeline is longer in this location. As stated above, health impacts associated with exposure to diesel exhaust from project construction are not anticipated to be substantial because construction activities would occur over a short period of time and in phases at different locations throughout the site, rather than being concentrated in any one location for a long period. Therefore, the project would not result in long-term emissions of diesel exhaust at any one location on the project site. There would be no adverse effect.

Impact AQ-2: Comply with General Conformity

Construction of the Alternative 3 Intertie would be the similar to what was described for Alternative 2. However, the pipeline component of Alternative 3 is longer than the pipeline that would be installed under Alternative 2, and therefore would have a slightly longer construction schedule for that phase. As shown in Table 3.6-6 below, Alternative 3 would result in a net increase in ROG, NO_X, CO, PM10, and CO_2 emissions. However, these increases in emissions are below the federal *de minimis* threshold levels and the regionally significant threshold. Consequently, implementation of Alternative 3 is found to be a conforming project, and there would be no adverse effect.

Table 3.6-6. Alternative 3 Emissions for 2009 (Tons per Year)

Component	ROG	NO_X	CO	PM10	CO_2 (metric tons)
Grading for Pumping Plant and Intake Structure	0.13	1.14	0.46	0.24	110.43
Construction of Pumping Plant and Intake Structure	0.90	8.26	3.02	0.35	768.80
Grading for California Aqueduct Turnout Structure	0.07	0.53	0.25	0.06	51.41
Construction of California Aqueduct Turnout Structure	0.35	3.24	1.19	0.14	301.83
Grading for Pipeline	0.11	0.99	0.42	0.64	104.04
Grading for Transmission Line	0.1	0.94	0.3	1.64	85.76
Installation of Pipeline	0.24	1.97	0.90	0.09	199.04
Installation of Transmission Line	0.7	6.36	2.32	0.26	592.26
Coating of California Aqueduct Turnout Structure	0.00	0.00	0.00	0.00	0.00
Coating of Pumping Plant and Intake Structure	0.00	0.00	0.00	0.00	0.00
Final Site Grading	0.01	0.09	0.05	0.30	7.11
Construct Roads and Parking Lot	0.05	0.41	0.19	0.02	40.34
Total Emissions	2.66	23.93	9.1	3.74	2,261.02
Federal *de minimis* Threshold Levels	100	100	100	NA	NA
Regionally Significant Threshold (10% threshold)	13,475.8	17,958.0	70,404.9	7,767.2	NA

Operation Effects

Similar to Alternative 2, Alternative 3 would require the use of four electrically powered pumps for water conveyance. However, these pumps will be powered by the transmission line that hooks into Tracy Substation, which delivers power from Reclamation's hydroelectric plants on upstream reservoirs. There would be no operational effects on air quality as a result of this alternative.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact AQ-1: Exposure of Sensitive Receptors to Elevated Health Risks from Exposure to Diesel Particulate Matter from Construction Activities

No permanent features would be constructed under this alternative. Installation of the temporary intertie during emergencies would require some heavy equipment, such as a grader and haul trucks. As stated above, health impacts associated with exposure to diesel exhaust from project construction are not anticipated to be considerable because construction activities would occur over a very short period of time and in phases at different locations throughout the site, rather than being concentrated in any one location for a long period. In addition, there are no sensitive receptors near the site. Therefore, the project would not result in long-term emissions of diesel exhaust at any one location on the project site. There would be no adverse effect.

Impact AQ-2: Comply with General Conformity

No permanent features would be constructed under this alternative. However, installation of the temporary, or virtual, intertie would require some heavy equipment, such as graders and haul trucks. As shown in Table 3.6-7 below, Alternative 4 would result in a net increase in ROG, NO_X, CO, PM10, and CO_2 emissions. However, these increases in emissions are below the federal *de minimis* threshold levels and the regionally significant threshold. Consequently, implementation of Alternative 4 is found to be a conforming project, and there would be no adverse effect.

Table 3.6-7. Alternative 4 Emissions for 2009 (Tons per Year)

Component	ROG	NO_X	CO	PM10	CO_2 (metric tons)
Grading	0.00	0.01	0.00	0.01	0.46
Hauling Equipment	0.02	0.28	0.08	0.03	34.19
Generator operations	5.99	75.58	23.28	2.32	7,385.83
Total Emissions	6.01	75.87	23.36	2.36	7,420.48
Federal *de minimis* Threshold Levels	100	100	100	NA	NA
Regionally Significant Threshold (10% threshold)	13,475.8	17,958.0	70,404.9	7,767.2	NA

Operational Effects

Alternative 4 would require the use of diesel generators that would be implemented during emergencies or maintenance activities when the temporary intertie is installed. As stated above, these generators would be subject to the BAAQMD New Source Review rule. All stationary internal combustion engines larger than 50 horsepower (hp) must obtain a BAAQMD Permit to Operate, and diesel engines also must comply with the BAAQMD-administered Statewide Air Toxics Control Measure (ATCM) for Stationary Diesel Engines.

The final ATCM regulation order states that new stationary emergency standby diesel-fueled engines (larger than 50 brake horsepower [bhp]) must emit diesel PM at a rate less than or equal to 0.15 grams per brake horsepower hour (g/bhp-hr), must meet the EPA's Tier 1 standards for ROG, NO_X, and CO emissions, and not operate more than 50 hours per year for maintenance and testing purposes. Engine operation for emergency use is not limited. It is currently unknown how many hours the generators would operate within a year, as operations are predicated solely on emergency usage requirements and an estimate of potential emergency situations is not available. To represent a worst-case scenario, it was assumed that the six diesel generators would operate 24-hours per day over a 365-day period. Emissions associated with operations under Alternative 4 are presented in Table 3.6-7, and the results presented indicate that operation of the generators would not result in emissions in excess of the *de minimis* standards identified above.

The use of Banks Pumping Plant to convey water in nonemergency situations would not result in changes in air quality. When CVP water is wheeled at Banks, CVP provides the power, which is hydroelectric and generated at upstream reservoirs. For this reason and because the diesel generators that would be used under Alternative 4 would be limited to the above standards, there would be no adverse effect.

3.7 Noise

3.7.1 Introduction

This section describes the existing environmental noise conditions in the project area and the consequences related to noise of constructing and operating the project alternatives.

3.7.2 Affected Environment

The Intertie would be located within the boundary of Alameda County. The following discussion provides background information on noise terminology and describes the existing environment in terms of sensitive receptors, existing noise levels, and regulatory requirements.

Noise Terminology

Following are brief definitions of acoustic and vibration terminology used in this chapter:

- **Sound.** A vibratory disturbance created by a vibrating object that, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone.
- **Noise.** Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- **Decibel (dB).** A unitless measure of sound on a logarithmic scale that indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals.
- **A-Weighted Decibel (dBA).** An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- **Maximum Sound Level (L_{max}).** The maximum sound level measured during the measurement period.
- **Minimum Sound Level (L_{min}).** The minimum sound level measured during the measurement period.
- **Equivalent Sound Level (L_{eq}).** The equivalent steady-state sound level that in a stated period of time would contain the same acoustical energy.
- **Percentile-Exceeded Sound Level (L_{xx}).** The sound level exceeded “x” percent of a specific time period. L_{10} is the sound level exceeded 10% of the time.

- **Day-Night Sound Level (L_{dn}).** The energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.
- **Community Noise Equivalent Level (CNEL).** The energy average of the A-weighted sound levels occurring during a 24-hour period with 5 dB added to the A-weighted sound levels occurring during the period from 7:00 p.m. to 10:00 p.m. and 10 dB added to the A-weighted sound levels occurring during the period from 10:00 p.m. to 7:00 a.m.

L_{dn} and CNEL values rarely differ by more than 1 dB. As a matter of practice, L_{dn} and CNEL values are considered to be equivalent and are treated as such in this assessment. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as doubling or halving the sound level.

Sources of Information

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

- Alameda County General Plan Noise Element (Alameda County Community Development Agency 1994).
- Alameda County General Ordinance Code.

3.7.3 Noise-Sensitive Land Uses

Noise-sensitive land uses generally are defined as locations where people reside or where the presence of unwanted sound could adversely affect the use of the land. Noise-sensitive land uses typically are residences, hospitals, schools, guest lodging, libraries, and certain types of recreational uses.

The project area is primarily rural agricultural land with low-to-moderate-density residential development. Table 3.7-1 identifies noise-sensitive land uses in the vicinity of each build alternative and the distance between these uses and the location of proposed pumps and the nearest facility construction.

Table 3.7-1. Noise-Sensitive Land Uses in the Project Area for Each Alternative

Land Use ID	Land Use	Distance to Pumps (feet)	Distance to Nearest Facility Construction (feet)	Location
Alternative 2 (Proposed Action)				
R-1	Rural residences	1,900 feet	1,900 feet	Northeast
R-2	Rural residences	2,700 feet	2,300 feet	West
Alternative 3 (TANC Intertie)				
R-3	Rural residences	850 feet	840 feet	East
R-4	Rural residences	2,000 feet	800 feet	Southwest
Alternative 4 (Virtual Intertie)				
R-1*	Rural residences	3,500 feet	3,500 feet	North
R-2*	Rural residences	4,700 feet	4,600 feet	Northwest

* These are the same residences identified for Alternative 2.

General Noise Levels in Project Study Area

The existing noise environment in the project area is governed primarily by vehicles traveling along I-205 and I-580. Events at the Altamont Motorsports Parks, agricultural activities, and occasional aircraft overflights also are a source of noise in the area.

Population density and ambient noise levels tend to be closely correlated. Areas that are not urbanized are relatively quiet, while more urbanized areas are subjected to higher noise levels from roadway traffic, industrial activities, and other human activities. Table 3.7-2 summarizes typical ambient noise levels based on population density.

Table 3.7-2. Population Density and Associated Ambient Noise Levels

	dBA, L_{dn}
Rural	40–50
Small town or quiet suburban residential	50
Normal suburban residential	55
Urban residential	60
Noisy urban residential	65
Very noise urban residential	70
Downtown, major metropolis	75–80
Adjoining freeway or near a major airport	80–90

Source: Hoover and Keith 1996.

Noise levels in the rural category are representative of noise levels where noise from traffic on I-205 and I-580 is not dominant. The receiver locations identified in Table 3.7-1 are located in the range of 1,200 to 3,330 from I-205 or I-580. Peak hour traffic noise levels at these distances have been estimated using traffic data developed by Caltrans and the Federal Highway Administration (FHWA) Traffic Noise Model (Version 2.5). Peak hour noise levels are in the range of 53 to 58 dBA. These values correspond to L_{dn} values in the range of 55 to 60 dBA.

3.7.4 Environmental Consequences

Assessment Methods

The noise from potential construction activities was evaluated using methodology developed by the Federal Transit Administration (FTA) (Federal Transit Administration 2006). Noise from operation of the Proposed Action and alternatives was evaluated using equipment data provided the project engineers and reference noise source data (Hoover and Keith 1996).

Regulatory Setting

Federal

There are no federal regulations or laws related to noise that apply to the Proposed Action.

State

There are no state regulations or laws related to noise that apply to the Proposed Action.

Local

Alameda County General Plan

The Proposed Action is in Alameda County. Alameda County has established policies and regulations concerning the generation and control of noise that could adversely affect their citizens and noise-sensitive land uses.

The General Plan is a document required by state law that serves as the jurisdiction’s blueprint for land use and development. The plan is a comprehensive, long-term document that provides details for the physical development of the jurisdiction, sets policies, and identifies ways to put the policies into action. The General Plan provides an overall framework for development in the jurisdiction and protection of its natural and cultural resources. The Noise Element of the General Plan (Alameda County Community Development Agency 1994) contains planning guidelines relating to noise.

However, the noise element does not contain specific policies or land use compatibility standards that are applicable to the Proposed Action.

The Alameda County General Ordinance Code establishes noise standards for areas within the unincorporated county (Tables 3.7-3 and 3.7-4). Construction activities that occur between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday, and between 8:00 a.m. and 5:00 p.m. Saturday and Sunday are exempt from the county's noise ordinance. In addition, construction and maintenance and repair operations conducted by public agencies and/or utility companies or their contractors that are deemed necessary to serve the best interests of the public are exempt from the county's noise ordinance.

Table 3.7-3. Alameda County Code Exterior Noise Level Standards*

Category	Cumulative Number of Minutes Allowable in Any 1-Hour Time Period	Daytime Limit (dBA) (7:00 a.m.–10:00 p.m.)	Nighttime Limit (dBA) (10:00 p.m.–7:00 a.m.)
1	30	50	45
2	15	55	50
3	5	60	55
4	1	65	60
5	0	70	65

* For residential, school, hospital, church, or public library land uses.

Table 3.7-4. Alameda County Code Exterior Noise Level Standards for Commercial Properties

Category	Cumulative Number of Minutes Allowable in Any 1-Hour Time Period	Daytime Limit (dBA) (7:00 a.m.–10:00 p.m.)	Nighttime Limit (dBA) (10:00 p.m.–7:00 a.m.)
1	30	65	60
2	15	70	65
3	5	75	70
4	1	80	75
5	0	80	80

3.7.5 Environmental Effects

Alternative 1 (No Action)

The No Action Alternative would not result in changes in noise or effects on noise-sensitive land-uses because there would be no construction or changes in operation of the existing facilities.

Alternative 2 (Proposed Action)

Construction Effects

Impact NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise

Noise impacts resulting from construction depend on the noise generated by various pieces of construction equipment, the timing and duration of noise-generating activities, and the distance and shielding between construction noise sources and noise-sensitive areas. Construction noise impacts result primarily when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise-sensitive land uses, or construction lasts over extended periods of time.

Construction of the Proposed Action would be completed within about 12–15 months after award of the construction contract. Construction activities would include installing cofferdams, constructing intake and outlet structures, constructing the pumping plant, connecting the pumps to the intake and outlet structures, constructing access roadways on the site, and constructing a transmission line on the west side of the canal from the Intertie to the Tracy substation, about 4.5 miles to the north.

It is anticipated that the equipment listed in Table 3.7-5 would be used in the construction process. Typical L_{max} noise levels for each piece of equipment also are shown in Table 3.7-5 (Federal Highway Administration 2006). The acoustical use factor—the percentage of time per hour that the equipment typically would be used—is indicated. L_{eq} values are determined from the L_{max} value and the use factor.

Table 3.7-5. Construction Equipment Noise Emission Levels

Equipment	Typical Noise Level (dBA-L_{max}) 50 feet from Source	Acoustical Use Factor	Typical Noise Level (dBA-L_{eq}) 50 feet from Source
Air Compressor	80	40	76
Backhoe	80	40	76
Concrete mixer	85	40	81
Crane (mobile)	85	16	77
Drill rig	85	20	78
Dump truck	84	40	81
Line truck*	84	40	81
Aerial lift truck*	84	40	81
Excavator	85	40	81
Front-end loader	80	40	76
Generator	82	50	79
Pump	77	50	74
Roller	85	20	78
Vibratory compactor	80	20	73
Vibratory pile driver	95	20	88

* Expected to be similar to dump truck.

Source: Federal Highway Administration 2006.

Typical non-impact construction activities, excluding pile driving, is expected to generate L_{max} values in the range of 77 to 85 dBA and L_{eq} values in the range of 74 to 81 dBA at a distance of 50 feet. Pile driving required for the placement of sheet piles is expected to generate L_{max} values of 95 dBA and L_{eq} values of 88 dBA at 50 feet.

Noise produced by construction equipment typically attenuates over distance at a rate of about 6 dB per doubling of distance based solely on geometry. Additional attenuation in the range of 1 to 2 dB per doubling of distance is provided by ground absorption. Noise levels are further reduced where shielding is provided by intervening terrain, walls, or structures located between the construction and noise-sensitive uses.

Under Alternative 2, the closest residence would be about 1,900 feet from the facility site. Table 3.7-6 summarizes predicted noise levels from typical construction equipment and pile driving at this distance that has been calculated using the source levels identified above and an attenuation calculation method that includes effects of both geometric attenuation and ground absorption (Federal Transit Administration 2006).

Table 3.7-6. Construction Noise Levels under Alternative 2

Distance from Facility to Nearest Residence	Typical Construction Equipment at 50 feet	Pile Driving at 50 feet	Typical Construction Equipment at 1,900 feet	Pile Driving at 1,900 feet
1,900 feet	77 to 85 dBA-L_{max} 74 to 81 dBA-L_{eq}	95 dBA-L_{max} 88 dBA-L_{eq}	35 to 43 dBA-L_{max} 29 to 32 dBA-L_{eq}	53 dB-L_{max} 46 dBA-L_{eq}

During construction of the powerline, activities could occur closer to residences. However, construction activities associated with the powerline would be limited in duration to several days for any one location. Construction noise would be lower in acoustically shielded locations and at noise-sensitive receivers located farther from the project site.

Construction activities that occur between the hours of 7:00 a.m. and 7:00 p.m. Monday through Friday, and between 8:00 a.m. and 5:00 p.m. Saturday and Sunday, are exempt from the county's noise ordinance. Additionally, construction conducted by public agencies and/or utility companies or their contractors that is deemed necessary to serve the best interests of the public is exempt from the county's noise ordinance. As a result, construction of the project occurring during any hours, day or night, would be exempt from the ordinance.

Although construction equipment is exempt from the ordinance, the results in Table 3.7-6 indicate that construction noise that occurs at night could result in annoyance and an adverse impact on residences.

Implementation of Mitigation Measure NZ-MM-1 would reduce this impact.

Mitigation Measure NZ-MM-1: Employ Noise-Reducing Construction Practices

To reduce the potential for annoyance from construction noise, the construction contractor would employ noise-reducing construction practices between the hours of 7:00 p.m. and 7:00 a.m. on Monday through Friday and 5:00 p.m. and 8:00 a.m. on Saturday and Sunday such that the noise from construction does not exceed the applicable noise criteria in the Alameda County noise ordinance (Tables 3.7-3 and 3.7-4).

Measures that can be used to limit noise may include, but are not limited to:

- limiting hours of construction operation;
- locating equipment as far as practical from noise-sensitive uses;
- using sound-control devices such as mufflers on equipment;
- using equipment that is quieter than standard equipment;
- selecting haul routes that affect the fewest number of people;
- using noise-reducing enclosures around noise-generating equipment;

- constructing barriers between noise sources and noise-sensitive land uses or taking advantage of existing barrier features (terrain, structures) to block sound transmission; and
- temporarily relocating residents (i.e., providing hotel vouchers) during periods of high construction noise that cannot be effectively reduced by other means.

Operation Effects

Impact NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Intertie Operation

Noise from the operation of the Intertie pumping plant would be governed primarily by the facility pumps. The facility would have four 1,000-horsepower (hp) electric pumps housed in a pre-engineered steel shell building. Each pump is anticipated to produce a sound level of 97 dBA at 3 feet (Hoover and Keith 1996). Four pumps operating simultaneously would produce a sound level of 103 dBA at 3 feet. This corresponds to a sound level of 79 dBA at 50 feet. The building sheet is anticipated to provide at least 10 dB of noise reducing, resulting in a nominal source level of about 69 dBA at 50 feet.

The nearest residence is located 1,900 feet from the plant site. Assuming the effect of geometric attenuation and ground absorption, the predicted noise level at the nearest residence would be 27 dBA. Because this is below the applicable Alameda County noise standards, no adverse impact is anticipated.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise

Noise impacts resulting from construction under Alternative 3 would be similar to the impacts identified under Alternative 2. As discussed above, typical construction equipment is expected to generate L_{max} values in the range of 77 to 85 dBA and L_{eq} values in the range of 74 to 81 dBA at a distance of 50 feet. Pile driving required for the placement of sheet piles to shore excavations is expected to generate L_{max} values of 95 dBA and L_{eq} values of 88 dBA at 50 feet.

Under Alternative 3 the closest residence would be about 800 feet from the facility site. Table 3.7-7 summarizes predicted noise levels from typical construction equipment and pile driving at this distance.

Table 3.7-7. Construction Noise Levels under Alternative 3

Distance from Facility to Nearest Residence	Typical Construction Equipment at 50 feet	Pile Driving at 50 feet	Typical Construction Equipment at 800 feet	Pile Driving at 800 feet
800 feet	77 to 85 dBA-L_{max} 74 to 81 dBA-L_{eq}	95 dBA-L_{max} 88 dBA-L_{eq}	46 to 54 dBA-L_{max} 40 to 43 dB-L_{eq}	64 dB-L_{max} 57 dBA-L_{eq}

Although construction equipment is exempt from the County's noise ordinance, the results in Table 3.7-7 indicate that construction noise that occurs at night could result in annoyance and an adverse impact on residences.

Implementation of Mitigation Measure NZ-MM-1 would reduce this impact.

Mitigation Measure NZ-MM-1: Employ Noise-Reducing Construction Practices

Described above.

Operation Effects

Impact NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Intertie Operation

Pump operations and equipment under Alternative 3 would be the same as under Alternative 2. The resulting nominal noise source level is expected to be 69 dBA at 50 feet.

The nearest residence is located 850 feet from the plant site. Assuming the effect of geometric attenuation and ground absorption the predicted noise level at the nearest residence would be 33 dBA. Because this is below the applicable Alameda county noise standards, no adverse impact is anticipated.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact NZ-1: Exposure of Noise-Sensitive Land Uses to Construction Noise in Excess of Applicable Standards

Under Alternative 4, temporary equipment would be placed when needed. There would be no pile driving. There would, however, be heavy equipment used to place the temporary equipment. Noise impacts associated with placement of temporary equipment would be similar to the impacts identified under Alternative 2. The duration of impacts would be less. As discussed above, typical construction equipment is expected to generate L_{max} values in the range of 77 to 85 dBA and L_{eq} values in the range of 74 to 81 dBA at a distance of 50 feet.

Under Alternative 4, the closest residence would be about 3,500 feet from the facility site. Table 3.7-8 summarizes predicted noise levels from typical non-impact construction equipment at this distance.

Table 3.7-8. Construction Noise Levels under Alternative 4

Distance from Facility to Nearest Residence	Typical Construction Equipment at 50 feet	Typical Construction Equipment at 3,500 feet
3,500 feet	77 to 85 dBA-L_{max} 74 to 81 dBA-L_{eq}	29 to 37 dBA-L_{max} 23 to 26 dB-L_{eq}

Note: No pile driving under this alternative.

Although construction equipment is exempt from the ordinance, the results in Table 3.7-8 indicate that construction noise that occurs at night could result in annoyance and an adverse impact on residences.

Implementation of Mitigation Measure NZ-MM-1 would reduce this impact.

Mitigation Measure NZ-MM-1: Employ Noise-Reducing Construction Practices

Described above.

Operation Effects

Impact NZ-2: Exposure of Noise-Sensitive Land Uses to Operational Noise during Temporary Intertie Operation

Under Alternative 4, temporary diesel-powered pumps would be used to transfer water. It is anticipated that 10 portable pumps powered by 425-hp turbocharged diesel engines would be used. Each pump is anticipated to produce a sound level of 87 dBA at 50 feet. Six pumps operating simultaneously would produce a sound level of 95 dBA at 50 feet.

The closest residence is about 3,500 feet from the temporary site. Assuming the effect of geometric attenuation and ground absorption, the predicted noise level at the nearest residence would be 47 dBA. This result indicates that operation of the temporary pumps could result in exceedance of the Alameda County night noise ordinance standard of 45 dBA. Operation of the temporary pumps therefore is considered to result in an adverse effect.

Implementation of Mitigation Measure NZ-MM-2 would reduce this impact.

Mitigation Measure NZ-MM-2: Employ Noise-Reducing Measures for the Temporary Pumps

To reduce the potential for annoyance from operation of the temporary pumps, the project applicant will implement noise-reducing measures such that noise from operation of the pumps does not exceed Alameda noise ordinance standards at the nearest residence. Measures that can be implemented to reduce noise from the pumps includes:

- use of upgraded silencing mufflers on the engines and
- construction of temporary barriers between the pump array and noise-sensitive land uses, or taking advantage of existing barrier features (terrain, structures) to block sound transmission.

3.8 Climate Change

3.8.1 Introduction

This section provides an assessment of the potential impacts of the Intertie project on climate change and the potential effects of the climate change on the project. The potential impacts that the Intertie and its alternatives may have on greenhouse gas (GHG) emissions are presented quantitatively. The emissions analysis is focused exclusively on potential climate change; the quantification of emissions associated with conventional air quality pollutants is addressed in Section 3.6, Air Quality. In addition to the GHG analysis, a discussion of how California's climate is expected to evolve as a consequence of worldwide GHG emissions is described qualitatively.

There are no formal guidelines on how to address climate change in NEPA documents and the state of climate change practice is changing continuously. In this section, various state and local regulations and court rulings are discussed to provide perspective on the interrelation of climate change and environmental impact assessment. Note that many of the regulations and court proceedings listed below do not have direct bearing on the Intertie project; they are discussed to provide prospective and context for climate change issues and should not be considered binding requirements for this project or its alternatives.

3.8.2 Environmental Setting

This section presents an overview of statewide, national, and global GHG emission inventories. The characteristics, sources, and units used to quantify the six gases listed in Assembly Bill (AB) 32 (i.e., carbon dioxide [CO_2], methane [CH_4], nitrous oxide [N_2O], hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [SF_6]) will be documented.

Global Climate Change

Global climate change is caused in part by anthropogenic emissions of GHGs released into the atmosphere (through combustion of fossil fuels) and by other activities that affect the global GHG budget (such as deforestation and land-use change). According to the California Energy Commission (CEC), GHG emissions in California are attributable to human activities associated with industrial/manufacturing, utilities, transportation, residential, and agricultural sectors as well as natural processes (California Energy Commission 2006a).

GHGs play a critical role in the Earth's radiation budget by trapping infrared radiation emitted from the Earth's surface, which could have otherwise escaped to space. Prominent GHGs contributing to this process include water vapor, CO_2, N_2O, CH_4, ozone, certain HFCs and fluorocarbons, and SF_6. This phenomenon, known as the “greenhouse effect” keeps the Earth’s atmosphere near the surface warmer than it would otherwise be and allows for successful habitation by humans and other forms of life. The combustion of fossil fuels releases carbon that has been stored underground into the active carbon cycle, thus increasing concentrations of GHGs in the atmosphere. Emissions of GHGs in excess of natural ambient concentrations are thought to be responsible for the enhancement of the greenhouse effect and to contribute to what is termed “global warming,” a trend of unnatural warming of the Earth’s natural climate. Higher concentrations of these gases lead to more absorption of radiation and warm the lower atmosphere further, thereby increasing evaporation rates and temperatures near the surface.

Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as ozone precursors) and toxic air contaminants (TACs), which are primarily pollutants of regional and local concern. Because GHG emissions have long atmospheric lifetimes, GHGs are effectively well-mixed globally and are expected to persist in the atmosphere for time periods several orders of magnitude longer than criteria pollutants such as ozone.

The Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant for the understanding of climate change; its potential impacts; and options for adaptation and mitigation. The IPCC predicts substantial increases in temperatures globally of between 1.1 to 6.4° Celsius (depending on scenario) by the year 2100 (Intergovernmental Panel on Climate Change 2007a).

Climate change could potentially impact the natural environment in California, and the world at large, in the following ways (California Climate Change Center 2006):

- rising sea levels along the California coastline, particularly in San Francisco and the Sacramento–San Joaquin River Delta (Delta) due to ocean expansion, melting ice sheets, and other mechanisms;
- changing extreme-heat conditions, such as heat waves and very high temperatures, which could last longer and become more frequent;
- increasing wildfire frequency and intensity;
- increasing heat-related human deaths, infectious diseases, and increasing risk of respiratory problems caused by deteriorating air quality;
- decreasing snow pack and spring runoff in the Sierra Nevada mountains, affecting winter recreation and water supplies;
- increasing severity of winter storms, affecting peak stream flows and flooding;

- changing growing season conditions that could affect California agriculture, causing variations in crop quality and yield; and
- changing distribution of plant and wildlife species due to changes in temperature, competition from colonizing species, changes in hydrologic cycles, changes in sea levels, and other climate-related effects.

These changes in California's climate and ecosystems are occurring at a time when California's population is expected to increase from 34 million to 59 million by the year 2040 (California Energy Commission 2005a). As such, the number of people potentially affected by climate change as well as the amount of anthropogenic GHG emissions expected under a "business as usual" scenario is expected to increase.

Greenhouse Gases

The characteristics, sources, and units used to quantify the six gases listed in AB 32 (CO_2, CH_4, N_20, HFCs, PFCs, and SF_6) are documented in this section, in order of abundance in the atmosphere. Note that water vapor, although the most abundant GHG, is not included in AB 32 because natural concentrations and fluctuations far outweigh anthropogenic influences.

In order to simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the *global warming potential* (GWP) methodology defined in the IPCC reference documents (Intergovernmental Panel on Climate Change 2001). The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2 equivalents (CO_2e), which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). For example, a high GWP represents high infrared absorption and long atmospheric lifetime when compared to CO_2. One must also select a time horizon to convert GHG emissions to equivalent CO_2 emissions to account for chemical reactivity and lifetime differences between various GHG species. The standard time horizon for climate change analysis is 100 years. Generally, GHG emissions are quantified in terms of metric tons of CO_2e emitted per year.

The *atmospheric residence time* of a gas is equal to the total atmospheric abundance of the gas divided by its rate of removal (Seinfeld and Pandis 2006). The atmospheric residence time of a gas is in effect a half-life measurement of how long a gas is expected to persist in the atmosphere when taking into account removal mechanisms such as chemical transformation and deposition.

Units commonly used to describe the concentration of GHGs in the atmosphere are parts per million (ppm), parts per billion (ppb) and parts per trillion (ppt), which refer to the number of molecules of the GHG in a sampling of one million, one billion or one trillion molecules of air, respectively. Collectively, HFCs, PFCs, and SF_6 are referred to as high global warming potential gases (HGWPG). CO_2 is by far the largest component of worldwide CO_2e emissions, followed by CH_4, N20, and HGWPGs in order of decreasing contribution to CO_2e.

Carbon Dioxide

CO_2 is the most important anthropogenic GHG and accounts for more than 75% of all anthropogenic GHG emissions. Its long atmospheric lifetime (on the order of decades to centuries) ensures that atmospheric concentrations of CO_2 will remain elevated for decades after GHG mitigation efforts to reduce GHG concentrations are promulgated (Intergovernmental Panel on Climate Change 2007b).

Increasing concentrations of anthropogenic CO_2 in the atmosphere are largely due to emissions from the burning of fossil fuels, gas flaring, cement production, and land-use changes. Three quarters of anthropogenic CO_2 emissions are the result of fossil fuel burning (and to a very small extent, cement production), and approximately one quarter of emissions are the result of land-use change (Intergovernmental Panel on Climate Change 2007a).

Anthropogenic emissions of CO_2 have increased concentrations in the atmosphere most notably since the Industrial Revolution; the concentration of CO_2 has increased from about 280 to 379 ppm over the last 250 years (Intergovernmental Panel on Climate Change 2007c). IPCC estimates that the present atmospheric concentration of CO_2 has not been exceeded in the last 650,000 years and is likely to be the highest ambient concentration in the last 20 million years (Intergovernmental Panel on Climate Change 2007a; Intergovernmental Panel on Climate Change 2001).

Methane

CH_4, the main component of natural gas, is the second largest contributor to anthropogenic GHG emissions and has a GWP of 21 (Association of Environmental Professionals 2007; Intergovernmental Panel on Climate Change 1996).

Anthropogenic emissions of CH_4 are the result of growing rice, raising cattle, combusting natural gas, and mining coal (National Oceanic and Atmospheric Administration 2005). Atmospheric CH_4 has increased from a preindustrial concentration of 715 to 1,775 parts per billion in 2005 (Intergovernmental Panel on Climate Change 2007c). Though it is unclear why, atmospheric concentrations of CH_4 have not risen as quickly as anticipated (National Oceanic and Atmospheric Administration 2005).

Nitrous Oxide

N_2O is a powerful GHG, with a GWP of 310 (Intergovernmental Panel on Climate Change 1996). Anthropogenic sources of N_2O include agricultural processes, nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. N_2O is also used in rocket engines and racecars and as an aerosol spray propellant. Agricultural processes that result in anthropogenic N_2O emissions are fertilizer use and microbial processes in soil and water (Association of Environmental Professionals 2007).

N_2O concentrations in the atmosphere have increased from preindustrial levels of 270 ppb to 319 ppb in 2005 (Intergovernmental Panel on Climate Change 2007c).

Hydroflourocarbons

HFCs are human-made chemicals used in commercial, industrial, and consumer products and have high GWPs (Environmental Protection Agency 2006a). HFCs are generally used as substitutes for ozone-depleting substances (ODS) in automobile air conditioners and refrigerants. Concentrations of HFCs have risen from zero to current levels. Because these chemicals are human-made, they do not exist naturally in ambient conditions.

Perfluorocarbons

The most abundant PFCs include CF4 (PFC-14) and C2F6 (PFC-116). These human-made chemicals are emitted largely from aluminum production and semiconductor manufacturing processes. PFCs are extremely stable compounds that are only destroyed by very high-energy ultraviolet rays, which result in the very long lifetimes of these chemicals. PFCs have large GWPs and have risen from zero to current concentration levels.

Sulfur Hexafluoride

SF_6, another human-made chemical, is used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, in semiconductor manufacturing, and also as a trace chemical for study of oceanic and atmospheric processes (Environmental Protection Agency 2006a). In 1998, atmospheric concentrations of SF_6 were 4.2 ppt and steadily increasing in the atmosphere.

SF_6 is the most powerful of all GHGs listed in IPCC studies with a GWP of 23,900 (Intergovernmental Panel on Climate Change 1996).

GHG Inventories

A GHG inventory is a quantification of all GHG emissions and sinks within a selected physical and/or economic boundary. GHG inventories can be performed on a large scale (i.e., for global and national entities) or on a small scale (i.e., for a particular building or person).

Many GHG emission and sink specifications are complicated to evaluate because natural processes may dominate the carbon cycle. Though some emission sources and processes are easily characterized and well understood, some components of the GHG budget (i.e., the balance of GHG sources and sinks) are not known with accuracy. Because protocols for quantifying GHG emissions from many sources are currently under development by international, national, state, and local agencies, ad-hoc tools must be developed to quantify emissions from certain sources and sinks in the interim.

The following sections outline the global, national, and statewide GHG inventories to contextualize the magnitude of Intertie project-related emissions.

IPCC Global GHG Inventory

In the 2007 IPCC Synthesis Report, global anthropogenic GHG emissions were estimated to be 49,000 million metric tons of CO_2e in 2004, which is 24% greater than 1990 emissions levels. CO_2 contributed to 76.7% of total emissions; CH_4 accounted for 14.3%; N_2O contributed 7.9% of total emissions and fluorinated gases (HFCs, PFCs, and SF_6) contributed to the remaining 1.1% of global emissions in 2004. Energy supply was the sector responsible for the greatest amount of GHG emissions (25.9%), followed by industry (19.4%), forestry (17.4%), agriculture (13.5%), and transport (13.1%) (Intergovernmental Panel on Climate Change 2007c).

U.S. Environmental Protection Agency National GHG Inventory

The EPA estimates that total U.S. GHG emissions for 2004 amounted to 7,078 million metric tons of CO_2e, which is 13.1% greater than 1990 levels (U.S. Environmental Protection Agency 2008a). U.S. GHG emissions were responsible for 14.4% of global GHG emissions in 2004 (Intergovernmental Panel on Climate Change 2007c; U.S. Environmental Protection Agency 2008a). The largest contributors to U.S. GHG emissions in 2004 were electricity generation (33.4%), transportation (27.9%), and the industrial sector (19.6%) (U.S. Environmental Protection Agency 2008a).

Statewide GHG Inventory

CEC's *Inventory of Greenhouse Gas Emissions and Sinks: 1990–2004* estimates that California is the second largest emitter of GHG emissions of the United States (California Energy Commission 2004). The commission estimates that in 1990 California's gross GHG emissions were between 425 and 452 million metric tons of CO_2e. The CEC estimates that in 2004, California's gross GHG emissions were 492 million metric tons of CO_2e. The transportation sector produced approximately 40.7% of California's GHG emissions in 2004. Electric power production accounted for approximately 22.2% of emissions, and the industrial sector contributed 20.5% of the total; agriculture and forestry contributed 8.3%, and other sectors contributed 8.3% (California Energy Commission 2006a).

The California Air Resources Board (CARB) recently released revised estimates of California's 1990 and 2004 emissions, estimating that 1990 emissions amounted to 433 million metric tons of CO_2e and 2004 emissions levels were 484 million metric tons of CO_2e (California Air Resources Board 2007a; California Air Resources Board 2007b). Based on California's 2004 population of 37 million, this amounts to approximately 13 tons of CO_2e per person (State of California, Department of Finance 2008). According to the Congressional Research Service, per capita GHG emissions for the ten states with the highest GHG emissions levels for 2003 range from 12.7 to 46.9 tons of CO_2e per person (Congressional Research Service 2007).

Climate Change Predictions for California

There is a great deal of interest about future climate change effects on California water resources. DWR prepared a major study in 2006, *Progress on Incorporating Climate Change into Management of California's Water Resources* (California Department of Water Resources 2006), and included two sections on climate change effects in the 2005 California Water Plan Update (California Department of Water Resources 2005). Each of these studies described the general process of assuming a future change in CO_2 levels, and using a general circulation model (GCM) to estimate the likely changes in temperature and precipitation. The GCM results then are used to extract monthly estimates of precipitation, temperature, and humidity for the California region. The GCM models generally provide 150-year time-series of seasonal weather conditions throughout the globe, which begin about 1950 and continue to 2100. The first 50 years of GCM results should generally match the historical period, and the next 100 years of GCM results forecast future climate change. The simulated weather conditions vary greatly from year to year because of all the climate processes that affect our regional temperatures and precipitation. DWR reports that some of the GCM results indicate higher precipitation, and some suggest lower precipitation for the California region.

Climate Change Predictions for the Central Valley and Key State Water Project Regions

Although there is broad scientific consensus that anthropogenic GHG emissions will result in long term global (i.e., planet-wide averaged) warming, it is challenging to utilize global estimates to predict the climate change associated with a specific locale. For example, if the global temperatures were to increase by 2 degrees centigrade, certain regions (e.g., Greenland) may have an average temperature increase considerably greater than 2 degrees whereas other locals may actually have a decrease in average temperature.

The process of taking GCM results and applying them to sub-regions is referred to as *downscaling*. Downscaling GCM simulations to a specific sub-region is a complex and evolving science made difficult by the need to have adequate regional data.

Appendix R of the CVP/SWP Longterm Operations Plan is titled the *Sensitivity of Future Central Valley Project and State Water Project Operations to Potential Climate Change and associated Sea Level Rise* (hereafter referred to as Appendix R). Appendix R is one of the most recent and compressive efforts to downscale potential climate change predictions to assist in CVP and SWP operational planning. A review of the main findings of Appendix R as listed discussed below.

The Appendix R study had the following three components:

- Definition of regional climate change scenarios
- Definition of sea level rise assumptions, and
- Selection of methods for conducting “scenario-impacts” analysis

Similar to the DWR approach, four climate change scenarios were employed to estimate a range of climate change possibilities in the year 2030. One sea level rise scenario was used for 2030 that assumed at 1-foot sea level rise coupled with a 10% increase in tidal range. Based on regional climate change and sea level estimates, monthly changes in water quality and quantity were defined and simulated. Key results of this study were consistent with previous literature studies; highlights of the study include the following:

- Climate change is expected to cause a greater fraction of annual runoff to occur during winter and early spring at the expense of spring and summer flow,
- Changes in natural runoff and water supply are more affected by changes in precipitation patterns than by changes in mean-annual temperature, and
- Sea level rise impacts on salt water intrusion resulted in a significant decrease in CVP and SWP deliveries.

The four scenarios were used in the CVP/SWP Longterm Operations Plan to analyze the sensitivity of baseline conditions to climate change. The scenarios define a range of climate change predictions with respect to both warming (with all scenarios being warmer than historical conditions) and annual precipitation (with annual precipitation both higher and lower than historical conditions). These scenarios, as listed below, define boundaries for potential climate change that include most of the climate change predictions:

- Greater than historical precipitation and a smaller increase in temperature;
- Greater than historical precipitation and a larger increase in temperature;
- Less than historical precipitation and a smaller increase in temperature;
- Less than historical precipitation and a larger increase in temperature.

The "wetness" of the historical hydrology used for the CALSIM II model analysis lies within the range of the scenarios used in the global warming analysis performed in the CVP/SWP Longterm Operations Plan. All of the scenarios consider temperatures which are above the historical temperatures, so that the historical conditions are outside of the range of most of the climate change predictions. However, Appendix R of the CVP/SWP Longterm Operations Plan noted that CVP and SWP water deliveries and carryover storage were "much more sensitive to scenario changes in mean-annual precipitation," and that "the influence of scenario changes in mean-annual air temperature on either metric was minor" (Appendix R, page R-4). This indicates that it is much more important that the historical hydrology used for the CALSIM II model is within the range of potential future precipitation than it is to be within the range of potential future temperatures.

Each of these scenarios also includes an assumed one foot rise in sea level. (CVP/SWP Longterm Operations Plan, pages 9-94 to 9-95). If sea level rise only is considered (i.e., no changes in temperature and precipitation are assumed), CVP and SWP deliveries would decrease, and there would be greater salinity intrusion into the Delta. However, Appendix R also indicates that "the wetter regional climate change scenarios showed that such sea level rise effects on salinity intrusion were offset by increased upstream runoff and delta outflow" (Appendix R, page R-4). This indicates that the historical hydrology used for the CALSIM II model provides a reasonable basis to evaluate future conditions over the time frame considered in this EIS.

These general conclusions appear to be consistent with Table 9-22 of the CVP/SWP Longterm Operations Plan (beginning on page 9-96). That table shows that the "base study" (which did not include climate change effects) results were generally inside of the range of the four sensitivity scenarios with respect to end of September reservoir storage, river flows, and delta parameters (which include pumping at Jones and Banks Pumping Plants).

Based on the analysis of the sensitivity of the baseline to climate change in the CVP/SWP Longterm Operations Plan, as summarized above, it is concluded that the historical hydrology used for the CALSIM II modeling provides a reasonable basis to evaluate the impacts of the Intertie.

Regulatory Setting

Climate change has only recently been widely recognized as an imminent threat to the global climate, economy, and population. Thus, the climate change regulatory setting—nationally, statewide, and locally—is complex and evolving. The following section identifies key legislation, executive orders, and seminal court cases relevant to the environmental assessment of Intertie project GHG emissions.

Federal Regulations

Federal Action on Greenhouse Gas Emissions

In 2002, President George W. Bush set a national policy goal of reducing the GHG emission intensity (tons of GHG emissions per million dollars of gross domestic product) of the U.S. economy by 18% by 2012. No binding reductions were associated with the goal. Rather the EPA administers a variety of voluntary programs and partnerships with GHG emitters in which the EPA partners with industries producing and utilizing synthetic gases to reduce emissions of these particularly potent GHGs.

April 2007 Supreme Court Ruling

In *Massachusetts et al. vs. Environmental Protection Agency et al.* (April 2, 2007) the U.S. Supreme Court ruled that the EPA was authorized by the federal Clean Air Act (CAA) to regulate CO_2 emissions from new motor vehicles. The court did not mandate that the EPA enact regulations to reduce GHG emissions but found that the only cases in which the EPA could avoid taking action were if it found that GHGs do not contribute to climate change or if it offered a “reasonable explanation” for not determining that GHGs contribute to climate change. On July 11, 2008, EPA released an Advanced Notice of Proposed Rulemaking (ANPR) inviting comments on options and questions regarding regulation of GHGs under the CAA. The ANPR announced a 120-day public comment period to conclude on November 28, 2008.

Corporate Average Fuel Economy Standards

In response to the U.S. Supreme Court ruling, the Bush Administration issued an executive order on May 14, 2007, directing the EPA and Departments of Transportation (DOT) and Energy (DOE) to establish regulations that reduce GHG emissions from motor vehicles, nonroad vehicles, and nonroad engines by 2008. On December 19, 2007, the Energy Independence and Security Act of 2007

(EISA) (discussed below) was signed into law, which requires an increased Corporate Average Fuel Economy (CAFE) standard of 35 miles per gallon for the combined fleet of cars and light trucks by model year 2020. EISA requires establishment of interim standards (from 2011 to 2020) that will be the "maximum feasible average fuel economy" for each fleet. On October 10, 2008, the National Highway Traffic Safety Administration (NHTSA) released a final environmental impact statement analyzing proposed interim standards for model years 2011 to 2015 passenger cars and light trucks. NHTSA is expected to issue a final rule on interim standards in November 2008.

Energy Independence and Security Act of 2007

In addition to setting increased CAFE standards for motor vehicles, the EISA includes other provisions:

- Renewable Fuel Standard (RFS) (Section 202);
- Appliance and Lighting Efficiency Standards (Section 301–325);
- Building Energy Efficiency (Sections 411–441).

Additional provisions of the EISA address energy savings in government and public institutions, promoting research for alternative energy, additional research in carbon capture, international energy programs, and the creation of "green jobs."

Reporting Requirements

Congress passed the "Consolidated Appropriations Act of 2008" (HR 2764) in December 2007, which includes provisions requiring the establishment of mandatory GHG reporting requirements. The measure directs EPA to publish draft rules by September 2008 and final rules by June 2009 to mandate GHG reporting "for all sectors of the economy." It also directs EPA to determine what thresholds to use. As of the time of release of this document, the EPA has not developed draft rules as directed by the act.

State Regulations

A variety of legislation has been enacted in California relating to climate change, much of which sets aggressive goals for GHG reductions within the state. However, none of this legislation provides definitive direction regarding the treatment of climate change in environmental review documents. The Office of Planning and Research (OPR) has been directed to develop guidelines for the mitigation of GHG emissions and their effects. CARB must adopt regulations for the implementation of AB 32 beginning in January 2010. OPR recently released a draft guidance document for treatment of GHGs under CEQA. This document is purely advisory and, once finalized, will serve as guidance only. In addition, on October 24, 2008, CARB released a draft staff proposal entitled *Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases* *under the California Environmental Quality Act* (Draft CARB Thresholds). The Draft CARB Thresholds provide a framework for developing significance thresholds for industrial, commercial, and residential projects. However, as of the time of release of this document, many details remain unresolved and the document is still in draft form.

3.8.3 Environmental Consequences

Assessment Methods

This analysis discloses both the Intertie alternatives' contribution to climate change and the effects that climate change may have on the project. The Intertie alternatives have the potential to contribute to climate change as a result of energy use during construction and operation.

There are lifecycle, construction, and operational GHG emissions associated with dams which would result in non-zero GHG emission factors for energy production. However, since hydroelectric power has considerably lower GHG emissions than those emanating from fossil fuel power plants, the GHG emission associated with hydroelectric energy production are considered net carbon neutral. This assumption simplifies the GHG analysis without changing its ultimate conclusion.

The quantification of construction emissions was performed using the URBEMIS 2007 (Version 9.24) model, which takes into account the GHG components described above. This same model was used to determine emissions associated with operation of the temporary intertie under Alternative 4.

3.8.4 Environmental Effects

No Action Alternative

Under the No Action Alternative, there would be no construction or operational changes that would result in changes in GHG emissions or energy use. Changes in the environment related to climate change likely would require adjustments in operations of CVP, SWP, and other systems to control and capture flows and maintain a reliable water supply.

Alternative 2: (Proposed Action)

Construction

Impact CC-1: Construction-Related Changes in Greenhouse Gas Emissions

Construction activities associated with the Intertie would result in a temporary increase of GHG emissions. Based on the same assumptions used for the air quality analysis regarding construction equipment and activities, approximately 1,726 metric tons of CO_2 would be released during construction. It is not expected that substantial GHG emissions would be generated during construction, as construction activities are anticipated to be temporary and are minor compared to the local, state, federal, and global GHG inventory.

Operation

Impact CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Intertie Operations

As described in Section 5.2, Power Production and Energy, the use of the Intertie and associated increase in Jones pumping would require approximately a 1% increase in CVP power use. However, the CVP system generates this energy, and the Intertie would be connected to this power source at the Tracy substation. The power generated by the CVP is hydroelectric and does not result in a net increase of GHG emissions. As such, the Intertie operations would not result in an increase in GHG emissions.

Impact CC-3: Project Performance under Changed Conditions

As described above, many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system. The Intertie would be a valuable tool in addressing these changed conditions as it would resolve the physical constraint in the DMC that would otherwise preclude use of full Jones pumping capacity at times when available flows and regulatory regimes would allow for such pumping. With the Intertie, additional authorized Jones pumping could occur in winter months, which would help meet water demand south of the Delta. For example, during a wet winter and dry spring year type, Reclamation would fill San Luis Reservoir in the winter when flows are high, thus responding to the shift in timing of flows attributable to climate change. The Intertie provides additional flexibility in the system in meeting demands and managing the timing of pumping. All of the effects of operating the Intertie are described in this EIS.

Alternative 3 (TANC Intertie Site)

Construction

Impact CC-1: Construction-Related Changes in Greenhouse Gas Emissions

Construction activities associated with the Intertie would result in a temporary increase of GHG emissions. Based on the same assumptions used for the air quality analysis regarding construction equipment and activities, approximately 1,922 metric tons of CO_2 would be released. It is not expected that substantial GHG emissions would be generated during construction, as construction activities are anticipated to be temporary and are minor when compared to the local, state, federal, and global GHG inventory.

Operation

Impact CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Intertie Operations

As described in Section 5.2, Power Production and Energy, the use of the Intertie and associated increase in Jones pumping would require approximately a 1% increase in CVP power use. However, the CVP system generates this energy, and the Intertie would be connected to this power source at the Tracy substation. The power generated by the CVP is hydroelectric and does not result in a net increase of GHG emissions. As such, the Intertie operations would not result in an increase in GHG emissions.

Impact CC-3: Project Performance under Changed Conditions

As described above, many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system. The Intertie would resolve the physical constraint in the DMC that would otherwise preclude use of full Jones pumping capacity at times when available flows and regulatory regimes would allow for such pumping. With the Intertie, additional authorized Jones pumping could occur in winter months, which would help meet water demand south of the Delta. For example, during a wet winter and dry spring year type, Reclamation would fill San Luis Reservoir in the winter when flows are high, thus responding to the shift in timing of flows attributable to climate change. The Intertie provides additional flexibility in the system in meeting demands and managing the timing of pumping. All of the effects of operating the Intertie are described in this EIS.

Alternative 4: (Virtual Intertie)

Construction

Impact CC-1: Construction-Related Changes in Greenhouse Gas Emissions

Construction activities associated with the Virtual Intertie would result in minor temporary increases in GHGs when the temporary intertie structure is installed during emergencies. Based on the same assumptions used for the air quality analysis regarding construction equipment and activities, approximately 34 metric tons of CO_2 would be released. It is not expected that substantial GHG emissions would be generated during construction.

Operation

Impact CC-2: Permanent Changes in Greenhouse Gas Emissions as a Result of Virtual Intertie Operations

There are two potential mechanisms for GHG emissions related to the Virtual Intertie: Banks pumping and the temporary Intertie pumping. As described in Section 5.2, Power Production and Energy, the use of Banks Pumping Plant would require approximately a 1% increase in power use, and the CVP provides power for the water wheeled by the SWP for the CVP. This power is hydroelectric, and therefore no additional GHGs are expected to be emitted.

When the temporary Intertie is installed during emergencies, six 425-hp diesel generators would be used to power the movement of this water. It is currently unknown how many hours the generators would operate within a year, as operations are predicated solely on emergency usage requirements and an estimate of potential emergency situations is not available. To represent a worst-case scenario, it was assumed that the six diesel generators would operate 24-hours per day over a 365-day period. Based on this assumption, it is anticipated that a maximum of 7,420 metric tons of CO_2 would be emitted a year. However, this is the worst-case scenario, and actual emissions are expected be much less because operation of these pumps would be limited to emergency periods, which are expected to occur very infrequently and for short periods of time. As such, the Virtual Intertie operations would not result in a substantial increase in GHG emissions as operational emissions are minor when compared to the local, state, federal, and global GHG inventory.

Impact CC-3: Project Performance under Changed Conditions

As described above, many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system. The Intertie would resolve the physical constraint in the DMC that would otherwise preclude use of full Jones pumping capacity at times when available flows and regulatory regimes would allow for such pumping. With the Intertie, additional authorized Jones pumping could occur in winter months, which would help meet water demand south of the Delta. For example, during a wet winter and dry spring year type, Reclamation would fill San Luis Reservoir in the winter when flows are high, thus responding to the shift in timing of flows attributable to climate change. The Intertie provides additional flexibility in the system in meeting demands and managing the timing of pumping. All of the effects of operating the Intertie are described in this EIS.

Inter-Comparison of Alternative GHG Emissions

The construction and operational GHG emissions associated with the four project alternatives are presented in Figure 3.8-1. As shown in this figure, there are no construction emissions associated with the no action alternative. The proposed Intertie GHG emissions were the lowest of the action alternatives. The 1-year operational emissions for a single year of Alternative 4 operations could be as much as five times those associated with Alternative 2 or 3. Conservative assumptions were used to determine the Alternative 4 operational assumptions, so one year operational emissions may be overestimated. However, Alternatives 2 and 3 would create emissions only during construction, which would be temporary, whereas Alternative 4 would have fewer construction-related emissions each time it is constructed, but could be constructed multiple times, depending on emergency and maintenance needs. Alternative 4 would also result in operational emissions during maintenance and emergencies. As it is unknown how often the temporary intertie would be installed and operated, it is difficult to quantify the emissions associated with it.

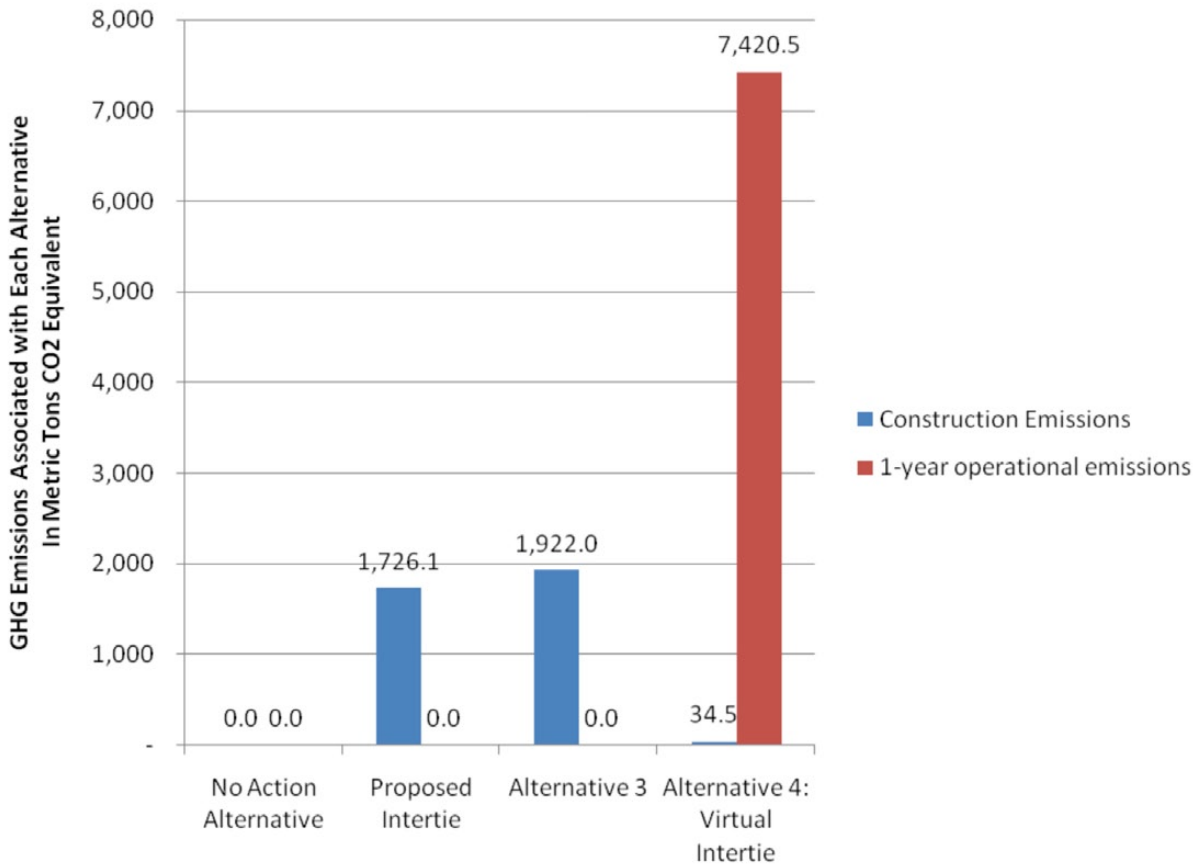

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Figure 3.8-1
A Comparison of the Operational and Construction Emissions Associated with Each Project Alternative

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.).

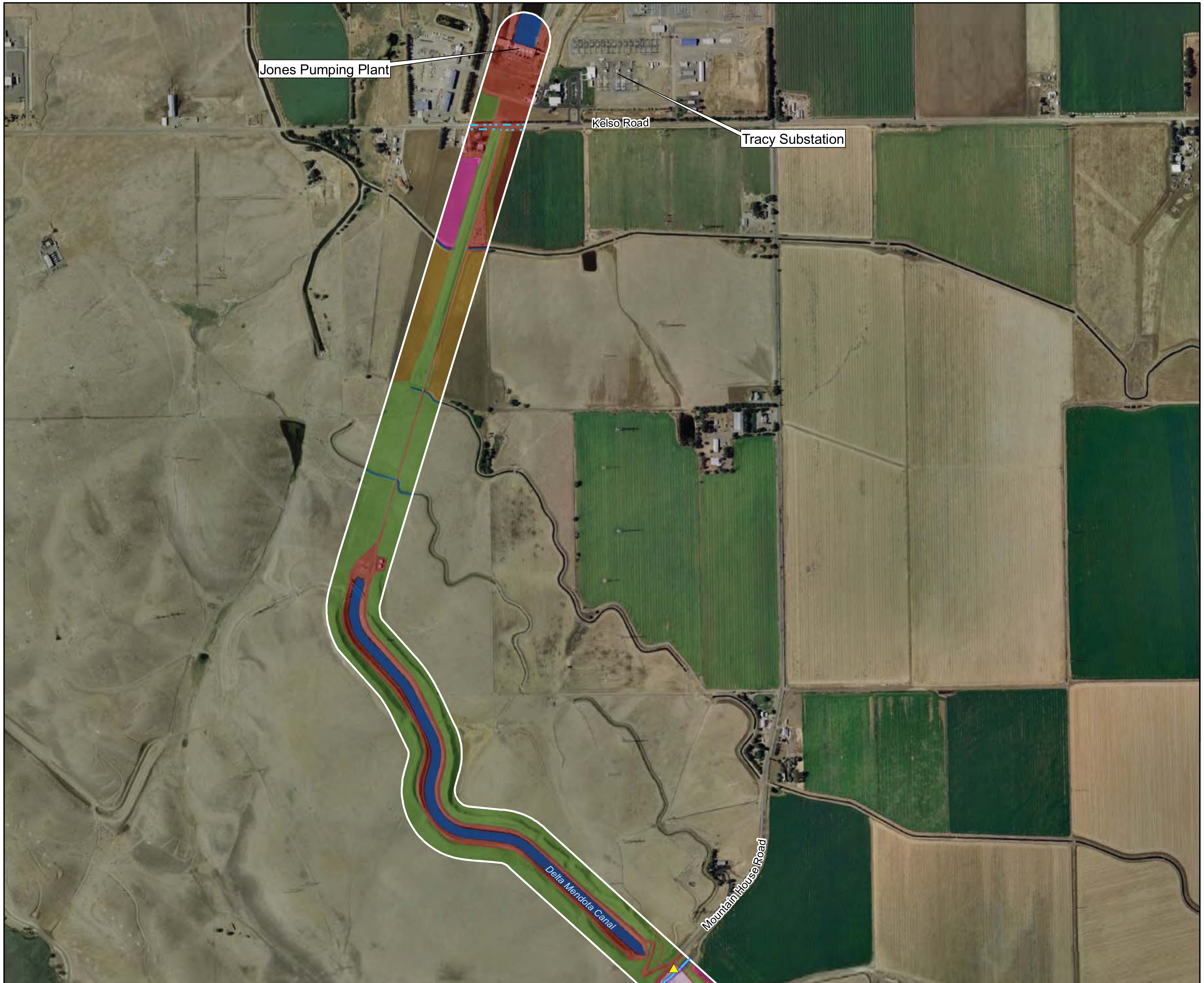


Figure 4.2-1
Map Sheet 1 of 4
Habitat Types in the Study Area

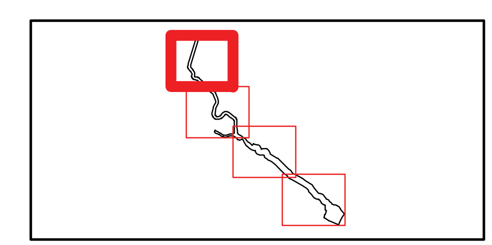
Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
Ephemeral Drainage	0.18
Alfalfa	180.25
Black Willow Riparian Woodland	0.31
Open Water	124.42
(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
Alkali Wetland	0.15
Developed	312.86
Emergent Marsh	1.66
Alkali Grassland	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



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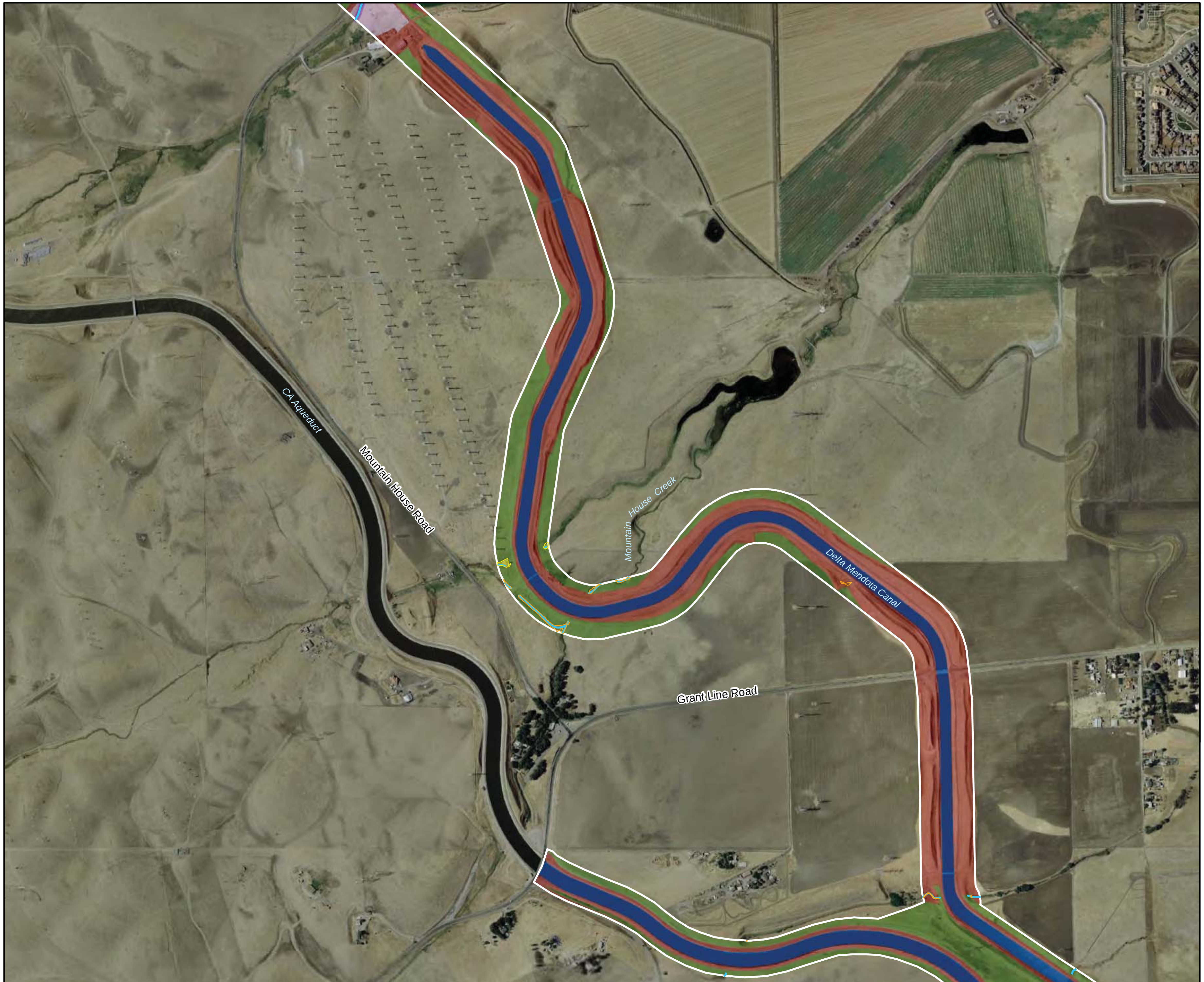


Figure 4.2-1
Map Sheet 2 of 4
Habitat Types in the Study Area

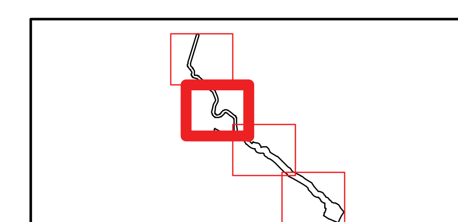
Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
Ephemeral Drainage	0.18
Alfalfa	180.25
Black Willow Riparian Woodland	0.31
Open Water	124.42
(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
Alkali Wetland	0.15
Developed	312.86
Emergent Marsh	1.66
Alkali Grassland	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



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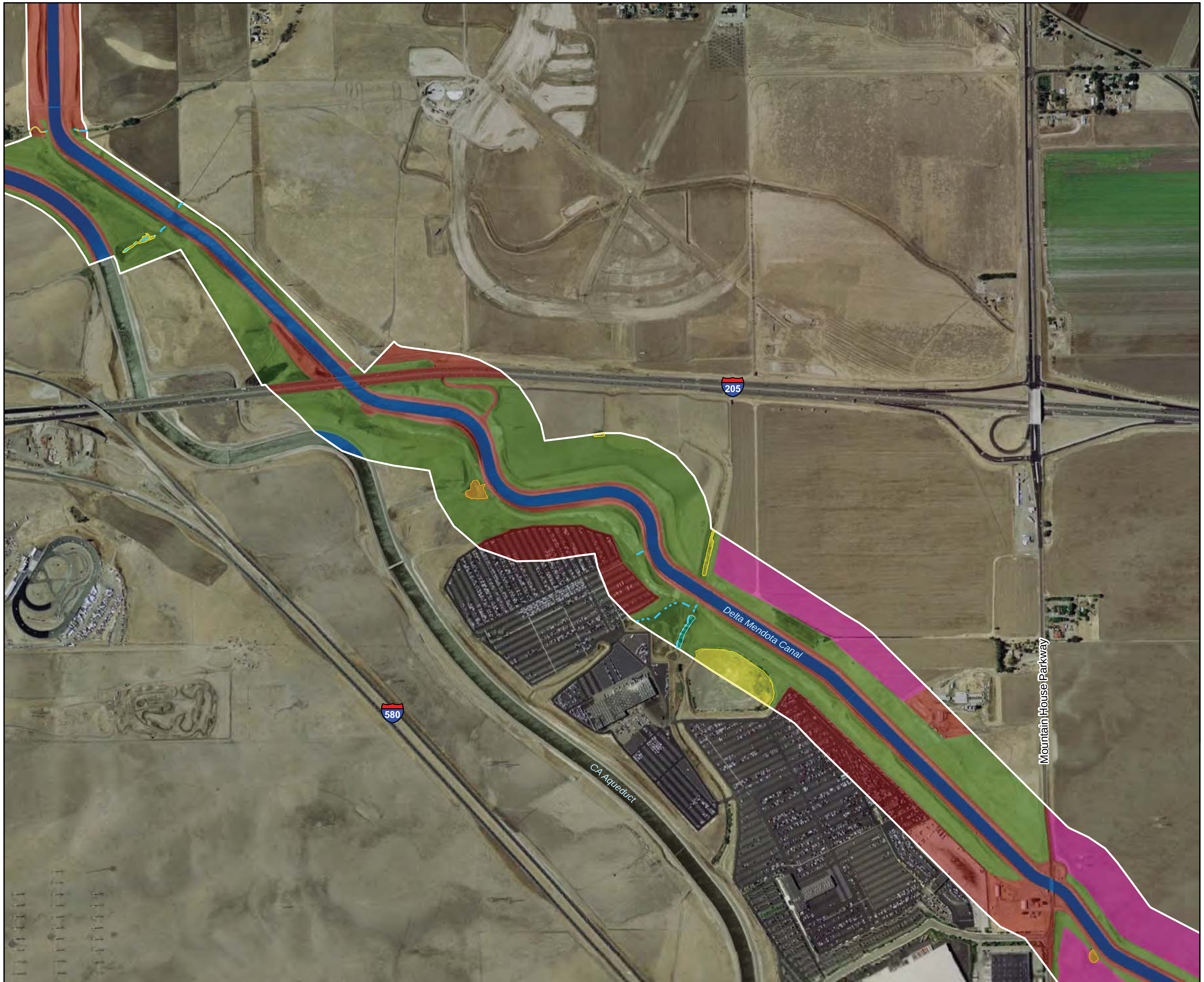

Figure 4.2-1
Map Sheet 3 of 4
Habitat Types in the Study Area

Habitat	Acres
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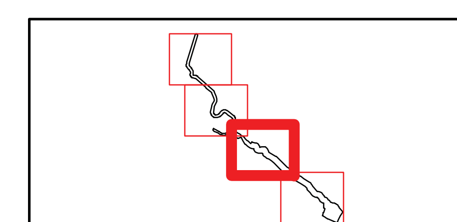
Study Area   Crownscale

Feet
1,000 500 0 1,000

N

Aerial Photo Source: Aerials Express, 2007



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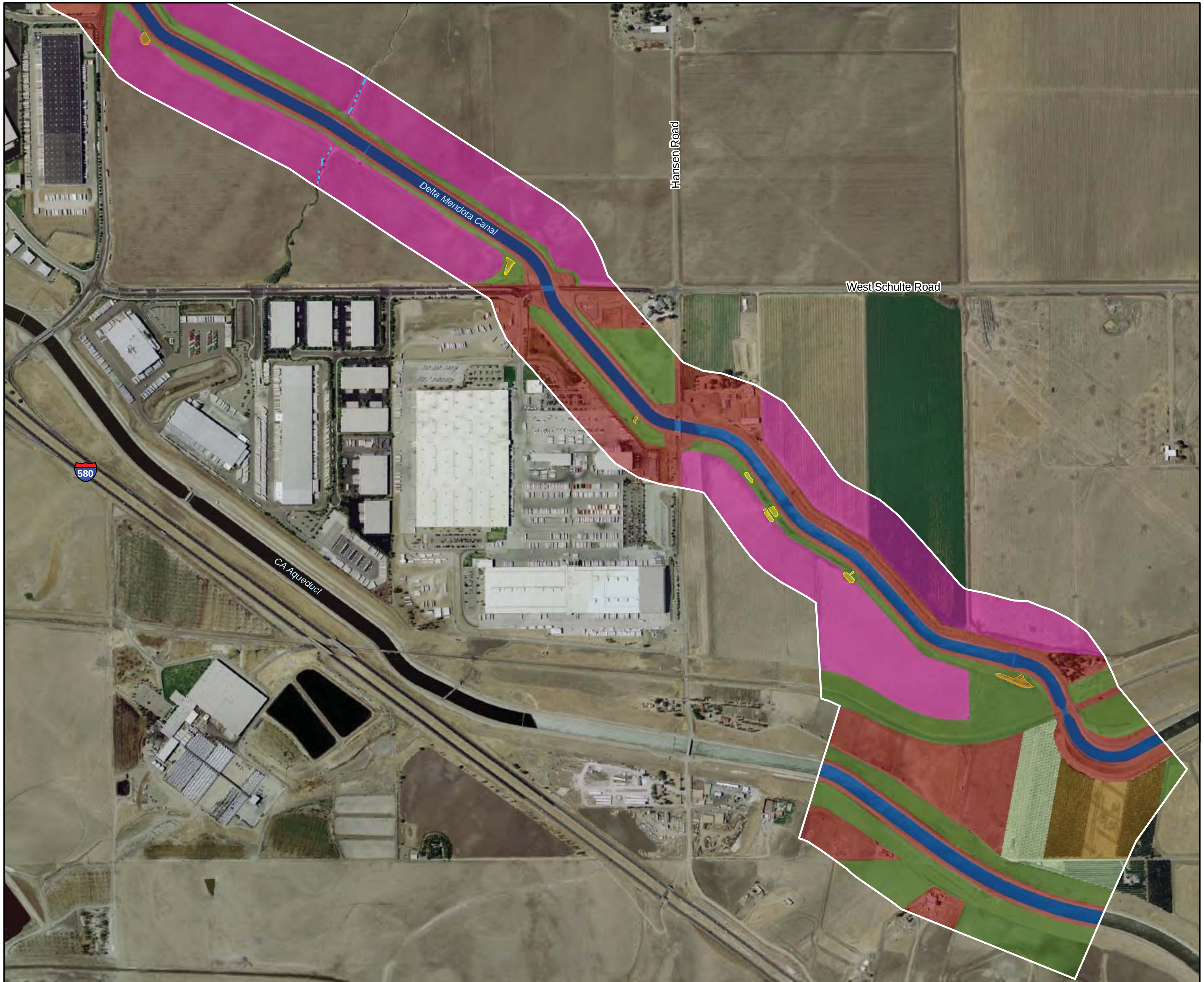

Figure 4.2-1
Map Sheet 4 of 4
Habitat Types in the Study Area

Habitat	Acres
Perennial Drainage	0.53
Intermittent Drainage	0.19
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(CA Aqueduct 23.56)	
(Delta-Mendota Canal 100.42)	
(Irrigation Canal 0.44)	
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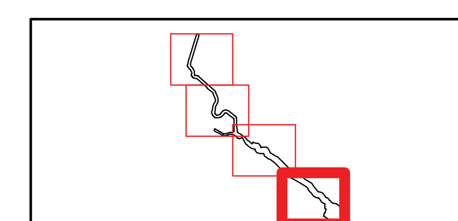
Study Area
Crownscale

Feet
1,000 500 0 1,000

N

Aerial Photo Source: Aerials Express, 2007



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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.

Chapter 5 Services, Social Issues, and Socioeconomics

This chapter provides the results of the assessment of effects on services, social issues, and socioeconomics. 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 5.1, *Land Use*;
- Section 5.2, *Power Production and Energy*;
- Section 5.3, *Visual Resources*;
- Section 5.4, *Cultural Resources*;
- Section 5.5, *Hazards and Hazardous Materials*;
- Section 5.6, *Socioeconomics*;
- Section 5.7, *Indian Trust Assets*;
- Section 5.8, *Utilities and Public Services*; and
- Section 5.9, *Environmental Justice*.

5.1 Land Use

5.1.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on land use. The primary concern related to land use is the conversion of farmland to nonagricultural use.

5.1.2 Affected Environment

Sources of Information

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

- California Department of Conservation Farmland Mapping and Monitoring Program, Unpublished digital information for Alameda County, 2006 (California Department of Conservation 2009a);
- California Department of Conservation Farmland Mapping and Monitoring Program, Unpublished digital information for San Joaquin County, 2008 (California Department of Conservation 2009b);
- California Department of Conservation, The California Land Conservation (Williamson) Act 2006 Status Report (for surveys done in 2004) (California Department of Conservation 2006); and
- site visits conducted on August 23, 2003, and September 17, 2008.

Project Area

Alternative 2 is located entirely within Alameda County, while Alternatives 3 and 4 are located in both Alameda and San Joaquin counties. Information for both counties is provided for context of potential environmental effects.

Alameda County

Of the 525,335 acres mapped by FMMP in Alameda County in 2008, approximately 1.5% was classified as farmland, 46% as grazing land, 28% as urban land, 14% as other land, and the remainder as water. Of the 7,689 acres of farmland mapped in Alameda County in 2008, 3,957 is prime farmland, 1,290 is farmland of statewide importance, and 2,442 is unique farmland. In 2008, 134,411 acres of Alameda County agricultural lands were covered by the Williamson Act contract. (California Department of Conservation 2006, 2009a.)

San Joaquin County

Of the 912,600 acres mapped by FMMP in San Joaquin County in 2006, approximately 68% was classified as farmland, 16% as grazing land, 10% as urban land, 5% as other land, and the remainder as water. In San Joaquin County, other land is a category that includes wetlands, low-density “ranchettes,” and brush or timberlands unsuitable for grazing. (California Department of Conservation 2009b.)

Of the 620,070 acres of farmland mapped in San Joaquin County in 2006, 407,609 is prime farmland, 89,273 is farmland of statewide importance, 63,231 is unique farmland, and 59,957 is farmland of local importance. In 2004, 477,261 acres of San Joaquin County farmland were covered by the Williamson Act contract. (California Department of Conservation 2006, 2009b.) San Joaquin County also provides Farmland Security Zones (FSZ) as another program to protect farmland. In 2004, 60,219 acres of farmland in San Joaquin County were protected through FSZ contracts.

Local

The predominant land use in the vicinity of Alternative 2 is grazing land. The predominant land use in the vicinity of Alternative 3 is orchards classified as prime farmland. Grazing land and farmland of local importance is also in the vicinity of Alternative 3. The predominant land use in the vicinity of Alternative 4 is grazing land.

5.1.3 Environmental Consequences

Assessment Methods

Land use impacts were assessed based on the compatibility of constructing and operating the project on adjacent land uses and the compatibility with local land use plans and policies, specifically important farmland designations or Williamson Act contracts. The assessment of the compatibility of the project with adjacent land uses was based on project site visits (August 23, 2003, and September 17, 2008) and review of aerial photographs. The location and acres of farmland classes (e.g., prime, unique, and state and locally important farmland) in the project area were based on data provided by the Department of Conservation’s Farmland Monitoring Program. San Joaquin County identifies all farmland that does not meet the state definitions for “prime,” “statewide importance,” or “unique,” as “locally important.” This designation includes land that is or has been used for irrigated pasture, dryland farming, confined livestock or dairy facilities, aquaculture, poultry facilities, and dry grazing.

Regulatory Setting

Farmland Protection Policy Act

The purpose of the Farmland Protection Policy Act (FPPA) is to minimize the extent to which federal programs contribute to irreversible conversion of farmland to nonagricultural uses, and to ensure that federal programs are administered in a manner that would be compatible with state and local government and private farmland protection programs and policies. The FPPA directs federal agencies to consider the effects of federal programs or activities on farmland. The agencies are to consider alternative actions, as appropriate, that could lessen such adverse effects, and ensure that such federal programs, to the extent practicable, are compatible with state, local, and private farmland protection programs and policies.

5.1.4 Environmental Effects

Alternative 1 (No Action)

Under Alternative 1, there would be no construction or changes in operations that would result in changes in statewide and federal programs to preserve open space and agricultural lands. The trend of land conversion from agricultural uses to urbanization and nonagricultural uses would likely continue.

Alternative 2

Construction

Impact LU-1: Temporary Conversion of Important Farmland during Construction

Construction of Alternative 2 would involve staging and access to the project site that could affect surrounding land uses. Access to the site would be on existing roads and staging and construction disturbance would be limited to the adjacent grassland areas. These areas are not classified as prime, unique, or statewide important, and upon completion of the project, these areas would be reseeded with native grasses to return the site to pre-project conditions. Therefore this temporary conversion is not considered adverse.

Impact LU-2: Permanent Conversion of Important Farmland

All of Alternative 2 is located on grazing land. The pipeline would be buried and would not result in any permanent conversion. Approximately 2 acres of grazing land would be permanently converted to developed land, but this land is not classified as prime, unique, or statewide important. As such, this conversion is not considered adverse.

Operation

Impact LU-3: Incompatibility with Surrounding Land Uses

Alternative 2 includes the operation of the Intertie that would improve water supply reliability for south of Delta agricultural CVP contractors. Additionally, the permanent above-ground structures associated with the Intertie are similar to other industrial structures in the region associated with water and power delivery. As such, the Intertie would be compatible with the surrounding land uses. There would be no effect, and in years when the Intertie results in an increased water supply, there would be a beneficial effect for south of Delta CVP contractors.

Alternative 3

Construction

Impact LU-1: Temporary Conversion of Important Farmland during Construction

Although most of the area in which Alternative 3 would be constructed is designated prime farmland, it is in fact developed area and fallowed agricultural land. Staging and access to the project site would be limited to the developed area to the extent possible. However, up to 0.7 acres of prime farmland (orchard and fallowed field) may be temporarily converted during construction. Additionally, some surrounding grazing lands could be temporarily affected. These areas are not classified as prime, unique, or statewide important, and upon completion of the project, these areas would be reseeded with native grasses to return the site to pre-project conditions. Therefore this temporary conversion is not considered adverse.

Impact LU-2: Permanent Conversion of Important Farmland

Most of the above-ground Intertie structure for Alternative 3 is located in developed areas, but approximately 0.4 acres would be located in an orchard or fallowed land classified as prime farmland. This includes the area above the pipeline, which would be taken out of agricultural production as a result of implementation of Alternative 3. The transmission line would span prime farmland, farmland of local importance, grazing land, and other lands not relevant to agriculture. To the extent possible, conversion of prime farmland would be avoided by adjusting the alignment of the transmission line poles. However, the worst-case scenario would result in the conversion of approximately 0.04 acres of prime farmland. This combined conversion from the Intertie structure and transmission line (0.44 acres) represents a very small fraction of the total 407, 609 acres of prime farmland. As such, this effect is not considered adverse.

Operation

Impact LU-3: Incompatibility with Surrounding Land Uses

Alternative 3 includes the operation of the Intertie that would improve water supply reliability for south of Delta agricultural CVP contractors. Additionally, the permanent above-ground structures associated with the Intertie are similar to other industrial structures in the region associated with water and power delivery. As such, the Intertie would be compatible with the surrounding land uses. There would be no effect, and in years when the Intertie results in an increased water supply, there would be a beneficial effect for south of Delta CVP contractors.

Alternative 4

Construction

Impact LU-1: Temporary Conversion of Important Farmland during Construction

Implementation of Alternative 4 would involve repeated staging and access to the project site each time the temporary intertie structure is installed that could affect surrounding land uses. Access to the site would be on existing roads and staging and construction disturbance would be limited to the adjacent grassland areas. These areas are not classified as prime, unique, or statewide important, and upon completion of the project, these areas would be reseeded with natives grasses to return the site to pre-project conditions. Therefore this temporary conversion is not considered adverse.

Operation

Impact LU-3: Incompatibility with Surrounding Land Uses

Alternative 4 does not include any new permanent physical structures and operations would occur at the existing Banks Pumping Plant. There would be no effect, and in years when the Intertie results in an increased water supply, there would be a beneficial effect for south of Delta CVP contractors.

5.2 Power Production and Energy

5.2.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on power production and the use of energy for pumping.

5.2.2 Affected Environment

Sources of Information

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

- The Bureau of Reclamation *Central Valley Operations Office Report of Operations for December 2007* (U.S. Department of the Interior, Bureau of Reclamation 2007).

Central Valley Project Facility Descriptions

The CVP extends from the Cascade Range in the north to along the Kern River in the south and generates an average of about 5.6 million megawatt hours (MWh) of electricity annually (depending on runoff conditions). The CVP facilities include reservoirs on the Trinity, Sacramento, American, Stanislaus, and San Joaquin Rivers. Water from the Trinity River is stored and re-regulated in Trinity Reservoir, Lewiston Lake, and Whiskeytown Reservoir and diverted through a system of tunnels and power plants into the Sacramento River for use in the Central Valley. CVP power plants include Keswick, Shasta, Spring Creek, Lewiston, Trinity, Judge Francis Carr, Folsom, Nimbus, New Melones, O'Neill, and San Luis (W. R. Gianelli pumping-generating plant).

Water from all of these reservoirs and other reservoirs owned and/or operated by the CVP and local water rights holders flows into the Sacramento River. Some of the CVP contractors divert water directly from or immediately below the dams' outlet works. Other CVP contractors, Sacramento River water rights contractors, and water rights holders divert water directly from the Sacramento and American Rivers. The Sacramento River carries water to the Delta. The Jones Pumping Plant at the southern end of the Delta near Tracy lifts the water into the DMC at Mile 3.5, using power supplied by the CVP power plants. The Jones Pumping Plant does not operate to generate power supply; rather, it consumes large quantities of energy to lift the water about 200 feet to the DMC.

The DMC delivers water to CVP contractors and exchange contractors on the San Joaquin River. The CVP water also is conveyed via the DMC to the San Luis Reservoir for deliveries to CVP contractors through the San Luis Canal. The O'Neill pumping station lifts water about 50 feet to O'Neill Forebay. The W. R. Gianelli pumping-generating plant lifts water a maximum of about 250 feet to San Luis Reservoir (at maximum storage, elevation of about 450 feet). A portion of this energy is recovered when the water is released in the summer peak demand period to the DMC (through O'Neill generating plant, or to the San Luis Canal where it is pumped about 125 feet at the Dos Amigos Pumping Plant to continue down the California Aqueduct to Westlands contractors. Water from the San Luis Reservoir also can be conveyed through the Pacheco Tunnel to CVP contractors in Santa Clara and San Benito Counties.

The CVP also delivers water from the Friant Dam on the San Joaquin River to CVP contractors located near the Madera and Friant-Kern Canals. A small generator is located on the Friant-Kern Canal. Water is stored in the New Melones Reservoir for water rights holders in the Stanislaus River Watershed and CVP contractors in the northern San Joaquin Valley. Power is generated at the Stanislaus power plant and at Tullock Dam (non-CVP).

Some CVP water is pumped at the Banks Pumping Plant and delivered through the California Aqueduct to O'Neill Forebay. The Banks Pumping Plant lifts water about 250 feet to Bethany Forebay. The Intertie water would be pumped at the Jones Pumping Plant and then pumped at the Intertie Pumping Plant into the California Aqueduct, and would flow to the O'Neill Forebay.

State Water Project Facility Descriptions

The SWP begins in northern California on the upper Feather River, a tributary of the Sacramento River. Runoff is stored behind Oroville Dam, which includes facilities such as the Oroville-Thermalito Complex. This complex coordinates between releasing water and producing power, and releasing water takes precedence. Power-producing facilities at Oroville Dam include Hyatt Power Plant, Thermalito Power Plant, and Thermalito Diversion Dam Power Plant (small for releases to river). These facilities operate together to move water and to generate electricity. The water then flows from Lake Oroville to the Delta where some of the water is pumped through the North Bay Aqueduct to Napa and Solano Counties. The Hyatt Power plant has six units, with three generating-pumping units, which allow some water to be pumped back into Oroville Reservoir from Thermalito Forebay during off-peak hours. The Thermalito Power Plant also has some generating-pumping units.

In the southern Delta, water is pumped by the Banks Pumping Plant about 250 feet to feed the South Bay Aqueduct and the California Aqueduct. Similar to the Jones Pumping Plant, Banks Pumping Plant does not operate to generate power supply; rather, it consumes large quantities of energy to pump water into the California Aqueduct.

Some SWP water is pumped about 350 feet into the South Bay Aqueduct from Bethany Forebay. Most of the SWP water flows down the California Aqueduct to the O'Neill Forebay. The W. R. Gianelli pumping-generating plant lifts water a maximum of about 250 feet to San Luis Reservoir (at maximum storage elevation of about 450 feet). A portion of this energy is recovered when the water is released in the summer peak demand period to the San Luis Canal (California Aqueduct) where it is pumped about 125 feet at the Dos Amigos Pumping Plant to continue down the California Aqueduct to Kern County and southern California SWP contractors. Some SWP water is pumped about 1,500 feet into the Coastal Branch pipeline near Kettleman City.

The California Aqueduct continutes to the foot of the Tehachapi Mountains, where the Edmonston Pumping Plant lifts the water almost 2,000 feet to enter 10 miles of tunnels and siphons that traverse the Tehachapi range. After crossing the Tehachapis, the California Aqueduct divides into two branches. The West Branch Aqueduct stores water in Pyramid and Castaic Reservoirs to serve Los Angeles and other coastal cities. The East Branch Aqueduct flows through the Antelope Valley, storing water in Silverwood Lake. The water finally reaches San Bernardino and Riverside Counties, storing water in the Lake Perris reservoir.

Joint Federal and State Facilities

Some CVP facilities (e.g., the San Luis Unit) were developed in coordination with the SWP. Both the CVP and the SWP use the San Luis Reservoir, O'Neill Forebay, and more than 100 miles of the aqueduct and its related pumping and generating facilities. These operations are closely coordinated at a Joint Operations Center in Sacramento and join with other agencies such as the National Weather Service and the Corps for joint action during flood emergencies. CVP routinely uses the Banks Pumping Plant to pump water into the California Aqueduct and O'Neill Forebay. This is sometimes called *wheeling* water. CVP supplies the Banks Pumping Plant with the energy required to wheel water and pays a maintenance charge for use of the SWP facilities.

5.2.3 Environmental Consequences

Assessment Methods

Reclamation completed a basic power impact analysis for the Intertie and alternatives that involved the modeling of the CVP power generation (power plants) and energy consumption (pumping plants) resources for the No Action conditions and for the Intertie alternatives. The differences in the power consumption are associated with the changes in CVP and SWP pumping.

As described in Section 3.1, Water Supply and Delta Water Managementl, the Intertie does not substantially change upstream reservoir operations. Because power generation occurs at these upstream reservoirs during normal releases (not during flood control releases), the Intertie causes no substantial changes in CVP power generation.

The changes in the CVP and SWP reservoir and Delta operations caused by the Intertie Alternatives were simulated with the CALSIM II monthly model. Because CALSIM II does not calculate CVP or SWP power generation or energy used for pumping water, the changes in energy used for the Intertie alternatives was estimated from the monthly pumping flows at Jones, Banks, and Intertie Pumping Plants.

The energy needed to pump an acre-foot of water each foot of elevation rise is about a kilowatt-hour (KWh). Therefore, to pump 1 taf at the Jones Pumping Plant during a month with an elevation change (pumping lift) of 200 feet requires about 200 MWh of energy. Because the electrical motors and water turbines (pumping units) are only about 85% efficient, this requires about 240 MWh. To pump the maximum Intertie capacity of 400 cfs for a month (25 taf) at the Jones Pumping Plant would require about 6,000 MWh.

The Intertie Pumping Plant has a maximum capacity of about 400 cfs, which would be a maximum volume of about 25 taf in a month. Because the lift is about 50 feet, the energy required for the Intertie pumps at full capacity (with an efficiency of 85%) for a month would be a maximum of about 1,500 MWh (i.e., 60 MWh for each taf). The energy required for 400 cfs additional pumping at Jones and the Intertie would be about 7,500 MWh (300 MWh for each taf).

The Banks Pumping Plant has a lift of 250 feet, so the Banks lift is identical to the combined Jones Pumping Plant lift and the Intertie Pumping Plant lift. The energy required to pump 400 cfs of water for a month would be about 7,500 MWh (300 MWh for each taf).

The CVP generates about four times more hydroelectric power than is needed for the Tracy and O’Neill and San Luis and Dos Amigos pumping. For example, in calendar year 2007, the Central Valley Operations Report (U.S. Department of the Interior, Bureau of Reclamation 2007) indicates that a total of about 4,290,000 MWh were produced at CVP hydropower (i.e., renewable energy) plants, including about 130,000 MWh produced at the San Luis and O’Neill generating plants. The report for 2007 indicates that 595,000 MWh of energy were used at Jones Pumping Plant, 75,000 MWh were used at the O’Neill Pumping Plant, 210,000 MWh were used at San Luis, and 145,000 MWh were used at Dos Amigos, with 40,000 MWh used for wheeling CVP water at Banks Pumping Plant. Therefore, a total of 1,065,000 MWh was used for CVP pumping, while about 4,290,000 MWh were generated during the year. The CVP pumping energy was about 25% of the CVP power generation.

5.2.4 Environmental Effects

Alternative 1 (No Action)

The No Action Alternative reflects the CVP and SWP energy required by pumping and energy generation if the Intertie is not constructed or implemented. There would be no changes in CVP or SWP pumping or generation, and no new power facilities would be constructed or operated. Therefore, no power production or energy use effects would be associated with the No Action Alternative. Table 5.2-1 gives the annual (water year) pumping at Banks and Jones Pumping Plants for the Future No Action simulation with CALSIM. The average Jones pumping was simulated to be 2,355 taf/yr, and the average Banks pumping was simulated to be 3,521 taf/yr. The average calculated energy use for Jones pumping was 565,165 MWh, and the average calculated energy use for Banks pumping was 1,056,416 MWh, for a combined total energy use of 1,621,581 MWh. This combined energy use is equivalent to the power production from a 185-MWh power plant. Additional energy is required to pump water into O'Neill Forebay and into San Luis Reservoir (although about 80% is recovered when the water is released). More energy is required at the Dos Amigos Pumping Plant to move CVP water in the San Luis Canal (California Aqueduct) to Westlands Water District turnouts, located north of Kettleman City.

Alternative 2 (Proposed Action)

Construction Effects

Impact POW-1: Increased Energy Consumption as a Result of Constructing the Intertie

The Intertie would cause irreversible and irretrievable commitments of nonrenewable energy resources needed to construct project structures. These resources include gasoline and diesel fuel used for construction equipment. However, the extent to which the resources would be used is limited, as the work is temporary and requires a relatively small area. Therefore, the change in energy consumption during construction would not be substantial, and there would be no adverse effect.

Operation Effects

Impact POW-2: Increased Electricity Consumption as a Result of Operating the Intertie

Table 5.2-1 shows the annual summary of energy consumption for the No Action and the Intertie Proposed Action Alternative. Implementing the Proposed Action should result in only a minor increase in the energy consumption of the CVP. The average calculated energy consumption for the Intertie Pumping Plant would be about 4,550 MWh to pump an average of 76 taf/yr. The additional Jones pumping would be about 35 taf/yr. This is less than the Intertie pumping, because Jones pumping would sometimes be reduced in February or March if Intertie pumping has filled CVP San Luis Reservoir storage earlier. The average additional energy use for Jones pumping was about 8,500 MWh. The CALSIM model indicates that Banks pumping would be reduced at times when CVP pumping with the Intertie was increased. The average change in Banks pumping would be a reduction of 3 taf/yr, reducing average energy use for Banks pumping by about 780 MWh.

The average energy impacts of the Proposed Action compared to simulated No Action levels of annual energy consumption are less than 1%, when the combined CVP and SWP pumping energy at the Banks, Jones, and Intertie Pumping Plants is evaluated. According to the CALSIM modeling results, the energy impact attributable to the Intertie Proposed Action is minimal and insignificant as a percentage of the overall level of CVP power production and energy consumption. The CVP power production would remain about four times the energy consumption for pumping the CVP water to south of Delta contractors. This is not an adverse effect.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact POW-1: Increased Energy Consumption as a Result of Constructing the Intertie

As described above for Alternative 2, the Intertie would cause irreversible and irretrievable commitments of nonrenewable energy resources needed to construct project structures. These resources include gasoline and diesel fuel used for construction equipment. However, the extent to which the resources would be used is limited, as the work is temporary and requires a relatively small area. Therefore, the change in energy consumption during construction would not be substantial, and there would be no adverse effect.

Operation Effects

Impact POW-2: Increased Electricity Consumption as a Result of Operating the Intertie

The energy impacts associated with the operation of Alternative 3 are identical to those of Alternative 2. These impacts would be less than 1% of the combined energy for pumping CVP and SWP water from the Delta, and are not considered adverse.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact POW-1: Increased Energy Consumption as a Result of Constructing the Temporary Intertie

Construction/installation of the temporary intertie during emergencies would cause irreversible and irretrievable commitments of nonrenewable energy resources, including gasoline and diesel fuel used for construction equipment. However, the extent to which the resources would be used is limited, as the work is temporary, would occur infrequently, and requires a relatively small area. Therefore, the change in energy consumption during construction would not be substantial, and there would be no adverse effect.

Operation Effects

Impact POW-2: Increased Electricity Consumption as a Result of Operating the Temporary Intertie

The energy impacts associated with the Virtual Intertie (Alternative 4) are assumed to be identical to the calculated impacts for the Proposed Action (Alternative 2), because the Intertie pumping actually would occur at the Banks Pumping Plant. Because the combined lift of the Jones and Intertie Pumping Plants (250 feet) is the same as the Banks Pumping Plant lift, the energy associated with pumping of CVP water at the Banks Pumping Plant is identical. Because the results in Table 5.2-1 indicate that the average energy use would increase by less than 1% and would be supplied by the excess CVP power generation capacity, this impact is not considered adverse.

Table 5.2-1. Annual Pumping (taf) and Energy Consumption (MWh) at Jones, Banks, and Intertie Power Plants

Water Year	FNA Jones Pumping (taf)	FNA Banks Pumping (taf)	FNA Jones Energy (MWh)	FNA Banks Energy (MWh)	FNA Total Energy (MWh)	Intertie Pumping Plant (taf)	Increased Jones Pumping (taf)	Increased Banks Pumping (taf)	Increased Intertie Energy (MWh)	Increased Jones Energy (MWh)	Increased Banks Energy (MWh)	Increased Total Energy (MWh)	Percent FNA Total Energy (%)
1922	2,747	4,480	659,362	1,344,003	2,003,365	109	20	-22	6,546	4,821	-6,557	4,810	0.2%
1923	2,644	3,766	634,506	1,129,839	1,764,345	92	76	22	5,544	18,149	6,562	30,256	1.7%
1924	1,636	1,742	392,544	522,487	915,031	40	82	-68	2,417	19,786	-20,502	1,701	0.2%
1925	2,182	2,558	523,649	767,362	1,291,012	6	-135	-10	332	-32,435	-3,150	-35,252	-2.7%
1926	1,861	2,308	446,560	692,359	1,138,919	38	22	33	2,274	5,284	9,939	17,496	1.5%
1927	2,487	4,250	596,952	1,275,044	1,871,997	82	-1	2	4,949	-161	482	5,271	0.3%
1928	2,588	3,858	621,120	1,157,309	1,778,429	103	80	-46	6,151	19,214	-13,919	11,446	0.6%
1929	1,789	1,996	429,440	598,827	1,028,267	64	95	-36	3,853	22,785	-10,767	15,871	1.5%
1930	1,965	2,804	471,498	841,059	1,312,557	48	-1	18	2,876	-267	5,256	7,866	0.6%
1931	1,444	1,420	346,501	426,045	772,545	24	-19	35	1,416	-4,525	10,402	7,293	0.9%
1932	1,612	2,174	386,986	652,228	1,039,213	66	47	12	3,950	11,332	3,493	18,775	1.8%
1933	1,324	1,778	317,747	533,499	851,247	10	-131	334	579	-31,357	100,145	69,367	8.1%
1934	1,106	1,955	265,377	586,581	851,959	48	159	-255	2,871	38,227	-76,588	-35,489	-4.2%
1935	1,990	3,755	477,714	1,126,511	1,604,225	48	19	-106	2,854	4,474	-31,936	-24,607	-1.5%
1936	2,458	4,152	589,960	1,245,512	1,835,473	57	-33	-18	3,405	-7,820	-5,292	-9,707	-0.5%
1937	2,074	3,792	497,719	1,137,482	1,635,201	67	5	-79	4,032	1,282	-23,602	-18,289	-1.1%
1938	2,310	4,915	554,305	1,474,444	2,028,749	31	11	-3	1,833	2,585	-873	3,544	0.2%
1939	2,043	2,962	490,387	888,662	1,379,049	56	74	26	3,364	17,833	7,764	28,961	2.1%
1940	2,437	3,906	584,834	1,171,659	1,756,493	79	34	2	4,726	8,175	643	13,543	0.8%
1941	2,826	4,702	678,310	1,410,491	2,088,802	98	29	-17	5,885	7,005	-5,024	7,867	0.4%
1942	2,724	4,744	653,711	1,423,191	2,076,903	93	14	12	5,583	3,455	3,585	12,624	0.6%
1943	2,643	4,070	634,433	1,221,095	1,855,528	92	27	-52	5,498	6,525	-15,606	-3,584	-0.2%
1944	2,426	3,360	582,192	1,008,019	1,590,211	81	68	101	4,876	16,399	30,159	51,434	3.2%
1945	2,549	4,099	611,690	1,229,579	1,841,269	85	25	-117	5,081	5,989	-35,054	-23,983	-1.3%
1946	2,755	3,979	661,089	1,193,598	1,854,687	101	59	-23	6,037	14,111	-6,880	13,267	0.7%

Water Year	FNA Jones Pumping (taf)	FNA Banks Pumping (taf)	FNA Jones Energy (MWh)	FNA Banks Energy (MWh)	FNA Total Energy (MWh)	Intertie Pumping Plant (taf)	Increased Jones Pumping (taf)	Increased Banks Pumping (taf)	Increased Intertie Energy (MWh)	Increased Jones Energy (MWh)	Increased Banks Energy (MWh)	Increased Total Energy (MWh)	Percent FNA Total Energy (%)
1947	2,491	3,033	597,836	909,879	1,507,715	87	73	-33	5,197	17,516	-9,776	12,936	0.9%
1948	2,491	2,950	597,845	885,001	1,482,846	24	-69	-21	1,414	-16,617	-6,360	-21,563	-1.5%
1949	2,565	2,626	615,516	787,795	1,403,310	52	-95	-166	3,112	-22,779	-49,664	-69,331	-4.9%
1950	2,572	2,960	617,239	887,863	1,505,102	101	117	297	6,053	28,131	89,013	123,197	8.2%
1951	2,202	4,256	528,371	1,276,900	1,805,271	59	12	129	3,512	2,869	38,820	45,200	2.5%
1952	2,909	4,931	698,192	1,479,362	2,177,554	104	23	-11	6,243	5,594	-3,182	8,655	0.4%
1953	2,664	4,020	639,351	1,206,143	1,845,494	93	-14	114	5,564	-3,322	34,201	36,443	2.0%
1954	2,596	4,015	623,148	1,204,494	1,827,642	98	96	-30	5,893	22,930	-9,009	19,814	1.1%
1955	2,181	2,756	523,478	826,833	1,350,311	77	110	-41	4,634	26,329	-12,346	18,616	1.4%
1956	2,580	4,278	619,215	1,283,535	1,902,750	82	21	-29	4,891	5,126	-8,703	1,313	0.1%
1957	2,520	3,459	604,735	1,037,630	1,642,365	96	6	23	5,776	1,547	6,758	14,081	0.9%
1958	2,862	4,855	686,841	1,456,423	2,143,264	112	0	22	6,712	41	6,741	13,494	0.6%
1959	2,537	3,491	608,894	1,047,195	1,656,089	104	116	-21	6,221	27,821	-6,166	27,875	1.7%
1960	2,035	2,846	488,333	853,833	1,342,166	52	35	-71	3,140	8,475	-21,265	-9,651	-0.7%
1961	2,436	3,133	584,725	939,757	1,524,482	80	14	-48	4,790	3,386	-14,409	-6,233	-0.4%
1962	2,510	3,390	602,503	1,016,919	1,619,422	82	84	-24	4,920	20,152	-7,188	17,883	1.1%
1963	2,619	4,339	628,505	1,301,761	1,930,266	106	34	75	6,366	8,073	22,462	36,901	1.9%
1964	2,218	3,228	532,314	968,360	1,500,674	83	85	-39	4,983	20,367	-11,804	13,546	0.9%
1965	2,542	3,983	610,111	1,195,032	1,805,143	101	47	21	6,057	11,306	6,289	23,652	1.3%
1966	2,627	3,774	630,519	1,132,077	1,762,596	127	160	-43	7,645	38,501	-12,940	33,205	1.9%
1967	2,833	4,719	680,008	1,415,765	2,095,773	96	34	19	5,739	8,153	5,717	19,610	0.9%
1968	2,504	3,842	601,040	1,152,687	1,753,727	74	-13	-117	4,459	-3,178	-35,010	-33,729	-1.9%
1969	2,796	4,747	671,063	1,424,072	2,095,134	96	59	-19	5,734	14,229	-5,644	14,319	0.7%
1970	2,274	4,076	545,724	1,222,698	1,768,422	70	64	-51	4,178	15,376	-15,387	4,167	0.2%
1971	2,701	4,213	648,244	1,263,994	1,912,238	93	58	-18	5,563	13,969	-5,406	14,126	0.7%
1972	2,597	3,505	623,312	1,051,556	1,674,868	106	165	-74	6,386	39,603	-22,233	23,757	1.4%

Water Year	FNA Jones Pumping (taf)	FNA Banks Pumping (taf)	FNA Jones Energy (MWh)	FNA Banks Energy (MWh)	FNA Total Energy (MWh)	Intertie Pumping Plant (taf)	Increased Jones Pumping (taf)	Increased Banks Pumping (taf)	Increased Intertie Energy (MWh)	Increased Jones Energy (MWh)	Increased Banks Energy (MWh)	Increased Total Energy (MWh)	Percent FNA Total Energy (%)
1973	2,554	4,014	613,012	1,204,272	1,817,284	100	48	27	6,000	11,581	8,181	25,762	1.4%
1974	2,792	4,678	670,058	1,403,411	2,073,468	113	85	-5	6,800	20,370	-1,629	25,541	1.2%
1975	2,711	4,601	650,566	1,380,425	2,030,991	115	90	35	6,899	21,612	10,391	38,902	1.9%
1976	1,889	2,687	453,329	806,236	1,259,565	74	77	51	4,467	18,492	15,310	38,269	3.0%
1977	1,287	836	308,782	250,853	559,636	23	-35	171	1,378	-8,387	51,207	44,198	7.9%
1978	2,552	3,890	612,568	1,167,035	1,779,603	77	-22	94	4,635	-5,362	28,114	27,387	1.5%
1979	2,713	3,900	651,155	1,170,008	1,821,164	104	12	-51	6,266	2,933	-15,239	-6,040	-0.3%
1980	2,613	4,311	627,144	1,293,442	1,920,586	93	66	-82	5,578	15,949	-24,495	-2,968	-0.2%
1981	2,744	3,342	658,469	1,002,660	1,661,130	99	26	6	5,910	6,145	1,663	13,718	0.8%
1982	2,829	4,877	679,040	1,463,091	2,142,131	95	20	11	5,702	4,874	3,275	13,851	0.6%
1983	2,741	4,925	657,837	1,477,384	2,135,221	87	-4	1	5,222	-906	365	4,682	0.2%
1984	2,206	4,106	529,343	1,231,697	1,761,040	46	5	22	2,760	1,127	6,660	10,548	0.6%
1985	2,650	3,732	635,906	1,119,699	1,755,605	92	83	-45	5,522	20,030	-13,508	12,045	0.7%
1986	2,663	4,241	639,142	1,272,309	1,911,451	91	39	-17	5,479	9,470	-5,018	9,931	0.5%
1987	1,587	3,207	380,877	962,155	1,343,032	35	-25	-52	2,100	-5,896	-15,516	-19,312	-1.4%
1988	1,676	1,798	402,346	539,269	941,615	47	13	-3	2,833	3,225	-794	5,264	0.6%
1989	2,087	2,812	500,773	843,702	1,344,475	32	36	2	1,930	8,711	531	11,171	0.8%
1990	1,711	1,760	410,532	528,096	938,627	6	8	-3	375	1,829	-778	1,425	0.2%
1991	1,539	1,211	369,450	363,300	732,749	44	-162	13	2,631	-38,863	3,979	-32,254	-4.4%
1992	1,175	1,420	281,913	425,984	707,897	22	85	166	1,302	20,353	49,764	71,418	10.1%
1993	2,318	3,916	556,202	1,174,811	1,731,013	99	114	27	5,964	27,258	8,069	41,291	2.4%
1994	2,453	2,898	588,654	869,365	1,458,019	65	83	3	3,882	19,898	946	24,726	1.7%
1995	2,718	4,590	652,362	1,377,118	2,029,481	83	143	-58	4,958	34,225	-17,293	21,889	1.1%
1996	2,647	4,172	635,195	1,251,677	1,886,872	87	-45	-77	5,247	-10,776	-23,223	-28,751	-1.5%
1997	2,587	3,600	620,999	1,080,037	1,701,036	108	20	-17	6,466	4,817	-5,059	6,224	0.4%
1998	2,753	4,693	660,833	1,407,939	2,068,772	92	47	-59	5,500	11,361	-17,567	-705	0.0%

Water Year	FNA Jones Pumping (taf)	FNA Banks Pumping (taf)	FNA Jones Energy (MWh)	FNA Banks Energy (MWh)	FNA Total Energy (MWh)	Intertie Pumping Plant (taf)	Increased Jones Pumping (taf)	Increased Banks Pumping (taf)	Increased Intertie Energy (MWh)	Increased Jones Energy (MWh)	Increased Banks Energy (MWh)	Increased Total Energy (MWh)	Percent FNA Total Energy (%)
1999	2,465	4,141	591,669	1,242,294	1,833,964	69	44	-51	4,113	10,650	-15,358	-595	0.0%
2000	2,563	4,012	615,203	1,203,595	1,818,797	116	42	74	6,952	9,995	22,251	39,198	2.2%
2001	2,303	2,851	552,606	855,361	1,407,967	86	83	-39	5,165	20,001	-11,736	13,430	1.0%
2002	2,608	2,959	625,847	887,761	1,513,608	50	-34	81	3,008	-8,273	24,176	18,912	1.2%
2003	2,484	3,622	596,084	1,086,662	1,682,746	100	100	-26	5,976	23,928	-7,832	22,072	1.3%
Min	1,106	836	265,377	250,853	559,636	6	-162	-255	332	-38,863	-76,588	-69,331	-4.9%
10%	1,640	1,959	393,524	587,806	950,280	32	-32	-74	1,947	-7,627	-22,136	-21,338	-1.4%
20%	2,036	2,805	488,743	841,588	1,343,321	48	-1	-51	2,872	-121	-15,334	-2,515	-0.1%
30%	2,235	2,983	536,337	895,027	1,502,002	64	13	-38	3,862	3,020	-11,445	4,720	0.2%
40%	2,455	3,472	589,177	1,041,456	1,638,067	77	22	-22	4,634	5,189	-6,478	9,165	0.6%
50%	2,515	3,783	603,619	1,134,779	1,754,666	83	34	-14	4,971	8,164	-4,100	13,349	0.7%
60%	2,569	3,982	616,550	1,194,459	1,794,927	92	47	2	5,499	11,349	512	14,242	0.9%
70%	2,617	4,104	628,097	1,231,061	1,839,530	95	72	16	5,725	17,180	4,873	19,753	1.3%
80%	2,694	4,274	646,465	1,282,208	1,912,081	100	83	27	5,996	20,025	8,008	27,062	1.7%
90%	2,753	4,701	660,686	1,410,236	2,072,999	106	99	80	6,356	23,828	24,005	38,839	2.1%
Max	2,909	4,931	698,192	1,479,362	2,177,554	127	165	334	7,645	39,603	100,145	123,197	10.1%
Avg	2,355	3,521	565,165	1,056,416	1,621,581	76	35	-3	4,550	8,474	-780	12,244	0.9%

FNA = Future No Action.
MWh = megawatt hours.
taf = thousand acre-feet.

5.3 Visual Resources

5.3.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on visual resources. Specifically, this section evaluates and discusses the consequences of the construction and operation of the project in terms of changes to visual character and quality, visibility of proposed changes, and viewer response to and significance of those changes. The primary concern related to visual/aesthetic resources in the project area is permanent changes in views.

5.3.2 Concepts and Terminology for Visual Assessment and Visual Quality

In Webster's *New World Dictionary*, aesthetics is defined as "the study or theory of beauty and the psychological responses to it." Aesthetics (or visual resource) analysis is, therefore, a process to logically assess visible change and viewer response to that change.

Identification of existing conditions with regard to visual resources entails three steps:

1. Objective identification of the visual features (visual resources) of the landscape.
2. Assessment of the character and quality of those resources relative to overall regional visual character.
3. Identification of the importance to people, or sensitivity, of views of visual resources in the landscape.

With an establishment of the existing (baseline) conditions, alternatives or other change to the landscape can be systematically evaluated for their degree of effect. The degree of the effect depends both on the magnitude of change in the visual resource (i.e., visual character and quality) and on viewers' responses to and concern for those changes. This general process is similar for all established federal procedures of visual assessment (Smardon et al. 1986) and represents a suitable methodology of visual assessment for other projects and areas.

The approach to this visual assessment is adapted from the FHWA's visual impact assessment system (Federal Highway Administration 1988) in combination with other established visual assessment systems. The visual impact assessment process involves identification of:

- relevant policies and concerns for protection of visual resources;

- visual resources of the region, the immediate project area, and the project site;
- important viewing locations (e.g., roads) and the general visibility of the project area and site using descriptions and photographs;
- viewer groups and their sensitivity; and
- potential effects.

The well-established approach to visual analysis adopted by the FHWA employs the concepts of vividness, intactness, and unity (Federal Highway Administration 1988). These terms are defined below.

- **Vividness—**The visual power or memorability of landscape components as they combine in striking or distinctive visual patterns.
- **Intactness—**The visual integrity of the natural and artificial landscape and its freedom from encroaching elements. Intactness can be present in well-kept urban and rural landscapes, as well as in natural settings.
- **Unity—**The visual coherence and compositional harmony of the landscape considered as a whole; it frequently attests to the careful design of individual components in the artificial landscape.

The appearance of the landscape is described below using these criteria and descriptions of the dominance of elements of form, line, color, and texture, the basic components used to describe visual character and quality for most visual assessments (U.S. Forest Service 1995; Federal Highway Administration 1988). In addition to their use as descriptors, *vividness*, *unity*, and *intactness* are used more objectively as part of a rating system to assess a landscape's visual quality. This rating system uses seven categories, ranging from very low to moderate to very high. Viewer sensitivity or concern is based on the visibility of resources in the landscape, the proximity of viewers to the visual resource, the relative elevation of viewers to the visual resource, the frequency and duration of views, the number of viewers, and the types and expectations of individuals and viewer groups.

The criteria for identifying importance of views are related in part to the position of the viewer relative to the resource. An area of the landscape that is visible from a particular location (e.g., an overlook) or series of points (e.g., a road or trail) is termed a *viewshed*. To identify the importance of views of a resource, a viewshed may be broken into distance zones of foreground, middleground, and background. Generally, the closer a resource is to the viewer, the more dominant it is and the greater is its importance to the viewer. Although distance zones in viewsheds may vary between different geographic regions or types of terrain, a commonly used set of criteria identifies the foreground zone as 0.4–0.8 kilometer (0.25–0.5 mile) from the viewer, the middleground zone as extending from the foreground zone to 4.8–8 kilometers (3–5 miles) from the viewer, and the background zone as extending from the middleground zone to infinity (U.S. Forest Service 1995).

Visual sensitivity also depends on the number and type of viewers and the frequency and duration of views. Generally, visual sensitivity increases with an increase in total numbers of viewers, the frequency of viewing (e.g., daily or seasonally), and the duration of views (i.e., how long a scene is viewed). Also, visual sensitivity is higher for views seen by people who are driving for pleasure; people engaging in recreational activities such as hiking, biking, or camping; and homeowners. Sensitivity tends to be lower for views seen by people driving to and from work or as part of their work (U.S. Forest Service 1995; U.S. Soil Conservation Service 1978; Federal Highway Administration 1988). Views from recreation trails and areas, scenic highways, and scenic overlooks generally are assessed as having high visual sensitivity.

5.3.3 Affected Environment

Sources of Information

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

- direct field observation from public vantage points, including public property and roadways (conducted by an ICF Jones & Stokes landscape architect on October 28, 2008);
- photographic documentation of key views of the project site;
- review of project construction drawings; and
- review of the project in regard to compliance with state and local ordinances and regulations and professional standards pertaining to visual quality.

Regional Visual Character

The Project is located in the Central Valley of California, approximately 5 miles west of Tracy, in unincorporated Alameda and San Joaquin Counties (Figure 2-1). For purposes of the visual analysis, the project region, as discussed in this section, is considered the area within a 30-mile radius of the project location. The cities of Lodi, Stockton, Manteca, Modesto, and Turlock are also in the region. Most regional development occurs along transportation corridors, such as I-5 to the west and SR 99 to the east. The Delta, northwest of the project site, is an integral part of the region’s visual character. Connected to the Delta are many rivers, creeks, sloughs, and bays that strongly influence local land use patterns. East of the Delta, open agricultural land is dotted with rural development that becomes increasingly urbanized near the city limits of Stockton and other smaller cities and towns in the region.

Agricultural land in the region, planted predominantly with orchard and row crops, stretches for miles. A patchwork of fields separates cities within the region from one another. These fields offer expansive views that extend over the valley floor to the east and Diablo Range to the west when haze is at a minimum. These landscape views are strongly characteristic of the Sacramento-San Joaquin Valley and have contributed to the regional identity.

Development radiating out from the urban cores is reducing the amount of agricultural land in parts of the region and closing the gap between larger and smaller outlying cities. This is beginning to change the visual character from rural to suburban. The smaller cities, including Tracy, are typified by a growing core of residential, commercial, and some industrial land uses with agricultural fields surrounding the city outskirts.

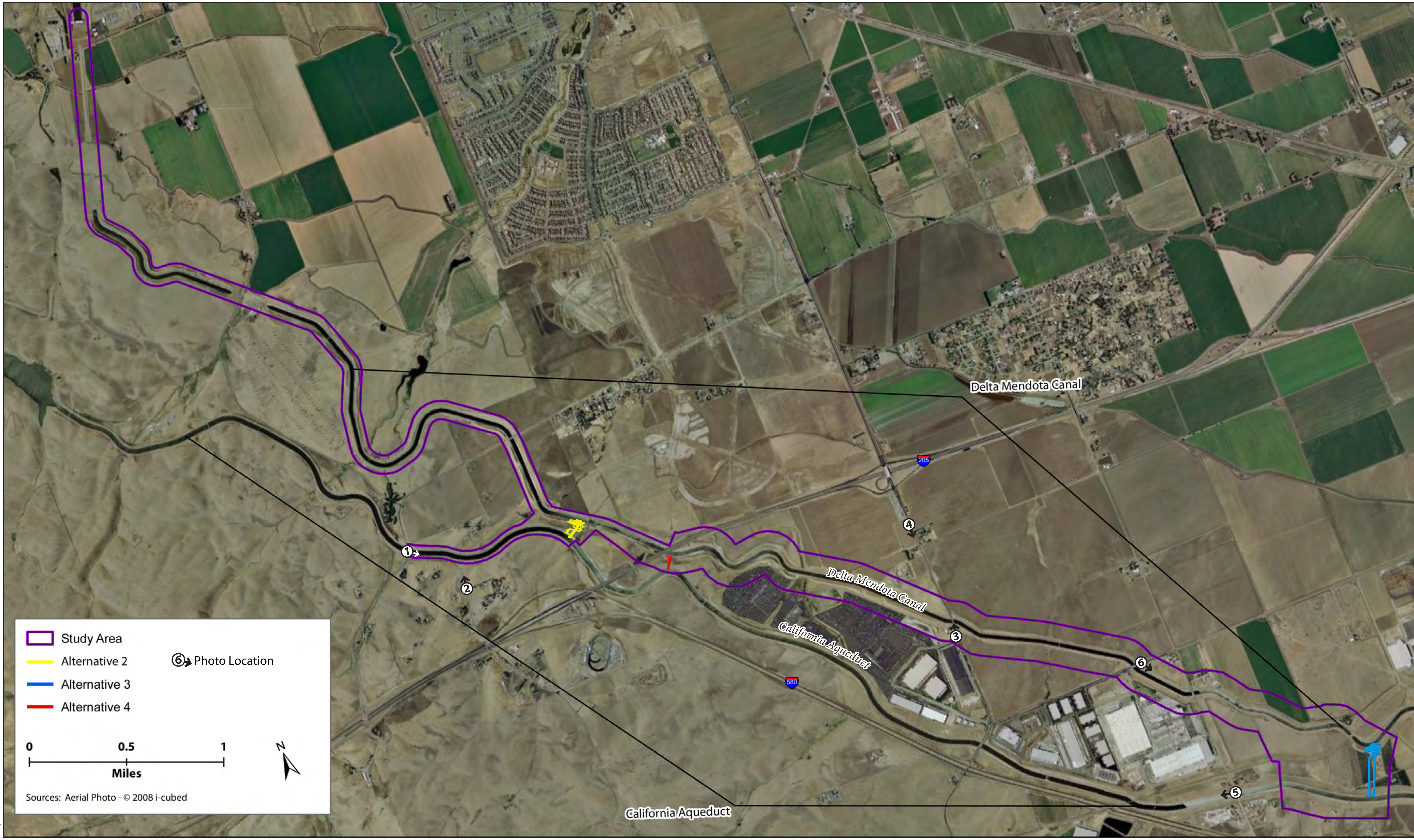
A mix of agricultural, developed, and natural landscapes characterizes the project region. The landscape pattern is influenced by development spreading from city cores and the major roadways in the region. Water features in the greater region include the Sacramento, Tuolumne, and San Joaquin Rivers and their tributaries, numerous Delta sloughs, the DMC, California Aqueduct, and smaller local irrigation ditches.

Visual Character of Project Vicinity

For the purposes of the visual analysis, the project vicinity is defined as the area within 0.5 mile of the project site. Key viewpoints, shown in Figure 5.3-1, have been chosen for their representation of the relative landscape and affected viewers. The project site is located at the eastern base of the Diablo Range foothills, in the agricultural outskirts of Tracy. The vicinity comprises primarily agricultural, warehouse, and open space land uses.

I-205 runs east-west through the northern portion of the site, and I-580 runs northwest-southeast just west of the site. The segment of I-580 in the vicinity is officially designated as a state scenic highway, and the proposed project site is located in the foreground of its viewshed. However, the project alternative sites are not readily visible from I-580 and local roadways because of the rolling terrain (Figure 5.3-2, Photos 1 and 2). The two highways are main thoroughfares through the vicinity. Several smaller local roads (West Patterson Pass, Schulte, and Hansen Roads) provide access to the larger roadways and are local travel routes in the area. The California Aqueduct and DMC are the major waterways in the vicinity.

Views in the vicinity are composed of warehouse facilities, rolling terrain, agricultural fields, rural residences, roadways, and human-made features (concrete-lined waterways, wooden utility poles, and transmission lines) back-dropped by the Diablo Range and flat valley floor extending east from the foot of the range and into the distant background (Figure 5.3-2, Photos 3 and 4).



Graphics ... 00668.06 (04-09) SS

ICF Jones & Stokes
an ICF International Company

Figure 5.3-1
Key Viewpoints and Photo Locations

Photo 1.

Photo 2.

Graphics ... 06688.06 (1-23-09) tm

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Figure 5.3-2
Representative Photographs

Photo 3.

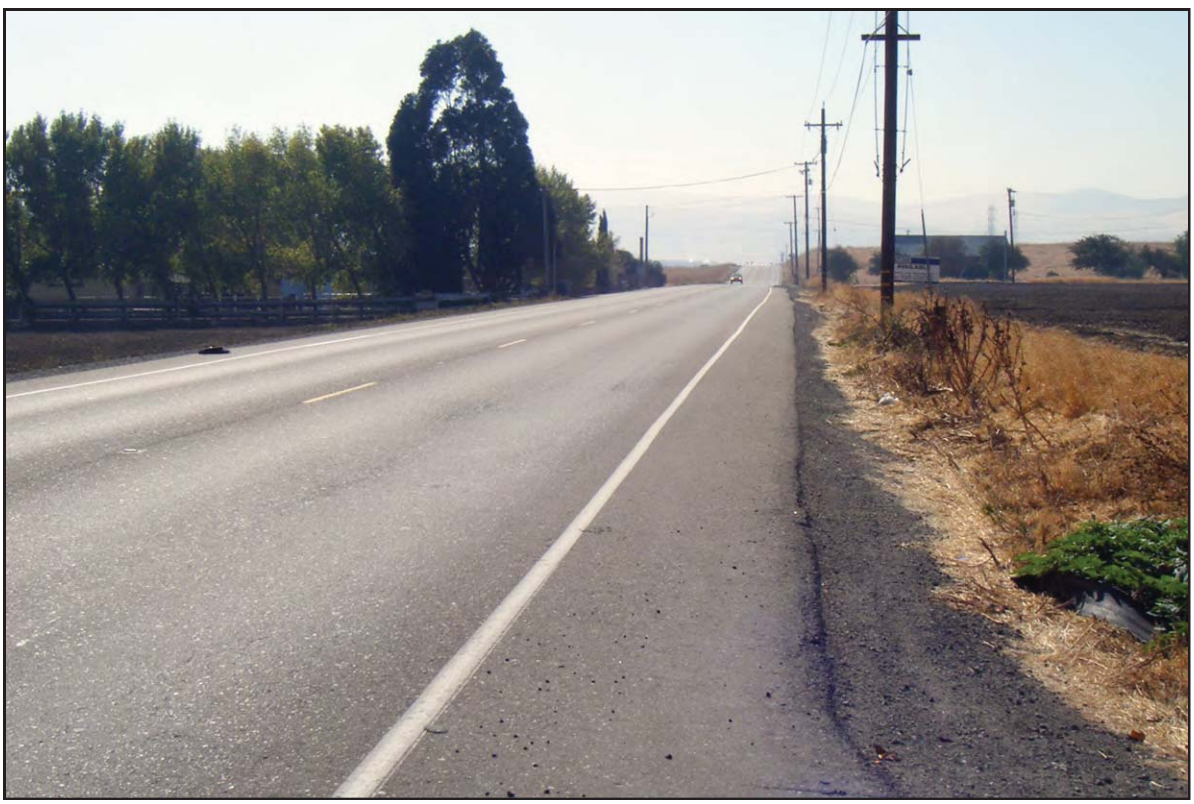

Photo 4.

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Figure 5.3-2
Representative Photographs

Photo 5.

Photo 6.

Graphics … 06688.06 (1-23-09) tm

ICF Jones & Stokes
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Figure 5.3-2
Representative Photographs

Viewer Groups and Viewer Response

Residents

Several single-family residences are located at the southern end of the project vicinity. These residents do not have direct views of the project site because of the rolling terrain, surrounding vegetation, and other built structures nearby. Residents are likely to have a moderately low sensitivity to visual changes at the project site.

Nototonme Northern Valley Yokut Tribe

The Nototonme Northern Valley Yokut Tribe (Yokut), addressed in Section 5.4, Cultural Resources, once inhabited the region. While there are no significant cultural resources within the project area, the vicinity and surrounding region contain sensitive resources of significance to the Yokut such as Mount Diablo, Brushy Peak, and Mountain House Road (a former foot trail for Native Americans traveling to worship at Mount Diablo). Views from the project area and vicinity to Mount Diablo have been identified as important in the religious ceremonies of the Yokut. It is noted that construction in the vicinity has failed to consider the importance of the view towards Mount Diablo. (Davis-King 2003a, 2003b.) Because of the importance of views in the vicinity outward toward sensitive cultural resources, the Yokut would have high sensitivity to visual changes at the project site.

Recreationists

Recreationists include people using the bike trail along the California Aqueduct (Figure 5.3-2, Photos 1 and 2) for walking, jogging, running, or cycling (Figure 5.3-2, Photo 5). Cycling also takes place on local roadways. Given the distance of larger residential areas, the number of recreationists is anticipated to be small. Recreationists are likely to be moderately sensitive to visual changes at the project site. They are more likely to regard the natural and built surroundings as a holistic visual experience. However, because of the presence of infrastructure existing along the canal and in the surrounding area, they are likely to be more accustomed to the operational nature of the canal and have moderately low sensitivity to visual changes associated with canal operations (Figure 5.3-2, Photo 6).

Roadway Users

Viewers who frequently travel I-205, I-580, and local roadways generally possess low visual sensitivity to their surroundings. The segment of I-580 in the project vicinity is an officially designated state scenic highway and is slightly elevated above local roadways, with views looking east and down gradient toward the site.

Travelers on this portion of I-580 may have glimpses of the site, but they would be traveling at high rates of speed, averaging 70–80 miles per hour. In addition, the rolling terrain mostly precludes view of the sites where the pump plant might be constructed. Travelers on local roadways include rural residents, warehouse shipping operations vehicle drivers, and commuters driving to the warehouse facilities in the area. Their views toward the sites where the pump plant might be constructed also are largely obscured by the rolling terrain. The passing landscape becomes familiar for roadway users, and their attention typically is not focused on the passing views. At standard roadway speeds, views are of short duration and roadway users are fleetingly aware of surrounding traffic, road signs, their immediate surroundings within the automobile, and other visual features. These viewers have low sensitivity to their surroundings because their focus is concentrated driving and roadway conditions.

5.3.4 Environmental Consequences

Assessment Methods

Analysis of the visual effects of the project is based on:

- direct field observation from key vantage points such as public roadways;
- photographic documentation of key views of and from the project site, as well as regional visual context;
- review of project construction drawings; and
- review of the project in regard to professional standards pertaining to visual quality.

Regulatory Setting

Federal

The preparation of EISs is guided by the NEPA Council on Environmental Quality (CEQ) regulations at the federal level. These regulations state that the following effects should be taken into account when determining an impact's significance: direct effects of the alternatives; indirect effects of the alternatives; and possible conflicts between the alternatives and the objectives of federal, regional, state, and local land use plans, policies, and controls for the area concerned.

State

I-580, in its entirety within San Joaquin County and from the San Joaquin County line to SR 205 in Alameda County, has been designated by state legislation as a scenic highway. The scenic corridor, defined as the area generally adjacent to and visible from the highway, is subject to protection, including regulation of land use, site planning, advertising, earthmoving, landscaping, and design and appearance of structures and equipment. Examples of visual intrusions that would degrade scenic corridors as stipulated by Caltrans, which are applicable to the proposed Project, include dense and continuous development, highly reflective surfaces, development along ridge lines, extensive cut and fill, scarred hillsides and landscape, exposed and unvegetated earth, and dominance of exotic vegetation. Unsightly land uses would include actions that result in these conditions (California Department of Transportation 1996).

> **Streets and Highway Code—Division 1, Chapter 2, Article 2.5 Section 261 Planning and Design Standards; Complete Highway:** The standards for official scenic highways shall also require that local governmental agencies have taken such action as may be necessary to protect the scenic appearance of the scenic corridor, the band of land generally adjacent to the highway right-of-way, including, but not limited to (1) regulation of land use and intensity (density) of development; (2) detailed land and site planning; (3) control of outdoor advertising; (4) careful attention to and control of earthmoving and landscaping; and (5) the design and appearance of structures and equipment.

5.3.5 Environmental Effects

Alternative 1 (No Action)

Under the No Action Alternative, the Intertie would not be widened and intersection improvements would not be constructed. There would be no impacts on visual resources.

Alternative 2 (Proposed Action)

Construction Effects

Impact VIS-1: Temporary Visual Impacts Caused by Construction Activities

Construction of the proposed improvements would create temporary changes in views of and from the project area. Construction activities would introduce considerable heavy equipment and associated vehicles, including dozers, graders, scrapers, and trucks, into the viewshed of recreational viewers using the California Aqueduct bike trail at the Intertie location. There are no public roadways or residential areas with direct views of this location. Construction for the entire project is expected to require approximately 15 months. Construction of the overhead transmission line, on the west side of the DMC and across I-205, would be visible to all viewer groups, but construction would not be occurring at one place along the alignment for any extended period of time.

Because this alternative is located in an area that has nearby construction activities, agricultural activities, and warehouse operations, all viewer groups in the project area are accustomed to seeing construction activities and large or heavy equipment in the area; their sensitivity to such impacts would be low. There would be no adverse effect.

Operation Effects

Impact VIS-2: Adversely Affect a Scenic Vista

The project area is not located in an area designated as a scenic vista and therefore would not obstruct public scenic vistas or views. Therefore, implementation of the proposed project would not result in any adverse effects on scenic vistas.

Impact VIS-3: Damage Scenic Resources along a Scenic Highway

I-580 is an officially designated state scenic highway worthy of protection for maintaining and enhancing scenic viewsheds. The project site is located out of view from I-580 and far enough away that it would not damage scenic resources, such as trees, rock outcroppings, and historic buildings along a scenic highway. There would be no adverse effect.

Impact VIS-4: Degrade the Existing Visual Character or Quality of the Site and Its Surroundings

All viewer groups, except for recreationists using the California Aqueduct bike trail, do not have direct views of the project site because this location is situated in rolling terrain and there are no public roadways with direct visual access. After the project is complete the facility will not be visible; however, if it were visible, it would not differ greatly from the existing facilities along the canal and would not contrast greatly from existing infrastructure and development in the area. The existing natural state would not be substantially altered. The project site's position in the landscape and surrounding vegetation make this site only minimally visible. Because of these factors, the proposed project would not detract from views from the project site and vicinity to surrounding sensitive Yokut cultural resources, such as Mount Diablo. Operation of the pump plant would not affect views. Transmission line crossing over I-205 would require replacing old lines with new lines. This may require slight tower height increase of less than 10%, which would not be a recognizable difference from the existing structures. Agency coordination could result in aerial marker balls and steel poles being required to facilitate highway crossings of transmission lines. However, the primary viewer group that would see these features would be roadway users, and given the high rate of travel speed on I-205 and existing presence of the transmission lines, these features would not stand out amongst the existing visual environment or greatly alter the existing visual character. There would be no adverse effect.

Impact VIS-5: Create a New Source of Light or Glare

Once the facility has been built, the Intertie pump plant and pipelines would increase the amount of reflective surface present but not to a level that would substantially alter the amount of glare perceived in the project area. New sources of light would be introduced from the safety lighting associated with the Intertie facility. Steel poles may be required to facilitate highway crossings of transmission lines over I-205. These poles are typically galvanized steel, and these surfaces would naturally oxidize within a short time following installation and would not cause reflective daytime or nighttime glare.

Implementation of Mitigation Measures VIS-MM-1, VIS-MM-2, and VIS-MM-3 would reduce any adverse effects.

Mitigation Measure VIS-MM-1: Apply Minimum Lighting Standards

Lights will be installed at the lowest allowable height; low-pressure sodium lamps at the lowest allowable wattage (less than 2000 lumens [150 watts]) will be used; lights will be screened and directed away from the night sky to the highest degree possible; and the amount of nighttime lights used, as well as the duration the lights are on, will be minimized to the highest degree possible.

Mitigation Measure VIS-MM-2: Construct Facilities and Infrastructure with Low-Sheen and Non-Reflective Surface Materials

Wall finishes will have low-sheen and non-reflective surface materials to reduce potential for glare. The use of smooth-trowelled surfaces and glossy paint will be avoided. At a minimum, infrastructure materials will be non-reflective, such as earth-toned concrete or galvanized steel that would naturally oxidize a short time after installation and would not cause reflective daytime glare.

Mitigation Measure VIS-MM-3: Reduce Visibility of New Structures

Recent studies have shown that painting structures 1 to 2 degrees darker than the color of the general surrounding area creates less of a visual impact than matching or lighter hues (U.S. Bureau of Land Management 2008). Therefore, new structures will be painted with a shade that is 1 to 2 degrees darker than the general surrounding area. Colors will be chosen from the U.S. Bureau of Land Management Standard Environmental Colors Chart CC-001: June 2008. Because color selection will vary by location, the project proponent will employ the use of color panels evaluated from key observation points during common lighting conditions (front vs. back lighting) to aid in the appropriate color selection. Color selection shall be made for the coloring of the most prevalent season. Panels will be a minimum of 3 feet by 2 feet in dimension and will be evaluated from various distances to ensure the best possible color selection. Refer to <http://www.blm.gov/bmp> for more information on this technique and other BMPs and techniques for visual screening.

All paints used for the color panels and structures will be color matched directly from the physical color chart and not any digital or color reproduced versions of the color chart. Paints will use a dull, flat, or satin finish only. Appropriate paint type will be selected for the finished structures to ensure long term durability of the painted surfaces. The project proponent will maintain the paint color over time.

Alternative 3 (TANC Intertie Site)

Construction Effects

Construction of the Alternative 3 Intertie would be the same as described for Alternative 2. The only difference is that there are a few rural residences located within 0.25 mile of this location, and an active railroad north of the project site. There are no restrictions on when construction could occur; therefore, implementation of Mitigation Measure VIS-MM-4 would reduce the effects of construction so there would be no adverse effects on nearby residences.

Mitigation Measure VIS-MM-4: Limit Construction to Daylight Hours near Residences

Construction activities scheduled to occur after 6:00 p.m. or on weekends should not continue past daylight hours (which vary according to season). This would reduce the amount of construction effects experienced by nearby residences because most construction activities would occur during business hours when most viewer groups are likely at work, and eliminate the need to introduce high-wattage lighting sources for nighttime construction.

Operation Effects

Operation of the Alternative 3 Intertie would be the same as described for Alternative 2; refer to Impacts VIS-2, VIS-3, VIS-4, and VIS-5 and Mitigation Measures VIS-MM-1, VIS-MM-2, and VIS-MM-3.

Alternative 4 (Virtual Intertie)

Construction Effects

No permanent features would be constructed under this Alternative. Installation of the temporary, pipeline would require some heavy equipment and would be constructed in an area that is rural and already includes use of heavy equipment for agriculture and industrial practices as described above. However, the temporary pipeline would only be installed during emergencies. As such, there would be no adverse effect.

Operation Effects

Operation of the existing Banks Pumping Plant in the south Delta would not result in any aesthetic changes. The temporary intertie would be placed and operated approximately 0.5 mile south of the proposed Alternative 2, in an area that has only intermittent recreational viewers. The temporary Intertie would be only for emergencies and would be used very infrequently. Because there would be no changes at Banks and because of the temporary nature of the virtual intertie and lack of sensitive viewers, there would be no adverse effect.

5.4 Cultural Resources

5.4.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on cultural resources. The term *cultural resources* is used to describe several different types of properties: prehistoric and historical archaeological sites; architectural properties such as buildings, bridges, and infrastructure; and resources of importance to Native Americans.

5.4.2 Affected Environment

The Proposed Action is located in the periphery of the Delta Region, as defined in the CALFED PEIS/EIR (CALFED Bay-Delta Program 2000a). Over the last 20–30 years, 16 cultural resource studies have been conducted in the footprint of the Proposed Action, resulting in intensive survey coverage of most of the project footprint (Atwell et al. 1995; Bard 2001; Canaday et al. 1992; Chavez 1995; Egherman 2001; Foster 1996; Holman 1982, 1983, 1984; Jensen & Associates 1986; Jones & Stokes Associates 1989; Moratto, Jackson et al. 1990; Moratto, Pettigrew et al. 1994; Peak 2002; Werner 1988; Western Area Power Administration 2005). The entire Alternative 2 footprint has been surveyed previously and approximately 30% of Alternative 3 has been surveyed previously. The Proposed Action potentially would affect five cultural resources: the DMC, the California Aqueduct, the Byron Bethany Irrigation District Main Canal (CA-Ala-549H/CA-CCo-738H), the Tracy Switch Station (P-01-10443), and Jones Pumping Plant (P-01-10442). Alternative 3 potentially would affect two cultural resources: the DMC and the California Aqueduct.

Sources of Information

The key sources of data and information used in the preparation of this section are listed below.

- Detailed records searches obtained from the California Historical Resources Information System (CHRIS).
- Input from Native American tribes and historical organizations.
- A review of historical literature and previous reports.
- Additional primary research.

Cultural Setting

Prehistory and Ethnography

Little is known of human occupation in the Delta prior to 4500 B.P. (years before present, with *present* being 1950). Because of rapid alluvial and colluvial deposition in the valley over the past 10,000 years, ancient cultural deposits are deeply buried in many areas. The earliest evidence of widespread occupation of the Delta region comes from several sites assigned to the Windmiller Pattern (previously, Early Horizon), dated ca 4500–2500 B.P. (Ragir 1972). Known Windmiller Pattern sites are concentrated on low rises or knolls within the floodplains of major creeks or rivers. Later prehistoric archeological sites attributed to the Berkeley and Augustine Patterns (previously, Middle and Late Horizon) exhibit wider geographic distribution, though few archaeological sites have been identified in the vicinity of the Proposed Action.

The aboriginal inhabitants of the area in which the Proposed Action is located are known as the *Cholvon* Northern Valley Yokuts and the *Luecha* tribelet of Costanoan Indians (Milliken 1994; Schenck 1926). *Yokuts* is a term applied to a large and diverse number of peoples inhabiting the San Joaquin Valley and Sierra Nevada foothills of central California. The Yokuts cultures include three primary divisions, corresponding to gross environmental zones: the Southern Valley Yokuts, the Foothill Yokuts, and the Northern Valley Yokuts (Kroeber 1976; Silverstein 1978). Principal Northern Valley Yokuts settlements were located on the tops of low mounds, on or near the banks of the larger watercourses. Yokuts settlement, however, focused on the Delta proper and the San Joaquin River (Wallace 1978).

Anthropologists and archaeologists typically attribute the margins of the northern San Joaquin Valley and the Delta to the Northern Valley Yokuts. Recent archival research, however, indicates that a small group of Indians speaking a Costanoan language lived near and periodically may have used the margins of the valley—this group is the Luecha tribelet of Costanoan Indians. The Luecha inhabited Arroyo Mocho, Corral Hollow, and Patterson Pass in the South Coast Ranges (Patterson Pass is about 3 miles southeast of DMC milepost 7.69). The Luecha probably had social ties to the valley, as indicated by marriages to the Cholvon and Pitemes Northern Valley Yokuts. The Luechas intermarried with other Costanoan-speaking groups in the eastern South Coast Ranges, however, suggesting a greater focus of activities in the uplands west of the valley. (Milliken 1994.)

The area that would be affected by ground disturbance associated with the Proposed Action has little potential to contain surface or buried archaeological sites. First, the footprint of the Proposed Action has been thoroughly surveyed for cultural resources, and no archaeological sites have been identified in that footprint. Second, there is little potential for the Proposed Action's footprint to contain buried archaeological sites because of the nature and degree of ground disturbance that resulted from construction of the DMC and the California Aqueduct. The DMC ROW, for instance, was excavated to depths of 25 feet below ground surface. Reclamation piled excavated soils directly next to the DMC, effectively raising the elevation of the ground surface (although Reclamation has sold some of the spoils for fill). The mounds formed by the spoil piles are 30 feet tall in some areas along the DMC. The California Aqueduct, which is wider and deeper than the DMC, was constructed in a similar manner, including spoil disposal (Werner 1988:6–7).

History

Project Area

The Project Area is located in eastern Alameda County, west of the city of Tracy, at the southern end of the Delta. In general, European settlers in Alta California ignored the Central Valley and the Delta region until the mid-nineteenth century. The Spanish confined their settlement to a thin strip along the coastline. In 1806, Gabriel Moraga explored much of the region by following the Kern and Kings Rivers into the foothills of the Sierra Nevada. Following Mexico’s independence from Spain in 1821, the settlement of California progressed with the issuance of rancho lands by the Mexican governors. The most notable of these governors were Juan Bautista Alvarado, Manuel Micheltorena, and Pio Pico. With the exception of a few grants in the Sacramento Valley, the ranchos were located in the same general areas as the coastal missions. The El Pescadero Grant (or Rancho San Antonio), which covered most of present day Alameda County including the project area, was granted to Luis Maria Peralta in 1820. Settlement on the grant was not substantial though, especially in the vicinity of the project area, until the well-publicized discovery of gold in 1848 (Bean and Rawls 1983:52; Kyle et. al. 1990:9).

Following the Gold Rush, settlement in the Delta region increased dramatically, largely as a result of the passage of the Swamp and Overflow Act in 1850. The law transferred swamplands from the U.S. government into the control of the state of California. As a result of this act, approximately 500,000 acres of newly acquired California swampland located in the Delta were sold to private citizens (CALFED Bay-Delta Program 1996:10; Thompson 1957:186). By the turn of the 20th century, transportation improvements, such as the construction of Southern Pacific Railroad and Western Pacific Railroad alignments in the Delta region connecting the Delta to populated centers such as Sacramento and San Francisco, encouraged the movement of agricultural products from the Delta to outlying markets. By the 1920s, crops such as asparagus, barley, celery, corn, and alfalfa for local dairy farms were introduced to the area (Thomas Brothers 1920). Throughout the twentieth century, the South Delta region continued to be used for agricultural purposes.

Central Valley Project

The DMC was constructed between 1946 and 1952 and was an essential component of the CVP. The origins of the CVP can be traced back as far as the 1870s, but a substantial statewide plan for a water system was not truly developed until 1919 after concern over declining water tables in the state led Robert B. Marshall, Chief Geographer at the USGS, to propose the Marshall Plan. In his plan, Marshall proposed building a large dam on the upper Sacramento River to create an enormous reservoir. Two large aqueducts, linked to the reservoir, would run along either side of the Central Valley and convey water south. Although California voters rejected Marshall's plan several times, it nevertheless laid the foundation for the construction of the CVP (JRP Historical Consulting Services 1995:190).

Despite the failure of Marshall's plan at the ballot box, in the 1920s the California State Legislature became interested in the state's systemic water problems and began to seek a resolution. As a result, between 1927 and 1931, California's State Engineer, Edward Hyatt, conducted studies of the issue and in 1931 released a new statewide water plan. This plan adopted components of Marshall's plan but also included substantial alterations. Hyatt proposed a large system of reservoirs and canals throughout the state, incorporating much of what would become the CVP, in addition to proposing a system to convey water from the Colorado River to California. California voters approved a bond initiative in 1933 for construction of the Central Valley portion of the project; however, because of the Great Depression, the state could not secure finances to begin construction. The initiative, called the Central Valley Project Act, is where the CVP takes its name (Hattersley-Drayton 2000:25; JRP Historical Consulting Services 1995:191).

In order to complete the project, the state approached the federal government for funding. As it was the Depression, the state proposed the project as a jobs program that would be part of Franklin Roosevelt's New Deal. After a series of negotiations, the federal government opted to make the project a federal reclamation undertaking, making Reclamation the lead agency on the project. Reclamation saw the CVP as several components operating as a single system. The proposed DMC, designed to convey Sacramento River water south from a pumping plant near Tracy, was a key component of the system. In 1935, the federal government released the first funds to begin construction of the CVP; however, construction was delayed on the DMC portion of the project because of the onset of World War II. In 1946, construction began on the DMC and Reclamation finally completed it in 1952 (JRP Historical Consulting Services 1995:191–192, 195).

State Water Project

Just 1 year before completion of the DMC, the California State Legislature approved another massive water project, the SWP, originally the Feather River Project. This project, proposed by State Engineer, Arthur D. Edmonston, sought to convey water from the Feather River to areas outside the CVP, namely Los Angeles and farming communities in the extreme southern portions of the San Joaquin Valley. California's growing population meant that more water was needed for agricultural and residential purposes. As planned, the Sacramento and Feather Rivers would convey runoff from a reservoir near Oroville created by a dam (the Oroville Dam) to the Delta, where a 444-mile aqueduct (the California Aqueduct) would convey it south. The plan was placed on the ballot in 1960, and voters approved it by a small margin. The following year, construction of the SWP began, including construction on its most essential component, the California Aqueduct (JRP Historical Consulting Services 1995:204).

In 1962, the SWP began delivering water to Alameda County. By 1972, all initial features of the SWP, including the California Aqueduct, were completed. Water was delivered to the Bay Area, San Joaquin Valley, and southern California communities (JRP Historical Consulting Services 1995:205–206).

Summary of Cultural Resources in the Project Area

The following section describes known cultural resources in, or directly adjacent to, the project area.

No archaeological resources are located within the project area. Five architectural (built environment) resources are located in the project area. These resources include the Delta-Mendota Canal, the California Aqueduct, Byron Bethany Irrigation District Main Canal, Tracy Switch Station, and the Jones Pumping Plant. The resources are described below.

Delta-Mendota Canal

The DMC is a component of the CVP. Construction on the resource commenced in 1946 and was completed in 1952. The DMC draws water from the Jones Pumping Plant and conveys it south to a point 30 miles west of Fresno on the San Joaquin River. Approximately 95 miles of the canal is concrete-lined, and 18 miles of it is earthen. (JRP Historical Consulting Services 1995:197.) The DMC is described in Chapter 2 of this EIS.

California Aqueduct

The California Aqueduct is a component of the SWP, which was constructed between 1961 and 1972. The canal draws water from the Delta and conveys it south, terminating in Riverside. It is generally constructed of unreinforced concrete and shrinks in width as it as it heads south (JRP Historical Consulting Services 1995:204–205). The California Aqueduct is described in Chapter 2 of this EIS.

Byron Bethany Irrigation District Main Canal

The overhead transmission line proposed as part of the Intertie crosses over the Byron Bethany Irrigation District Main Canal (CA-Ala-549H) 1,100 feet south of Kelso Road at the DMC. CA-Ala-549H was constructed in 1917 as an earthen ditch and was incorporated into the Byron Bethany Irrigation District as Canal 70 in 1919. The canal draws water from Kellogg Creek to the northwest and conveys water southeast to Mountain House Creek. The canal was significantly modified in 1968 through the addition of turnout gates and concrete lining in some areas (Bakic and Baker 2001).

Tracy Switch Station

Tracy Switch Station (P-01-10443) is located in the far northern portion of the Proposed Action and forms the terminus of the Proposed Action’s overhead transmission line. Reclamation began construction of the facility in 1946 and completed it in 1952. Tracy Switch Station consists of storage tanks, sheds, transmission towers, and other buildings. Much of the station consists of facilities added in the 1960s and 1990s. The switching station controls power for the DMC pumps (Baker 2001a; Bakic 2001a).

Jones Pumping Plant

Jones Pumping Plant (P-01-10442) is located at the far northern part of the Proposed Action and forms the terminus of the Proposed Action’s overhead transmission line. Reclamation constructed the pumping station between 1946 and 1952. The pumping station consists of a fenced yard enclosing two office buildings and a storage building, in addition to a pump station on the DMC. The pumping station was built to lift water from the DMC and is an integral part of the CVP. (Baker 2001a; Bakic 2001b.)

5.4.3 Environmental Consequences

Assessment Methods

The purpose of this section is to determine whether the Proposed Action has the potential to substantially affect cultural resources. This cultural resource assessment follows guidance and procedures set forth by CALFED and Reclamation (Bureau of Reclamation 2000; CALFED Bay-Delta Program 2000b). The assessment is based on records searches at the Central California Information Center (CCIC) and the Northwest Information Center (NWIC) of the CHRIS; a review of published literature on the prehistory, ethnography, and history of the project vicinity; consultation with the NAHC in Sacramento, and a pedestrian survey of the Alternative 3 footprint.

Records searches were conducted at the CCIC on May 5, 2003, and February 12, 2008. Records searches were conducted at the NWIC on May 16, 2003. The CCIC manages the State of California's database of previous cultural resource studies and known cultural resources for a seven-county area, including San Joaquin County; the NWIC manages the records for a 16-county area, including Alameda County. Information provided by the CHRIS, combined with the published literature on California's cultural resources, forms the baseline or existing conditions for cultural resources in environmental reviews.

In addition to the database of previous studies and known resources, the records searches included review of the National Register of Historic Places (NRHP), the California Register of Historical Resources (CRHR), *California Historical Landmarks*, *California Points of Historical Interest*, the California Office of Historic Preservation's Historic Resource Inventory listings for Alameda and San Joaquin Counties, California Department of Transportation's State and Local Bridge Survey, and historic maps and secondary historical sources (California Department of Parks and Recreation 1976; General Land Office 1857; Thompson & West 1976 [1878]; U.S. Geological Survey 1914, 1948).

On January 26, 2007, a request for a sacred lands search and a list of Native American contacts was sent to the NAHC. The NAHC responded on February 7, 2007, with a list of Native American contacts and a statement indicating that the sacred lands search was negative. Letters were sent to the Native American contacts, but no responses have been received to date.

This effects assessment focuses on those cultural resources that are considered historic properties for the purposes of Section 106 of the NHPA (36 CFR 800.16[l]). The discussion below describes the federal criteria for identifying adverse effects on cultural resources. Finally, significance statements for each cultural resource that would be affected by the Proposed Action are provided.

Regulatory Setting

Section 106 of the National Historic Preservation Act

Under NEPA, federal agencies must "preserve important historic, cultural and natural aspects of our national heritage" (Section 101 [b][4]). Section 106 of NHPA (16 USC 470f) requires federal agencies to take into account the effect of their undertakings on historic properties and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. Reclamation's directives and standards specify that NEPA actions will be coordinated with the compliance process for Section 106 of the NHPA (detailed in implementing regulations at 36 CFR 800). The Section 106 process normally includes the following steps:

- delineate the area of potential effects (APE), and identify and evaluate cultural resources in consultation with the State Historic Preservation Officer (SHPO) and any other consulting parties;
- assess adverse effects on historic properties that are eligible for inclusion in the NRHP, and notify the Advisory Council on Historic Preservation if adverse effects are identified;
- consult with the SHPO and other participating parties to resolve adverse effects on historic properties, generally resulting in a memorandum of agreement stipulating how the properties will be treated.

Historic properties are any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the NRHP (36 CFR 800.16[1]). For federal projects, cultural resource significance is evaluated in terms of eligibility for listing in the NRHP. The NRHP criteria for evaluation are defined at 36 CFR 60.4 as follows: The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling and association, and that

A. are associated with events that have made a contribution to the broad pattern of our history;

B. are associated with the lives of people significant in our past;

C. embody the distinct characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. have yielded, or are likely to yield, information important in prehistory or history (36 CFR 60.4).

Adverse effects occur when those characteristics of a historic property that qualify it for inclusion in the NRHP are altered in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (36 CFR 800.5[a]). Adverse effects include:

- physical destruction of or damage to all or part of the property;
- alteration of the property that is not consistent with the Secretary of the Interior's standards for the treatment of historic properties (36 CFR 68);
- removal of the property from its historic location;
- change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;
- introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features;
- neglect of a property that causes its deterioration; and

- transfer, lease, or sale of the property out of federal ownership or control.

Reclamation consulted with the SHPO regarding the Proposed Action on January 25, 2005 (Nepstad 2005). The SHPO concurred with Reclamation that efforts to identify historic properties in the APE were adequate and that no historic properties would be adversely affected by the Proposed Action (Donaldson 2005). Should the location of any element of the Proposed Action be changed or new elements added, Reclamation would commence Section 106 consultation to take into account the effects that such changes may incur upon historic properties. The Section 106 consultation process would need to be completed prior to approval of the Proposed Action. Selection of Alternative 3 would also require completion of Section 106 consultation.

5.4.4 Environmental Effects

Resource-Specific Significance Statements

Delta-Mendota Canal

The DMC has been recommended eligible to the NRHP under Criteria A and C and has exceptional significance for its key role in the original CVP (Egherman 2001; Farrell 2001; JRP Historical Consulting Services 1995). The DMC retains overall historic integrity (Egherman 2001; Farrell 2001). For the purposes of the Proposed Action, Reclamation considers the DMC to be a historic property under Section 106 of the NHPA; the SHPO implicitly concurred with Reclamation's findings in this regard (Donaldson 2005:1, 2; Leigh 2004:3, 4; Nepstad 2005:2).

California Aqueduct

JRP Historical Consulting Services evaluated the California Aqueduct for NRHP eligibility in 1995 (JRP Historical Consulting Services 1995). The evaluation included an assessment of the exceptional significance criteria required for recently constructed (less than 50 years old) properties (Sherfy and Luce 1998). JRP Historical Consulting Services concluded that although the California Aqueduct rivals the DMC as an outstanding engineering feature (NRHP criterion C) and has a significant association with the history of irrigation and water development in California (NRHP criterion A), it was simply too young (about 20 years old in 1995) to warrant listing in the NRHP. Conditions 13 years later do not appear to warrant reassessment of the California Aqueduct's significance. Therefore, as a recently constructed property that does not convey the exceptional significance criteria required for NRHP eligibility, the California Aqueduct does not appear to constitute a historic property at this time. For the purposes of the Proposed Action, Reclamation considers the California Aqueduct not to be a historic property under Section 106 of the NHPA; the SHPO implicitly concurred with Reclamation's findings in this regard (Donaldson 2005:1, 2; Leigh 2004:4; Nepstad 2005:2).

Byron Bethany Irrigation District Main Canal

PAR Environmental Services, Inc., evaluated the significance of CA-Ala-549H in 2001 and deemed it ineligible for listing in the NRHP. Other portions of the canal were determined ineligible for listing in the NRHP by a consensus determination of the Corps and the SHPO (Baker 2001b; California Office of Historic Preservation 2000:1). For the purposes of the Proposed Action, Reclamation considers CA-Ala-549H not to be a historic property under Section 106 of the NHPA; the SHPO implicitly concurred with Reclamation's findings in this regard (Donaldson 2005:1, 2; Leigh 2004:3, 4; Nepstad 2005:2).

Tracy Switch Station

PAR Environmental Services, Inc., evaluated the significance of the Tracy Switch Station in 2001 and recommended it ineligible for listing in the NRHP. Although an integral part of the CVP, which qualifies the Tracy Switch Station for NRHP eligibility under Criterion A, the station has suffered a substantial loss of integrity through the addition of several buildings in the 1960s and 1990s. Therefore, the Tracy Switch Station does not appear to qualify as a historic property (Baker 2001a; Bakic 2001a). For the purposes of the Proposed Action, Reclamation considers the Tracy Switch Station not to be a historic property under Section 106 of the NHPA; the SHPO implicitly concurred with Reclamation's findings in this regard (Donaldson 2005:1, 2; Leigh 2004:3, 4; Nepstad 2005:2).

Jones Pumping Plant

PAR Environmental Services, Inc., evaluated the significance of the Jones Pumping Plant (P-01-10442) in 2001 and recommended it eligible for listing in the NRHP. Jones Pumping Plant is an integral element in the development and operation of the CVP and appears to be significant under Criteria A and C of the NRHP. Furthermore, Jones Pumping Plant retains historic integrity. For the purposes of the Proposed Action, Reclamation considers the Jones Pumping Plant to be a historic property under Section 106 of the NHPA; the SHPO implicitly concurred with Reclamation's findings in this regard (Donaldson 2005:1, 2; Leigh 2004:3, 4; Nepstad 2005:2).

Summary of Cultural Resource Effects Assessment

The proposed action potentially would affect five cultural resources. Each resource was evaluated for significance according to criteria established by the NRHP. Of these five resources, previous cultural resource studies identify the

DMC and the Jones Pumping Plant as historic properties according to the NRHP criteria. The California Aqueduct, Byron Bethany Irrigation District Main Canal, and the Tracy Switch Station are not historic properties. Any effects on the latter three cultural resources would not be considered substantial and would not require mitigation. Therefore, these resources do not require further consideration under Section 106 of the NHPA.

Alternative 1 (No Action)

The No Action alternative would not result in ground-disturbing activities or changes in operation. Therefore, there would be no effects on cultural resources.

Alternative 2 (Proposed Action)

Construction Effects

Impact CUL-1: Modification of Known Cultural Resources Resulting from Construction

Modification of the DMC (and the California Aqueduct) would result from construction of the Proposed Action. The modification would result from excavating the intake and discharge structures into the sides of the canals. Construction of the aboveground Intertie facilities would result in some loss of historic integrity (alteration of design) for the DMC. The Proposed Action would represent a departure from the canal's original design. Given the scale of the Intertie facilities in the context of the DMC's size and overall retention of historic integrity, however, alteration of the canal's design would not result in an adverse effect (Donaldson 2005:2; Leigh 2004:4, 5; Nepstad 2005:2, 3).

Impact CUL-2: Visual Intrusions to the Historic Setting of Significant Cultural Resources from Transmission Line Construction

Construction of overhead transmission lines would result in the addition of structures that are not from the period of significance of identified cultural resources and may be out of character with the historic setting of cultural resources such as historic canals and buildings. Visual intrusion to the historic setting of significant cultural resources is considered an adverse impact under NEPA. The bullets below indicate the cultural resources affected by this impact by location/project element.

- Construction of the overhead transmission line would introduce a new element to the historic setting of the DMC, which is considered a historic property under the NRHP criteria. Numerous power lines already cross over the DMC and are part of the CVP system. The addition of the overhead transmission line under the Proposed Action would not constitute a departure from the overall historic setting of the DMC.

Construction of the Proposed Action would introduce aboveground structures that are at variance with the historic setting of the DMC. Given the scale of the DMC and the minor scale of the new construction (less than 1 acre), the addition of new structures would not result in a major loss of historic integrity. Therefore, this effect does not constitute an adverse effect (Donaldson 2005:2; Leigh 2004:4, 5; Nepstad 2005:2, 3).

- Construction of the overhead transmission line would introduce a new element to the historic setting of the Jones Pumping Plant, which is a historic property under the NRHP criteria. Numerous power lines, however, already cross over the Jones Pumping Plant and are part of the CVP system. The addition of the overhead transmission line under the Proposed Action would not constitute a departure from the overall historic setting of the Jones Pumping Plant. Therefore, this effect does not constitute an adverse effect (Donaldson 2005:2; Leigh 2004:4, 5; Nepstad 2005:2, 3).

Impact CUL-3: Inadvertent Damage to or Destruction of Buried Archaeological Sites and Human Remains

The Proposed Action has little potential to inadvertently damage or destroy buried archaeological sites or human remains through construction of Intertie facilities and placement of the overhead transmission line. The footprint of the Proposed Action is highly disturbed to depths up to 25 feet, and the areas slated for ground disturbance are composed of fill piles up to 30 feet high. The likelihood of intact buried archaeological deposits or human remains is remote. It is highly unlikely, therefore, that the Proposed Action would result in adverse effects on buried archaeological sites or human remains. However, in the unlikely event that such discoveries are made during construction, Reclamation will ensure that contractors stop work and implement measures to protect archaeological sites and human remains if discovered during ground-disturbing activities, as described in the environmental commitments section of Chapter 2.

Operation Effects

Operation of the Intertie would not result in any ground-disturbing activities and therefore would not result in adverse effects on cultural resources.

Alternative 3 (TANC Intertie Site)

Construction Effects

The construction effects of Alternative 3 would likely be identical to those described under Alternative 2 with the exception that no Section 106 consultation has been conducted for Alternative 3 by Reclamation. Implementation of Alternative 3 would require Reclamation to conduct a pedestrian archaeological survey of areas not previously surveyed and additional Section 106 consultation prior to reaching the same conclusions as Alternative 2.

Operation Effects

Operation of the Intertie would not result in any ground-disturbing activities and therefore would not result in adverse effects on cultural resources.

Alternative 4 (Virtual Intertie)

Construction Effects

Because of the proposed grading, the impacts of implementing Alternative 4 would be identical to Impact CUL-3 described under Alternative 2.

Operation Effects

Operation of the Intertie would not result in any ground-disturbing activities and therefore would not result in adverse effects on cultural resources.

5.5 Hazards and Hazardous Materials

5.5.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives related to hazards and hazardous materials. Of primary concern for the Intertie is the potential to disturb existing or release hazardous materials or to create hazards for people.

5.5.2 Affected Environment

Hazardous Materials

Hazardous materials and wastes are those substances that, because of their physical, chemical, or other characteristics, may pose a risk of endangering human health or safety or of endangering the environment (California Health and Safety Code Section 25260). Types of hazardous materials include petroleum hydrocarbons, pesticides, and volatile organic carbons (VOCs). In and around the Delta, most hazardous waste sites are associated with agricultural production activities and may include storage facilities and agricultural pits or ponds contaminated with fertilizers, pesticides, or herbicides.

A Phase I site assessment for hazardous materials was conducted for the Alternative 2 site. This assessment indicates that the Intertie area is not likely to contain hazardous materials because it lies between the California Aqueduct and the DMC, and few if any activities are permitted in this area.

Emergency Response/Evacuation Plans

Alameda County Office of Emergency Services (OES) is responsible for planning emergency response actions to hazardous material incidents. Area response plans incorporate hazardous materials inventory data, training for emergency responses, and evacuations.

Emergency response is carried out by the Alameda County Sheriff’s Office of Homeland Security and Emergency Services using vehicles or boats, depending on the location’s accessibility, predicted response time, and availability of resources.

Transmission Lines

The California-Oregon Transmission Project (COTP) is a 500-kV transmission line extending from near Malin, Oregon, south to the Tracy, California, area. It is owned and operated by the TANC. This line provides electricity to several cities and utility districts throughout northern California. The proposed action (Alternative 2) would lie partially beneath the COTP.

5.5.3 Environmental Consequences

Assessment Methods

Two topics are evaluated in this section: hazardous materials and waste release and disturbance, and public health. The release or disturbance of hazardous materials and/or waste is assessed based on an investigation into types of hazardous materials that are known to exist at the site, types of equipment that would be used during construction and operation of the project, types of disturbances that would occur at the project site, and how project-related actions may increase the risk for release or disturbance of hazardous materials and/or waste. To evaluate the risks to public health, the known construction and operation methods were assessed, and the potential risks are described in the effects section below.

Regulatory Setting

The principal federal regulatory agency responsible for the safe use and handling of hazardous materials is the EPA. Two key federal regulations pertaining to hazardous wastes are described below. Other applicable federal regulations are contained primarily in CFR Titles 29, 40, and 49.

Resource Conservation and Recovery Act

The federal Resource Conservation and Recovery Act enables the EPA to administer a regulatory program that extends from the manufacture of hazardous materials to their disposal, thus regulating the generation, transportation, treatment, storage, and disposal of hazardous waste at all facilities and sites in the nation.

Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund) was passed to facilitate the cleanup of the nation’s toxic waste sites. In 1986, the act was amended by the Superfund Amendment and Reauthorization Act Title III (community right-to-know laws). Title III states that past and present owners of land contaminated with hazardous substances can be held liable for the entire cost of the cleanup, even if the material was dumped illegally when the property was under different ownership.

5.5.4 Environmental Effects

Alternative 1 (No Action)

Under the No Action alternative, there would be no construction of any facilities, and therefore no operations. There would be no change in the potential for release or disturbance of hazardous materials and/or waste, and there would be no changes in the risk to public health and safety.

Alternative 2 (Proposed Action)

Construction Effects

Impact HAZ-1: Exposure to or Release of Hazardous Materials during Construction

Fuel, oils, grease, solvents and other petroleum-based products are commonly used in construction activities. Accidental releases of the products could contaminate soils and degrade surface water and groundwater quality. Accidental releases could also pose risks to worker safety by exposing workers to hazardous materials. Additionally, ground-disturbing activities may result in the release of hazardous materials. However, the Phase I site assessment indicated that there are no known hazardous materials in the area that would be disturbed. The potential to expose the environment and workers to hazardous materials therefore is low and would be further minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, “Project Description.” The potential change in worker safety or environmental exposure to commonly used construction products would not result in an adverse effect.

Impact HAZ-2: Increased Risk to the Public Attributable to Potential Disturbance of Overhead Powerlines

Work under the COTP has the potential to induce currents and static charges with and without any physical contact. Construction activities could cause electric arcs that could electrocute workers and bystanders, cause fires, and ground out the circuit. This could lead to a temporary collapse of the electric grid in the western region. If this were to happen, death and injury could result both at the project site and throughout the area of power outage. However, as described in the Environmental Commitments section of Chapter 2, “Project Description”, both Reclamation and the contractor would implement safety and security measures to protect workers and the public from potential hazards posed by construction activities. Reclamation's project site safety and security plan would include measures to ensure that construction equipment such as cranes, aerial lifts, or high profile equipment would maintain a minimum safe distance from the transmission line and conductors. The minimum safe distance for any overhead transmission line is designated in Reclamation's *Reclamation Safety and Health Standards* (U.S. Department of the Interior, Bureau of Reclamation 2002) or by the transmission line operating agency, whichever is more stringent.

Additionally, work under the COTP has the potential to cause flashovers. Flashovers occur when higher voltage electricity "jumps across" an air gap to create a conductive path, and are potentially life threatening to a person standing in the near vicinity of the flashover. Flashovers can also cause damage to nearby equipment and the transmission line, cause the line to relay, and can cause interruptions to power supply. Flashovers can occur when any suspended fine materials, particulate matter, or water droplets, etc. are allowed between the ground and the conductor.

The contractor's safety plan would include the following safety measures for working near energized overhead powerlines:

- A signal or flag person will guide cranes, aerial lifts, or other high profile equipment in transit near exposed energized lines.
- All crossings where equipment will be moved under high voltage lines will be posted with appropriate signs.
- Equipment will be prohibited from coming within the minimum safe clearance of the high voltage line.

The contractor's safety plan will also include a hazardous energy control program and a Flashover Prevention Plan. The hazardous energy control program will be established for the construction site to ensure that during construction there will be no release of stored energy and that the COTP transmission line will be protected. As described in the Environmental Commitments section of Chapter 2, the Flashover Prevention Plan would identify activities that could lead to fires, smoke, water spray, or other particulate matter or potential for other suspended fines between the ground and TANC's 500-kV conductors. The intent of the plan is to address adequate safety procedures to ensure the insulation level of the air is maintained to avoid flashovers.

Implementation of the safety plan would avoid any adverse effects.

Operation Effects

Impact HAZ-3: Exposure to or Release of Hazardous Materials during Operation

Operating and maintaining the Intertie and its associated structures may include the use of fuels to access the site. Accidental releases of these products could contaminate soils and degrade surface water and groundwater quality, resulting in a worker or public safety hazard. The potential to expose workers or the public to hazardous materials is low and would be further minimized by implementing the provisions of a spill prevention and control plan. This plan will include measures for responding to and remediating spills. The program will be an element of the SWPPP, as described in the Environmental Commitments section of Chapter 2, "Project Description." The potential change in worker safety is not substantial, and there would be no adverse effect.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact HAZ-1: Exposure to or Release of Hazardous Materials during Construction

This impact is the same as described under Alternative 2 above. There would be no adverse effect.

Impact HAZ-4: Risk to the Public during Installation of Transmission Line over I-205

Installation of the transmission line segment crossing I-205 could potentially increase the risk of drivers on I-205 to traffic accidents as well as direct hazards posed by stringing conductors over I-205. Installation of transmission line conductors, fiber optic cable, ground wires, and possibly aerial marker balls over I-205, in addition to large vehicles delivering materials and oversized vehicles used in the construction process, may affect traffic flow on I-205 resulting in a safety hazard. As part of the Traffic Control Plan, described in Chapter 2, if Alternative 3 is implemented, Reclamation would coordinate with Caltrans and the California Highway Patrol prior to and during installation of the I-205 segment the transmission line to minimize hazards to workers and the public.

Operation Effects

Impact HAZ-3: Exposure to or Release of Hazardous Materials during Operation

This impact would be the same as described under Alternative 2 above. There would be no adverse effect.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact HAZ-1: Exposure to or Release of Hazardous Materials during Construction

Under emergency circumstances, a temporary pipeline would be installed to connect the DMC and California Aqueduct. This would require minimal construction equipment and activities. However, when the pipeline is installed and removed, there is potential for accidental release of fuels, lubricants, and other hazardous materials. As described in the Environmental Commitments section in Chapter 2, a SWPPP will be developed and implemented and will include a spill response plan. This would ensure that no adverse effects on the environment occur during installation and removal of the temporary intertie.

Operation Effects

No adverse effects are expected to occur related to the operation of Banks Pumping Plant under Alternative 4.

Impact HAZ-3: Exposure to or Release of Hazardous Materials during Operation

This impact would be the same as described under Alternative 2 above. There would be no adverse effect.

5.6 Socioeconomics

5.6.1 Introduction

This section describes the existing socioeconomic conditions and the socioeconomic consequences of constructing and operating the Intertie alternatives. The study area for this assessment is composed of Alameda and San Joaquin Counties. Alameda County was selected because the project is located in the county. San Joaquin County was also selected because of the relative proximity of urban areas, including Stockton and Tracy. Both communities could provide the labor pool for constructing the Intertie and provide necessary services and housing.

5.6.2 Affected Environment

Sources of Information

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

- California Department of Finance databases and reports,
- California Employment Development Department databases, and
- United States Department of Commerce, Bureau of the Census databases.

Population

Alameda County

The population of Alameda County was estimated to total approximately 1,543,000 in 2008 (California Department of Finance 2008a). This represents an increase of about 7% from the estimated 2000 population of 1,444,000 (California Department of Finance 2008b). Alameda County's population is projected to reach 1,663,000 by 2020 (California Department of Finance 2008c).

The most populous cities in Alameda County are Oakland, with an estimated population of 420,200 in 2008, and Fremont, with an estimated population of 213,500 in 2008. Most of the county's population resides in incorporated communities. The total population in unincorporated areas of Alameda County totaled only 140,000 in 2008. (California Department of Finance 2008a.)

San Joaquin County

The population of San Joaquin County was estimated to total approximately 686,000 in 2008 (California Department of Finance 2008a). This represents an increase of about 21% from the estimated 2000 population of 564,000 (California Department of Finance 2008b). San Joaquin County's population is projected to reach 965,000 by 2020 (California Department of Finance 2008c).

The most populous cities in San Joaquin County are Stockton, with an estimated population of 290,000 in 2008, and Tracy, with an estimated population of 82,000 in 2008. Most of the county's residents reside in incorporated communities. The total population in unincorporated areas of San Joaquin County was estimated to total 145,000 in 2008. This represents just over 20% of the total county population (California Department of Finance 2008a).

Employment, Income, and Housing

Alameda County

Employment in Alameda County totaled 719,400 jobs in 2007, a decrease of approximately 21,600 jobs from 2000 levels. The trade, transportation, and utilities sector accounted for 136,000 jobs in 2007, followed by the government and health care and social assistance sectors, accounting for 137,100 and 66,700 jobs, respectively. The countywide unemployment rate was estimated at 4.8% in 2007. (California Employment Development Department 2008a.)

Total personal income in Alameda County was approximately $62.3 billion in 2005 or about 5% of the statewide total (Fedstats 2008a). Personal income per capita was estimated to be $42,956 in 2005 (FedStats 2008a), much higher than the statewide per capita income of $37,311 in 2005 (California Department of Finance 2008d).

The supply of housing units in Alameda County was 562,479 units in January 2006. The countywide vacancy rate was approximately 3.01% or 16,931 units. (California Department of Finance 2007.)

San Joaquin County

Employment in San Joaquin totaled 270,800 jobs in 2007, an increase of approximately 66,200 jobs from 2000 levels. The government sector accounted for 40,000 jobs in 2007, followed by the retail trade and health care and social assistance sectors, accounting for 27,000 and 23,000 jobs, respectively. The construction sector accounted for approximately 13,700 jobs in 2007. The countywide unemployment rate was estimated to be 8.2% in 2007. (California Employment Development Department 2008b.)

Total personal income in San Joaquin County was approximately $17.3 billion or about 1.3% of the statewide total (Fedstats 2008b). Personal income per capita was estimated at $26,071 in 2005 (FedStats 2008b), much lower than the statewide per capita income of $37,311 in 2005 (California Department of Finance 2008d).

The supply of housing units in San Joaquin County totaled 219,717 units in January 2006. The countywide vacancy rate was approximately 3.91% or 8,591 units. (California Department of Finance 2007.)

5.6.3 Environmental Consequences

Assessment Methods

Assessment methods and assumptions developed for the SDIP Draft EIS/EIR (California Department of Water Resources and the U.S. Department of the Interior, Bureau of Reclamation 2005) were used to help estimate the construction- and operation-related socioeconomic effects of constructing and operating the Intertie project. Estimates of the number of construction personal required during the construction phase were developed by Reclamation engineering staff. These assumptions were:

- **Origin of Construction Workers:** Sixty percent of construction workers would be supplied by the San Joaquin and Alameda workforce.
- **Population:** Workers not originating from the San Joaquin or Alameda workforce would temporarily locate within the study area. Family size is estimated to total three persons.
- **Employment and Income:** Changes in employment and income would occur during the construction phase of the project. Reclamation has estimated that up to 62 workers would be employed during construction of Alternatives 2 and 3 and up to 22 workers during construction of Alternative 4. Indirect changes in employment and income as a result of expenditures made for goods and services during the construction period were qualitatively assessed.
- **Construction Period:** Construction of the Intertie project is expected to be completed in 15 months.

5.6.4 Environmental Effects

Alternative 1 (No Action)

Under Alternative 1, the Intertie pumping facilities would not be constructed or operated. There would be no short-term or long-term changes in employment or income because no expenditures would be made to construct or operate the intertie facilities. This would result in no change in regional employment or income levels. Because no new workers would move into the region, there would be no effect on regional housing supplies.

Alternative 2 (Proposed Action)

Construction Effects

Impact SOC-1: Change in Population during Project Construction

During the construction period, the regional population is expected to increase by approximately 75 people. This increase includes construction workers and their families. This represents a very small increase in the study area population of 2.2 million.

This very small temporary increase in population is not expected to result in a measurable change in demand for housing. The increase in demand for housing would be limited to the construction phase of the project and is expected to be easily accommodated by the existing supply of housing in the study area. No adverse effects on housing supply are expected as a result of constructing Alternative 2.

Impact SOC-2: Change in Employment and Income during Project Construction

Constructing the pumping plant, pipelines, and transmission facilities is expected to require up to 62 workers. In addition, new jobs would be created as a result of expenditures made by contractors and construction workers in the region during the construction phase. The increase in construction-related employment also would result in a proportional increase in total personal income in the study area.

The temporary direct and indirect increases in employment and income, although small when placed in the context of total employment (990,000 jobs) and personal income ($79.6 billion) generated in the study area, would be considered a temporary beneficial effect of Alternative 2.

Operation Effects

Impact SOC-3: Change in Population, Employment, and Income during Project Operation

As indicated in Chapter 2, “Project Description,” after the initial start-up phase, the operation of the Intertie would be fully automated. Operation of a fully automated facility is not expected to result in an increase in employment or income or a change in regional population.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact SOC-1: Change in Population during Project Construction

Impacts on population occurring during construction of Alternative 3 would be the same as described for Alternative 2. There would be no substantial temporary change in population or increase in regional housing demand.

Impact SOC-2: Change in Employment and Income during Project Construction

Changes in employment and income during construction of Alternative 3 would be the same as described for Alternative 2. Although small, the temporary increase in employment and income would be considered beneficial.

Operation Effects

Impact SOC-3: Change in Population, Employment, and Income during Project Operation

As indicated in Chapter 2, “Project Description,” after the initial start-up phase, the operation of the Intertie would be fully automated. Operation of a fully automated facility is not expected to result in an increase in employment, income, or regional population.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact SOC-1: Change in Population during Project Construction

Constructed elements of Alternative 4 would be limited to a gravity-operated pipeline between the California Aqueduct and the DMC installed only during emergencies. During construction, the regional population is expected to increase by approximately 27 people. This increase includes construction workers and their families. This represents a very small increase in the study area population of 2.2 million.

This very small temporary increase in population is not expected to result in a measurable change in demand for housing. This very small increase in demand for housing would be limited to the construction phase of the project is expected to be easily accommodated by the existing supply of housing in the study area. No adverse effects on housing are expected as a result of constructing the Alternative 4.

Impact SOC-2: Change in Employment and Income during Project Construction

Constructing the gravity-operated pipeline is expected to require up to 22 workers. In addition, new jobs would be created as a result of expenditures made by contractors and construction workers in the region during the construction phase. The increase in employment would also result in a proportional increase in total personal income in the study area.

The temporary direct and indirect increases in employment and income, although small when placed in the context of total employment (990,000 jobs) and personal income ($79.6 billion) generated in the study area, would be considered a temporary beneficial effect of Alternative 4.

Operation Effects

Impact SOC-3: Change in Population, Employment, and Income during Project Operation

As indicated in Chapter 2, “Project Description,” Alternative 4 would use the existing capacity of the Banks Pumping Plant, and during emergencies a temporary pipeline linking the California Aqueduct with the DMC would be operated. Because the existing capacity would be used, increasing pumping at Banks Pumping Plant is not expected to result in new jobs or changes in regional population or income levels. Operating the temporary intertie pipeline also is not expected to increase employment because it would require only occasional inspections for operation and maintenance purposes.

5.7 Indian Trust Assets

5.7.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on Indian Trust Assets (ITAs).

ITAs are legal interests in property held in trust by the United States for federally recognized Indian tribes or individual Indians. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset. ITAs can include land, minerals, federally reserved hunting and fishing rights, federally reserved water rights, and in-stream flows associated with trust land. Beneficiaries of the Indian trust relationship are federally recognized Indian tribes with trust land; the United States is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the United States. The characterization and application of the United States trust relationship have been defined by case law that interprets Congressional acts, executive orders, and historical treaty provisions.

5.7.2 Affected Environment

The nearest ITA to the Intertie alternatives is the Lytton Rancheria, located approximately 44 miles northwest of the project area.

5.7.3 Environmental Consequences

Assessment Methods

Assessment of effects on ITAs was conducted by evaluating the effects described in the various preceding resource sections and determining if any would directly or indirectly affect the Lytton Rancheria or other ITAs.

Regulatory Setting

Consistent with President William J. Clinton’s 1994 memorandum, “Government-to-Government Relations with Native American Tribal Governments,” Reclamation assesses the effect of its programs on tribal trust resources and federally recognized tribal governments. Reclamation is tasked with actively engaging federally recognized tribal governments and consulting with such tribes on a government-to-government level (59 FR 1994) when its actions affect ITAs.

The U.S. Department of the Interior (DOI) Departmental Manual Part 512.2 ascribes the responsibility for ensuring protection of ITAs to the heads of bureaus and offices (U.S. Department of the Interior 1995). Part 512, Chapter 2 of the Departmental Manual states that it is the policy of the DOI to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of federally recognized Indian tribes and tribal members. All bureaus are responsible for, among other things, identifying any impact of their plans, projects, programs or activities on ITAs; ensuring that potential impacts are explicitly addressed in planning, decision, and operational documents; and consulting with recognized tribes who may be affected by proposed activities.

Consistent with this, Reclamation's Indian trust policy states that Reclamation will carry out its activities in a manner that protects ITAs and avoids adverse impacts when possible, or provides appropriate mitigation or compensation when it is not. To carry out this policy, Reclamation incorporated procedures into its NEPA compliance procedures to require evaluation of the potential effects of its proposed actions on trust assets (U.S. Department of the Interior, Bureau of Reclamation July 2, 1996). Reclamation is responsible for assessing whether the Intertie has the potential to affect ITAs. Reclamation will comply with procedures contained in Departmental Manual Part 512.2, guidelines, which protect ITAs.

Reclamation's ITA policy states that Reclamation will carry out its activities in a manner that protects ITAs and avoids adverse impacts when possible. When Reclamation cannot avoid adverse impacts, it will provide appropriate mitigation or compensation.

5.7.4 Environmental Effects

Alternative 1 (No Action)

Under the No Action Alternative, there would be no changes in the environment and no effects on the Lytton Rancheria or other ITAs.

Alternative 2 (Proposed Action)

The Lytton Rancheria is located in Healdsburg, California, and is not adjacent to any water that would be affected by Intertie operations. There would be no effect.

Alternative 3 (TANC Intertie Site)

The Lytton Rancheria is located in Healdsburg, California, and is not adjacent to any water that would be affected by Intertie operations. There would be no effect.

Alternative 4 (Virtual Intertie)

The Lytton Rancheria is located in Healdsburg, California, and is not adjacent to any water that would be affected by Intertie operations. There would be no effect.

5.8 Utilities and Public Services

5.8.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on utilities and public services such as natural gas, electricity, communications, wastewater, solid waste disposal, stormwater drainage, and emergency services. The impacts on water supply and electric power use are evaluated in Section 3.1, Water Supply and Delta Water Management, and Section 5.2, Power Production and Energy, respectively.

5.8.2 Affected Environment

Sources of Information

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

- San Joaquin County General Plan 2010, July 1996 (San Joaquin County 1996);
- City of Tracy General Plan, Public Facilities and Services Element, July 2006 (City of Tracy 2006);
- SDIP Draft EIS/EIR, October 2005 (California Department of Water Resources and U.S. Department of the Interior, Bureau of Reclamation 2005); and
- communications with fire protection and police representatives (Nelson pers. comm.; Terra pers. comm.).

Electricity

Major transmission facilities in the immediate project area include the Tracy-Tesla and Tracy-Los Banos 500-kV lines (which are components of the COTP and cross the project study area at the Intertie [Alternative 2] site), and the Tracy-Westley #1 and #2 230-kV lines which are located just east of the DMC.

The COTP is one of the three 500-kV Alternating Current (AC) lines that make up the California-Oregon Intertie (COI). The COTP originates at the Captain Jack Substation in Southern Oregon and extends southward to the Tracy area. TANC is the majority owner of the COTP and the COTP facilities are operated by Western. The other two COI 500-kV lines extend from the Malin Substation in southern Oregon to the Tesla Substation south of Tracy. The Table Mountain-Tesla segment of one of these two lines is located approximately 4,600 feet west of the project area. The COI facilities are used to deliver power from the Pacific Northwest and resources (primarily) hydroelectric) in northern California to load centers in northern California.

Natural Gas

The Pacific Gas and Electric Company (PG&E) owns and operates natural gas pipelines just northeast of the project study area in San Joaquin County. Two of these pipelines run northwest to southeast near Grant Line Road, and a third pipeline, also aligned in a northwest-southeast direction, is located near Byron Road and Patterson Pass Road. These pipelines range from 8 to 36 inches in diameter.

Chevron, Standard Oil, and Unocal operate and maintain underground gas pipelines that transport natural gas and oil through the area to the north of the project study area. These pipelines range from 6 to 20 inches in diameter, and most are aligned in a northwest-southeast direction near the Byron Highway.

Many of the residential and agricultural customers in the vicinity of the project use on-site tanks for their gas supply. There are no known natural gas pipelines in the potential area of effect for the Intertie alternatives.

Stormwater Drainage

Stormwater drainage networks typically consist of both natural and human-made conveyance systems to collect, convey, and store runoff resulting from a storm event. Most stormwater drainage systems in urban areas and in some rural areas are managed by flood control districts.

Impervious surfaces in the project area are limited to roads, other small sections of pavement, and areas covered by rural residential or agricultural structures. Local drainage is dictated largely by an extensive system of ditches and agricultural drains. Several culverts have been constructed to allow drainage from between the California Aqueduct and the DMC to enter surrounding areas, but because there are few impervious surfaces, stormwater drainage is similar to natural conditions.

Wastewater

All of the Intertie alternatives are located in rural areas. Wastewater generated near the project area is handled by sanitary sewer systems, treatment plants, and individual septic systems. Agricultural land in northeastern Alameda County is served mainly by on-site septic systems. Similarly, rural San Joaquin County is served primarily by individual septic tanks.

Solid Waste Disposal

Solid waste generated in Alameda County is transported to the nearest landfill (the Altamont Landfill). The Altamont Landfill, approximately 5.5 miles west of the project area, is expected to reach capacity by 2032 (California Integrated Waste Management Board 2009). Solid waste generated in San Joaquin County's South County Refuse Area is disposed of at the Foothill Sanitary Landfill northeast of the project area near the Stanislaus County line. This landfill is expected to reach capacity by 2054 (San Joaquin County 2009).

Communications

AT&T, Inc., is the primary supplier of telephone service to areas near the project study area. Underground fiber trunk lines feed switching equipment, and overhead lines and poles supply individual service units. The communication lines typically are aligned parallel to the roadways and traverse roadways to supply the individual service units. Cable markers indicating underground cabling are located in some areas parallel to roadways. A network of alternative telephone companies, cellular communication companies, and cable companies also serves the region. New service to specific sites is provided on a case-by-case basis.

Police, Fire, and Ambulance Services

Police protection services in the portion of the project study area in Alameda County are provided by the Alameda County Sheriff's Department and the California Highway Patrol Dublin office. The Dublin California Highway Patrol patrols I-205/I-580 from the San Joaquin–Alameda county border west as well as Alameda county roads near the project area (Nelson pers. comm.). Police services near the project area in San Joaquin County are provided by the Tracy Police Department and the San Joaquin County Sheriff's Department. The Tracy Police Department provides police services within Tracy's city limits. Police service within the Tracy Planning Area outside the city limits is provided by the San Joaquin County Sheriff's Department, located in French Camp south of Stockton. The Tracy Police Department provides mutual aid to the San Joaquin County Sheriff's office as needed; mutual aid is coordinated by the San Joaquin County Sheriff's Office. The Tracy California Highway Patrol patrols I-205, I-580, and San Joaquin County roads near the project area.

The portion of the project area in Alameda County is served by the Alameda County Fire Department from Station 8 in Livermore (Terra pers. comm.). The Alameda County Fire Department provides first response fire and medical services to all of eastern Alameda County. The Tracy Fire Department provides fire protection and first response emergency medical services to the city of Tracy and to more than 200 square miles in the southern part of San Joaquin County. There are three fire stations located within Tracy city limits and three located outside the city limits. The Tracy Fire Department has a mutual aid agreement with Alameda County that specifies that all participating agencies will provide emergency response into joint or borderline areas or when local resources are overwhelmed and assistance is needed for a particular incident.

Ambulance services for Alameda and San Joaquin Counties are provided by American Medical Response, a private ambulance company.

5.8.3 Environmental Consequences

Assessment Methods

The primary impact mechanism of the Proposed Action would be related to disruption of services during construction. This could occur primarily if utility lines were disrupted, construction activities resulted in changes in emergency response time, or public services such as landfills or wastewater treatment capacities were affected by the alternatives. Impacts were determined by assessing each alternative's potential to disrupt these services.

Regulatory Setting

State

At the state level, management of solid waste is regulated by the California Integrated Waste Management Board (CIWMB), which delegates local permitting, enforcement, and inspection responsibilities to local enforcement agencies. In 1997, some of the regulations adopted by the State Water Resources Control Board pertaining to landfills (Title 23, Chapter 15) were incorporated with CIWMB regulations (Title 14) to form Title 27 of the California Code of Regulations.

California Integrated Waste Management Act

The California Integrated Waste Management Act (Assembly Bill [AB] 939), adopted in 1989, established an integrated waste management hierarchy that consists of, in order of importance: source reduction, recycling, composting, and land disposal of solid waste. The law also required that each County prepare a new Integrated Waste Management Plan. The act further required each city to prepare a Source Reduction and Recycling Element (SRRE) by July 1, 1991. AB 939 also requires cities and counties to prepare SRREs in their General Plan.

Local

San Joaquin County

The San Joaquin County General Plan 2010 contains policies pertaining to utility corridors that apply to the Proposed Action:

Infrastructure Services—Utility Corridors

Policy 1. The environmental assessment of new or expanded utility lines shall address the potential adverse impacts on development as a result of a rupture or malfunction, and shall identify mitigation measures to be adopted by the utility to safeguard against such accidents and to respond in the event of an accident.

5.8.4 Environmental Effects

Alternative 1 (No Action)

Under the No Action Alternative, there would be no new facilities constructed or operated and no construction or operation effects on utilities or public services.

Alternative 2 (Proposed Action)

Construction Effects

Impact PUB-1: Disruption of Electricity Service

The COTP 500-kV transmission line crosses the Alternative 2 project area. Construction of the proposed pumping plant and appurtenant structures likely would require work under the energized COTP line. Construction activities could cause electric arcs or result in physical contact with the conductors, either of which could ground out the circuit and potentially collapse the high-voltage electric grid in the western region. Additionally, work under the COTP has the potential to cause flashovers. Flashovers occur when higher voltage electricity "jumps across" an air gap to create a conductive path, and are potentially life threatening to a person standing in the near vicinity of the flashover. Flashovers can also cause damage to nearby equipment and the transmission line, cause the line to relay, and can cause interruptions to power supply. Flashovers can occur when any suspended fine materials, particulate matter, or water droplets, etc. are allowed between the ground and the conductor.

If the western region electric grid were to collapse, outage impacts could be widespread and substantial. However, as described in the Environmental Commitments section of Chapter 2, “Project Description”, both Reclamation and the contractor would implement safety measures to ensure that construction equipment such as cranes, aerial lifts, or high profile equipment would maintain a minimum safe distance from the COTP transmission line and conductors. The minimum safe distance for any overhead transmission line is designated in Reclamation's *Reclamation Safety and Health Standards* (U.S. Department of the Interior, Bureau of Reclamation 2002) or by the transmission line operating agency, whichever is more stringent. Reclamation will coordinate with TANC and Western throughout the development of the construction details and any associated modifications to Safety Plan to ensure that appropriate measures are incorporated to minimize the potential for disruptions to the COTP.

Additional Environmental Commitments that would be implemented by Reclamation to reduce the potential for transmission line disturbance include:

- Ensuring that there are no cut, fill or spoil bank placement operations that compromise the clearances required for the 500-kV lines in accordance with the present conditions and the applicable government codes.
- Ensuring that there are no cut or fill or cofferdam construction/dewatering activities that could affect the stability of the COTP transmission tower footings consistent with all applicable government codes.
- Maintaining access to the COTP facilities by TANC and the COTP maintenance representatives at all times. TANC and its contractors, including Western, must be able to access all towers at any time with heavy equipment, and Reclamation will maintain this access during construction. Routine ground patrol to each tower occurs once a year; routine aerial patrol of the transmission lines occur four times a year.
- Allowing a TANC representative on site at times when major work is underway on the transmission line right-of-way. Reclamation will provide TANC advance notice of not less than 60 days for all construction schedules to accommodate the necessary communications and arrangements for such TANC on-site representation at TANC's discretion.
- Consulting with TANC and/or Western during the installation of temporary clearance markers to indicate the closest safe distances from the conductors.
- Furnishing and installing permanent markers on Reclamation's facilities indicating the proximity of energized high-voltage power line conductors before the completion of construction.
- Reviewing and complying, during and after construction, with all regulatory requirements and industry standards for proper grounding of metallic equipment, structures, fences, platforms, and other metal facilities in the high-voltage electric field.

The contractor's safety plan would include the following safety measures for working near energized overhead powerlines:

- A signal or flag person will guide cranes, aerial lifts, or other high profile equipment in transit near exposed energized lines.

- All crossings where equipment will be moved under high voltage lines will be posted with appropriate signs.
- Equipment will be prohibited from coming within the minimum safe clearance of the high voltage line.
- A Flashover Prevention Plan will be developed and implemented for all work adjacent to and underneath TANC's 500-kV transmission line. The plan would identify activities such as smoke from burning debris or power tools or their operation, water spray for dust control, etc. that could lead to fires, smoke, water spray, or other particulate matter or potential for other suspended fines between the ground and the 500-kV conductors. The intent of the plan is to address adequate safety procedures to ensure the insulation level of the air is maintained to avoid flashovers.

The Safety Plan may also include additional measures depending on the results of coordination with Western and TANC. Implementing the safety plan would avoid any adverse effects on electricity service.

Impact PUB-2: Disruption to Underground Utility Lines during Excavation Activities

As noted under Environmental Commitments in Chapter 2, "Project Description," existing underground utility lines at excavation sites will be identified prior to construction and underground utility lines will be avoided or relocated in coordination with the utility company or service provider. As such, there would be no disruption to these lines or the services they provide. There would be no adverse effect on underground utility lines.

Impact PUB-3: Disruption to Emergency Services during Construction

Construction of the Proposed Action would result in a temporary increase in the number of construction vehicles traveling on local roadways. These construction vehicles are not expected to change the level of service provided by local roadways or increase response times of emergency service providers because relatively few construction vehicles would be traveling to and from the site, trips would cease upon completion of construction, and the Intertie area and roads used to access it are not frequently used for emergency vehicle access. Therefore, there would be no adverse effect on emergency services.

Impact PUB-4: Increased Contributions to Local Landfills

Excavation during construction would result in spoils. However, excavated material not reused in permanent construction would be disposed of in spoilbanks in the federal and state right-of-way land between the DMC and the California Aqueduct. The small amount of waste that may require landfill disposal is not expected to substantially decrease the existing lifespan of the landfills near the project study area. Therefore, there would be no adverse effect.

Operation Effects

No impacts on utilities or public services would occur as a result of operation of the Proposed Action.

Alternative 3 (TANC Intertie Site)

Construction Effects

Impact PUB-1: Disruption of Electricity Service

Alternative 3 is the same project as Alternative 2, but at a different location. No major transmission lines traverse this site. Any minor transmission lines could be avoided during construction and have a very small potential to cause disruption of electricity services because of their small service areas.

Impact PUB-2: Disruption to Underground Utility Lines during Excavation Activities

This impact would be the same as described under Alternative 2 above. Underground utility lines will be avoided or relocated in coordination with the utility company or service provider. Refer to Environmental Commitments in Chapter 2, "Project Description." There would be no adverse effect.

Impact PUB-3: Disruption to Emergency Services during Construction

This impact would be the same as described under Alternative 2 above. There would be no adverse effect.

Impact PUB-4: Increased Contributions to Local Landfills

This impact would be the same as described under Alternative 2 above. There would be no adverse effect.

Operation Effects

No impacts on utilities or public services would occur as a result of operation of the Alternative 3.

Alternative 4 (Virtual Intertie)

Construction Effects

Impact PUB-1: Disruption of Electricity Service

This impact is similar to the one described under Alternative 2 above. The COTP crosses the Alternative 4 project area, and as a result there is the potential for disruption of electricity service resulting from construction activities as discussed under Alternative 2. The difference is that under Alternative 4 a temporary pipeline would be installed to connect the DMC and California Aqueduct under emergency circumstances. This would require minimal construction equipment and activities, and the likelihood of disruption is substantially less.

Impact PUB-2: Disruption to Underground Utility Lines during Excavation Activities

This impact potentially would occur under Alternative 4. However, the likelihood of occurrence is less than under Alternatives 2 and 3 because construction activities associated with the installation of the temporary intertie would be minimal compared to construction under Alternatives 2 and 3. Excavation activities under this alternative would be limited to minimal grading near the California Aqueduct to minimize the elevation difference between the DMC and the California Aqueduct. Underground utility lines would be avoided or relocated in coordination with the utility company or service provider. Refer to Environmental Commitments in Chapter 2, “Project Description.” There would be no adverse effect.

Impact PUB-3: Disruption to Emergency Services during Construction

This impact would be similar to the one described under Alternative 2 above but to a lesser extent because activities associated with the installation of the temporary intertie likely would take place over a period of 5 to 7 days and would occur infrequently. There would be no adverse effect on emergency services.

Impact PUB-4: Increased Contributions to Local Landfills

This impact would be the similar to the one described under Alternative 2 above but would occur to a lesser extent because excavation under Alternative 4 would be minimal. Similar to Alternative 2, excavation during construction would generate the greatest amount of waste material; however, because the Alternative 4 intertie is temporary, this material would be put back in place when the temporary intertie is removed. The small amount of waste that may require landfill disposal is not expected to substantially decrease the existing lifespan of the landfills near the project study area. There would be no adverse effect.

Operation Effects

Operation of the temporary intertie and the Banks Pumping Plant under Alternative 4 would not result in adverse effects on utilities or public services.

5.9 Environmental Justice

5.9.1 Introduction

This section describes the existing environmental conditions and the consequences of constructing and operating the project alternatives on environmental justice. The concept of environmental justice embraces two principles: (1) fair treatment of all people regardless of race, color, nation of origin, or income and (2) meaningful involvement of people in communities potentially affected by program actions. Executive Order 12898 requires all federal agencies to conduct programs, policies, and activities that subsequently affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have an effect of excluding persons (including populations) from participation in or denying persons the benefits of those programs, or subjecting persons to discrimination because of their race, color, or national origin. Section 1-101 requires federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority and low-income populations.

5.9.2 Affected Environment

Sources of Information

The following key source of information was used in the preparation of this section:

- U.S. Department of Commerce, Census Bureau 2003a and 2003b.

Demographics

The Proposed Action and alternatives are located in eastern Alameda County just outside the San Joaquin County line. The percentage of minorities residing in the counties is 35.8 and 45.4, respectively. For the State of California, 35.7% of the population is considered to be of a minority race. Table 5.8-1 illustrates the percentage of races residing in Alameda and San Joaquin Counties. Percentages for the State of California are also included for comparison.

Table 5.8-1. Race/Origin Characteristics, Census 2000 (%)

	Alameda County	San Joaquin County	State of California
Race			
White	48.8	58.1	59.5
Black or African American	14.9	6.7	6.7
American Indian and Alaska Native	0.6	1.1	1.0
Asian	20.4	11.4	10.9
Native Hawaiian, other Pacific Islander	0.6	0.3	0.3
Some other race	8.9	16.3	16.8
Two or more races	5.6	6.0	4.7
Origin			
Hispanic	19.0	30.5	32.4

Source: U.S. Department of Commerce, Census Bureau 2003a.

Percentages may total more than 100% because individuals may report more than one race. Hispanic is considered an origin by the Census Bureau. Therefore, those of Hispanic origin are also counted in one of the race categories.

As shown in Table 5.8-2 below, 7.7% of households in Alameda County and 13.5% of households in San Joaquin County were determined to have an income in 1999 below the poverty level. The State of California had 10.6% of households below the poverty level during the same period.

Table 5.8-2. Household Poverty Status in 1999 (%)

	Alameda County	San Joaquin County	State of California
Percent below poverty level	7.7	13.5	10.6

Source: U.S. Department of Commerce, Census Bureau 2003b.

5.9.3 Environmental Consequences

Methods

The following methodology is based on the EPA's Environmental Justice Guidance (U.S. Environmental Protection Agency 1998). The EPA's Environmental Justice Guidance states that

> [m]inority populations should be identified where either (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of analysis.

As such, demographic data for Alameda and San Joaquin Counties were compared to demographic data from the next highest unit of analysis, the State of California, to determine whether that specific area had a "meaningfully greater" percentage of minority or low-income population.

Potential environmental justice impacts were analyzed by comparing census data from the project location—Alameda County—with data from neighboring San Joaquin County and the State of California. Data were collected primarily from the U.S. Census Bureau 2000 Census. The population data that are key to the analysis of Environmental Justice are the following race, income, and age characteristics:

- percentage of minority population (black or African American; American Indian and Alaskan Native; Asian; Native Hawaiian and other Pacific Islander; some other race; and two or more races);
- percentage of persons of Hispanic origin; and
- percentage of population below the poverty level.

These data are presented in the previous section.

For this analysis, resource sections of this EIS were reviewed to identify any adverse effects and in which areas those effects would occur. The following questions then were applied:

- Is there an adverse effect?
- Does the potentially affected population include minority or low-income populations?
- Would the adverse environmental or human health effects be likely to fall disproportionately on minority or low-income populations?

5.9.4 Environmental Effects

No Action Alternative

Under the No Action Alternative, the Intertie would not be constructed or operated. The CVP would continue to operate under current conditions. There would be no changes in any of the resources analyzed in this EIS, and therefore, no environmental justice impacts would occur.

Proposed Action (Intertie)

The Proposed Action would allow the CVP to pump more often at or near its authorized pumping capacity of 4,600 cfs at the Jones Pumping Plant. All adverse environmental or human health impacts for this action have been mitigated, as described in each resource section. No population, including minority or low-income populations, would bear a disproportionate environmental or human health effect. Therefore, there would be no environmental justice effects resulting from implementing the Intertie.

Alternative 3 (TANC Intertie Site)

Environmental Justice for Alternative 3 would be the same as described for Alternative 2. No population, including minority or low-income populations, would bear a disproportionate environmental or human health effect. Therefore, there would be no environmental justice effects resulting from implementing the Intertie.

Alternative 4 (Virtual Intertie)

The Virtual Intertie would allow CVP to meet more often its demands from CVP contractors by using pumping capacity available at Banks Pumping Plant, and also includes the installation of a temporary intertie facility during emergencies. All adverse environmental or human health impacts of this action have been mitigated, as described in each resource section. No population, including minority or low-income populations, would bear a disproportionate environmental or human health effect. Therefore, there would be no environmental justice effects resulting from implementing the Virtual Intertie.

Chapter 6 Cumulative Impacts

6.1 Introduction

This chapter evaluates the cumulative impacts and the potential contribution of the Intertie to those impacts. The impact assessment discusses each resource topic evaluated in this EIS.

6.2 Approach to Impact Analysis

6.2.1 Legal Requirements

NEPA regulations require that the cumulative impacts of a proposed project be addressed in an EIS when the cumulative impacts are expected to be significant. Cumulative impacts are impacts on the environment that result from the incremental impacts of a proposed action when added to other closely related past, present, and reasonably foreseeable future actions (40 CFR 1508.7). Such impacts can result from individually minor but collectively significant actions taking place over time.

6.2.2 Methods

A list of past, current and probable future projects was compiled for the cumulative setting. These projects (cumulative projects) include other water supply projects affecting the Delta area which could result in similar impacts and benefits as those of the Intertie. Other cumulative projects which were considered include:

- Projects identified in the 2000 CALFED Record of Decision (ROD);
- Projects included in the 2008 CVP/SWP Longterm Operations Plan;
- Other projects in which Reclamation is involved; and
- Regional and local agency infrastructure projects (e.g., water and wastewater facilities construction and/or improvements).

In addition, regional plans were reviewed to characterize development trends and growth projections in Alameda and San Joaquin County. These projects are considered with the Intertie to determine if the combined effects of all of the projects would result in significant cumulative impacts.

6.2.3 Quantitative Analysis

The quantitative analysis uses the analysis presented in the 2008 CVP/SWP Longterm Operations Plan (U.S. Department of the Interior, Bureau of Reclamation 2008) and the 2008 USFWS Operations BO for Delta smelt (U.S. Fish and Wildlife Service 2008). The

CVP/SWP Longterm Operations Plan represents a hard look at existing operations and proposed near-future projects that are likely to affect similar resources. In addition to existing CVP and SWP operations, six near-future projects are included in the CVP/SWP Longterm Operations Plan, including the Intertie. The CVP/SWP Longterm Operations Plan, however, does not include all reasonably foreseeable projects, so a qualitative assessment is also included in this chapter. The following summarizes projects proposed by Reclamation in the CVP/SWP Longterm Operations Plan and the Reasonable and Prudent Alternative included in the USFWS Operations BO for delta smelt to reduce the effects of existing CVP and SWP operations and the proposed near-future projects on delta smelt.

South Delta Improvements Program Stage 1

The SDIP is divided into Stages 1 and 2. Stage 1 includes the construction and operation of permanent operable gates (to replace the temporary barriers), dredging in portions of the south Delta, and extension of some agricultural diversion structures by 2012. The operation of the gates is included in the OCAP analysis. The head of Old River gate would be operated between April 15 and May 15 and in the fall. The remaining 3 agricultural gates would be operated April 15 through the agricultural season. The gates would maintain south Delta water levels above 0.0 msl for channels upstream of the operable gates. Stage 2 (increase Banks pumping to 8,500 cfs) and the remainder of Stage 1 (construction and dredging) effects are evaluated qualitatively.

Freeport Regional Water Project

The Freeport Regional Water Project (FRWP) is a regional water supply project being developed on the Sacramento River near the town of Freeport by the Sacramento County Water Agency (SCWA) and the East Bay Municipal Utility District (EBMUD), in close coordination with the City of Sacramento and Reclamation. The project is designed to help meet future drinking water needs in the central Sacramento County area and supplement water conservation and recycling programs in the East Bay to provide adequate water supply during future drought periods.

FRWP will provide up to 100 mgd of water for EBMUD to use during drought years and 85 mgd for SCWA for use in all years. The project would divert water from the Sacramento River and deliver it to a Sacramento County Treatment facility and the Folsom South Canal. From the Folsom South Canal, water will be delivered to the Mokelumne Aqueducts. This project includes construction of fish screens and a pumping plant at the intake on the Sacramento River, a water treatment facility in Sacramento County, and pipeline facilities to transport the water from Freeport to the Mokelumne Aqueduct. The FRWP is currently under construction and is expected to begin operations in 2010.

Alternative Intake Project

CCWD's Alternative Intake Project (AIP) consists of a new 250 cfs screened intake in Victoria Canal and a pump station; levee improvements; and a conveyance pipeline to CCWD's existing conveyance facilities. CCWD will operate the intake and pipeline together with its existing facilities to better meet its delivered water quality goals and to better protect listed species. Operations with the AIP will be similar to existing operations: CCWD will deliver Delta water to its customers by direct diversion when salinity at its intakes is low enough, and will blend Delta water with releases from Los Vaqueros Reservoir when salinity at its intakes exceeds the delivered water quality goal. Los Vaqueros Reservoir will be filled from the existing Old River intake or the new Victoria Canal intake during periods of high flow in the Delta, when Delta salinity is low. The choice of which intake to use at any given time will be based in large part upon salinity, consistent with fish protection requirements in the biological opinions; salinity at the Victoria Canal intake site is at times lower than salinity at the existing intakes. The no-fill and no-diversion periods will continue as part of CCWD operations, as will monitoring and shifting of diversions among the four intakes to minimize impacts to listed species.

The AIP is a water quality project, and will not increase CCWD’s average annual diversions from the Delta. However, it will alter the timing and pattern of CCWD’s diversions in two ways: winter and spring diversions will decrease while late summer and fall diversions will increase because Victoria Canal salinity tends to be lower in the late summer and fall than salinity at CCWD’s existing intakes; and diversions at the unscreened Rock Slough Intake will decrease while diversions at screened intakes will increase. It is estimated that with the AIP, Rock Slough intake diversions will fall to about 10% of CCWD’s total diversions, with the remaining diversions taking place at the other screened intakes.

Red Bluff Diversion Dam Pumping Plant

Reclamation signed the ROD July 16, 2008 for Red Bluff Diversion Dam (RBDD) pumping plant and will change the operation of the RBDD to improve upstream fish passage. The new pumping plant will allow the RBDD gates to remain out (open) for approximately 10 months of the year. The pumping plant upstream from the dam will augment existing capabilities for diverting water into the Tehama-Colusa Canal during times when gravity diversion is not possible due to the RBDD gates being out.

The new pumping plant would be capable of operating throughout the year, providing both additional flexibility in dam gate operation and water diversions for the Tehama-Colusa Canal Authority (TCCA) customers. In order to improve adult green sturgeon passage during their spawning migrations (generally March through July) the gates could remain open during the early part of the irrigation season and the new pumping plant could be used alone or in concert with other means to divert water to the Tehama-Colusa and Corning canals.

Green sturgeon spawn upstream of the diversion dam and the majority of adult upstream and downstream migrations occur prior to July and after August. After the new pumping plant has been constructed and is operational, Reclamation proposes to operate the RBDD with the gates in during the period from four days prior to the Memorial Day weekend to three days after the holiday weekend (to facilitate the Memorial Day boat races in Lake Red Bluff), and between July 1 and the end of the Labor Day weekend. This operation would provide for improved sturgeon and salmon passage.

State Water Project Oroville Facilities

The SWP Oroville Facilities operations are regulated by FERC and the State Water Board. A new license from FERC is currently being sought by DWR. Until FERC issues the new license for the Oroville Project, DWR will not significantly change the operations of the facilities and when the FERC license is issued, it is assumed that downstream of Thermalito Afterbay Outlet, the future flows will remain the same. There is a great deal of uncertainty as to when the license will be issued and what conditions will be imposed by FERC and the State Water Board.

The process that DWR has to go through to get the new license is as follows:

DWR finalized the Final Environment Impact Report in July 2008, the State Water Board will prepare the Clean Water Act Section 401 Certification for the project which may take up to a year and the 401 Certification may have additional requirements for DWR operations of Oroville. Once the 401 Certification is issued, FERC can issue the new license; however, in the interim, the documents or process may be challenged in court. When the new FERC license is issued, additional flow or temperature requirements may be required. At this time, DWR can only assume that the flow and temperature conditions required will be those in the FERC Settlement Agreement (SA); therefore, those are what DWR proposes for the near-term and future Oroville operations.

The proposed future operations in the SA include 100–200 cfs increase in flows in the low-flow channel (LFC) of the Lower Feather River and reduced water temperatures at the Feather River Hatchery and in the Low Flow channel. It is unlikely that either the proposed minor flow changes in the LFC or the reduced water temperatures will affect conditions in the Sacramento River downstream of the confluence but if they were detectable, they would be beneficial to anadromous fish in the Sacramento River.

The SA includes habitat restoration actions such as side-channel construction, structural habitat improvement such as boulders and large woody debris, spawning gravel augmentation, a fish counting weir, riparian vegetation and floodplain restoration, and facility modifications to improve coldwater temperatures in the low and high flow channels. These actions are designed to improve conditions for Chinook and steelhead in the Feather River.

USFWS Operations BO-Reasonable and Prudent Alternative

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 Operations BO-Reasonable and Prudent Alternative

The 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.

6.2.4 Qualitative Analysis

The qualitative analysis relies on project descriptions and other information on projects not included in the quantitative modeling efforts. These projects have been identified in CALFED and other planning documents and will not necessarily be implemented. However, they are or have been considered and are therefore included in the qualitative analysis below.

Shasta Reservoir Enlargement

The CALFED ROD includes enlargement of Shasta Reservoir as an option to increase storage north of the Delta. Alternatives to expand Shasta Reservoir by raising the height of the dam by 6.5 to 18.5 feet, which would inundate a segment of McCloud River, protected under the California Wild and Scenic Rivers Act, as well as portions of the Pit River and Upper Sacramento River. The alternatives include modifications to the dam and reservoir re-operations. This is currently in the planning stages, with an "Initial Alternatives Information Report" issued in 2004. At the time of this writing, an environmental document has not been issued for the project and a Plan Formulation Report was issued in 2008.

Shasta Enlargement could contribute to cumulative effects on water supplies and associated resources and could increase water supplies available for export in those years when Shasta Reservoir otherwise would have spilled. It could also modify the timing and magnitude of upstream reservoir releases in wet years.

North-of-Delta Off-Stream Storage (Sites Reservoir)

Reclamation and DWR are currently studying several off-stream storage locations including Sites Reservoir, located 70 miles northwest of Sacramento, as possible options for additional storage north of the Delta. With a potential maximum capacity of 1.8 maf, Sites Reservoir could increase the reliability of water supplies for a large portion of the Sacramento Valley and could improve fish migration by reducing water diversions on the Sacramento River.

A new Sites Reservoir could contribute to cumulative effects on water supplies and associated resources. It could increase water supplies available for export in those years when water otherwise would have been unavailable for storage and export, and modify the timing and magnitude of upstream reservoir releases in wet years.

A Notice of Preparation/Notice of Intent (NOP/NOI) for this project was issued in November 2001 and public scoping for the environmental document occurred in January 2002. The Initial Alternatives Information Report (IAIR) was issued in May 2006 and a 'Plan Formulation Report' was issued in May 2009. The environmental document and feasibility study are in progress and are scheduled for completion in 2010.

In-Delta Storage

In-Delta Storage would increase the reliability, operational flexibility, and water availability for south-of-Delta water users. An in-Delta storage location can capture peak flows through the Delta in the winter when the CVP and SWP systems do not have the capacity or ability to capture those flows. Water can then be released from the in-Delta reservoirs during periods of export demands, typically summer months. Storing water in the Delta provides the opportunity to change the timing of Delta exports and the ability to capture flows during periods of low impacts on fish. In May 2006, DWR completed the "2006 Supplemental Report to 2004 Draft State Feasibility Study In-Delta Storage Project," and recommended that further detailed study of the In-Delta Storage Project be suspended until a proposal is submitted by potential participants detailing their specific interests, needs, and objectives that support re-initiation.

However, the Delta Wetlands Project, a private water development project that would divert and store up to 210,000 acre-feet on two islands in the Delta and dedicate two other islands for wetland and wildlife habitat improvements is currently being pursued. The Delta Wetlands Project was analyzed in environmental documents and permits were issued for the private project in 2001, and an update to those analyses is currently being prepared. As part of the Delta Wetlands Project, Webb Tract and Bacon Island would be converted to reservoirs, and Bouldin Island and Holland Tract would be used as wetland and wildlife habitat per DFG habitat management plans.

Los Vaqueros Reservoir Expansion

Reclamation, DWR, and CCWD are conducting a feasibility study examining alternatives to improve water quality, and water supply reliability for Bay Area water users while enhancing the Delta environment through providing water for environmental uses, by expanding the existing Los Vaqueros Reservoir from 100,000 acre-feet up to 275,000 acre-feet. An expanded reservoir may require a new or expanded Delta intake. Under certain alternatives, a new Delta intake could be built in Old River near CCWD's existing intake. Water from an expanded reservoir could be delivered to Bay Area water users through existing interties or a new connection to the South Bay Aqueduct.

A Draft EIS/EIR was prepared by Reclamation and CCWD and released in February 2009. The analysis shows that there would be no significant effect on water levels for current Delta water users, or on river velocities. Depending on the project alternative selected, the Los Vaqueros Reservoir Expansion Project could contribute to cumulative effects on water supplies and associated resources. The project could cause changes in the timing of diversions from the Delta, generally shifting more diversions into wetter years and resulting in fewer diversions in dryer years. These changes in diversion timing would be coordinated to benefit the Delta ecosystem while minimizing any effect on other water supply projects. Changes in Delta outflow associated with the reservoir expansion project would generally include increased outflow in dryer years, and relative decreases in outflow in wetter years. Changes in upstream reservoir operation associated with this reservoir expansion project would be minimal. Some alternatives of the reservoir expansion project could provide additional water supply reliability to San Francisco Bay Area water agencies.

South Bay Aqueduct Enlargement

The purpose of the South Bay Aqueduct (SBA) Enlargement Project is to increase the capacity of the SBA from 270 cfs to 430 cfs to meet Zone 7 Water Agency's future needs and provide operational flexibility to reduce State Water Project peak power consumption. The Project includes the addition of four 45 cfs pumps to the South Bay Pumping Plant, including expansion of the existing plant structure, a new service bay, and a new switchyard; construction of a third (Stage 3) Brushy Creek Pipeline and surge tank parallel to the existing two barrels; construction of a 500 acre-foot reservoir (425 acre-feet of active storage) to be served by the Stage 3 Brushy Creek Pipeline; raising the height of the canal embankments, canal lining, and canal over crossing structures and bridges along the Dyer, Livermore, and Alameda canals and at the Patterson Reservoir; modification of check structures and siphons along the Dyer, Livermore, and Alameda canals; and construction of new drainage over crossing structures to eliminate drainage into the canals. Currently, construction is proceeding to enlarge the South Bay Pumping Plant to make room for the four new pump units being fabricated.

Upper San Joaquin River Basin Storage Investigation

The Upper San Joaquin River Basin Storage Investigation is a feasibility study by Reclamation and DWR. The purpose of the Investigation is to determine the type and extent of Federal, State and regional interests in a potential project in the upper San Joaquin River watershed to expand water storage capacity; improve water supply reliability and flexibility of the water management system for agricultural, urban, and environmental uses; and enhance San Joaquin River water temperature and flow conditions to support anadromous fish restoration efforts.

Progress and results of the Investigation are being documented in a series of interim reports that will culminate in a Feasibility Report and an EIS/EIR. The first of a series of reports analyzing alternatives was completed in 2003, with a second report, an "Initial Alternatives Information Report," completed in spring 2005, and a Plan Formulation Report completed in October 2008. A final feasibility report and environmental review are expected to be complete in 2011.

South Delta Improvements Program

As described above, the SDIP is divided into Stages 1 and 2. The permanent gates are included in the quantitative analysis. The qualitative analysis includes dredging portions of south Delta channels and extending agricultural diversions (Stage 1), and increasing the permitting diversion amount at CCF to 8,500 cfs (Stage 2). All of SDIP was evaluated in an EIS/EIR, finalized in 2006. DWR and Reclamation are currently preparing a supplemental document for Stage 1. Neither agency intends to pursue Stage 2 in the near future, but it is included in the cumulative analysis because it could be foreseeable if Delta conditions improve and DWR and/or Reclamation decide to pursue it.

Hypothetical Assessment of 10,300 cfs at Banks Pumping Plant

The CALFED ROD envisioned two steps for conveyance improvements in the south Delta:

- Banks Pumping Plant at 8,500 cfs and other improvements for fish and local impacts, and
- Banks Pumping Plant at 10,300 cfs with construction of operable barriers and a new intake and fish screening facility at CCF to support the maximum pumping rate.

Banks Pumping Plant has a physical export pumping capacity of 10,300 cfs; however, current permit terms limit the diversion of water to CCF to 6,680 cfs. Implementation of the SDIP, as described above, would increase allowable diversions at CCF from 6,680 cfs to 8,500 cfs. To take advantage of the full pump capacity of 10,300 cfs, DWR would need to construct fish screens and increase the capability of the Clifton Court Fish Facility to handle fish entering CCF. Also, the existing intake to CCF may physically limit flows needed to support 10,300 cfs and would need substantial modifications to accommodate the new fish screens. Therefore, a new CCF intake could be constructed as part of a 10,300 cfs project. No specific improvements or project has been defined; however, because it was identified in the CALFED ROD as a potential scenario, it is evaluated in this cumulative analysis.

Tracy Fish Test Facility

The Tracy Fish Test Facility, to be constructed near Byron, California, will develop and implement new fish collection, holding, transport, and release technology to significantly improve fish protection at the major water diversions in the south Delta. DWR and Reclamation will use results of the Tracy Fish Test Facility to design the CCF Fish Facility, an element of the 10,300 cfs project described above, and improve fish protection at the Jones Pumping Plant facility as required by the CVPIA. The test facility, unlike conventional fish screening facilities, will require fish screening, fish holding, and fish transport and stocking capabilities. The facility would be designed to screen about 500 cfs of water at an approach velocity of 0.2 feet per second and meet other appropriate fish agency criteria. The facility would have the structural and operational flexibility to optimize screening operations for multiple species in the south Delta. However, construction of the facility has been delayed by shortfalls in funding. The South Delta Fish Facilities Forum, a CALFED workgroup, is evaluating the cost effectiveness and cost sustainability of the fish facilities strategy. If eventually constructed, the Tracy Fish Test Facility would not affect current CVP and SWP operations.

Lower San Joaquin Flood Improvements

The primary objective of this potential project is to “design and construct floodway improvements on the lower San Joaquin River and provide conveyance, flood control, and ecosystem benefits” (CALFED ROD). This potential project would construct setback levees in the South Delta Ecological Unit along the San Joaquin River between Mossdale and Stockton, and convert adjacent lands to overflow basins and nontidal wetlands or land designated for agricultural use. The levees are necessary for future urbanization and will be compatible with the Sacramento and San Joaquin River Basins comprehensive study. Progress has been indefinitely delayed with no scheduled date for completion. Nevertheless, if implemented, the potential project may also include the restoration of riparian and riverine aquatic habitat, increased riparian habitat, restrictions of/on dredging and sediment disposal, reduction of invasive plants, and protection and mitigation of effects on threatened or endangered species. This potential project could contribute to ecosystem improvements in the lower San Joaquin River.

Delta Cross Channel Re-operation and Through-Delta Facility

As part of the CALFED ROD, changes in the operation of the DCC and the potential for a Through-Delta Facility (TDF) are being evaluated. Studies are being conducted to determine how changing the operations of the DCC could benefit fish and water quality. This evaluation will help determine whether a screened through-Delta facility is needed to improve fisheries and avoid water quality disruptions. In conjunction with the DCC operations studies, feasibility studies are being conducted to determine the effectiveness of a TDF. The TDF would include a screened diversion on the Sacramento River of up to 4,000 cfs and conveyance of that water into the Delta.

Both a DCC re-operation and a TDF would change the flow patterns and water quality in the Delta, affecting fisheries, ecosystems, and water supply reliability. Further consideration of related actions will take place only after completion of several assessments.

North Delta Flood Control and Ecosystem Restoration Project

The purpose of the North Delta Flood Control and Ecosystem Restoration Project is to implement flood control improvements in the northeast Delta in a manner that benefits aquatic and terrestrial habitats, species, and ecological processes. The North Delta project area includes the North and South Fork Mokelumne Rivers and adjacent channels downstream of I-5 and upstream of the San Joaquin River. Solution components being considered for flood control include bridge replacement, setback levees, dredging, island bypass systems, and island detention systems. The project will include ecosystem restoration and science actions in this area, and improving and enhancing recreation opportunities. In support of the environmental review process, an NOP/NOI was prepared and public scoping was held in 2003. An EIR was prepared in 2008, but the project is not currently funded for implementation.

Clifton Court Forebay–Jones Pumping Plant Intertie

This project would construct an intertie between the CVP and the CCF. It would require an increase in the capacity of the proposed CCF screened intake (see description of 10,300-cfs at Banks, above). This project would provide increased operational flexibility by modifying intake operations to improve the water quality of exports, improving water supply reliability, and minimizing impacts on fish entrainment. This project was included in the CALFED ROD and is therefore analyzed in this cumulative impact assessment.

Old River and Rock Slough Water Quality Improvement Project

CCWD recently completed the Old River and Rock Slough Water Quality Improvement Project (in 2006). This project was designed to minimize salinity and other constituents of concern in drinking water by relocating or reducing agricultural drainage in the south Delta. CCWD intake facilities are located on Rock Slough and Old River, which also receive agricultural drainage water discharged from adjacent agricultural lands. Agricultural drainage water can adversely affect water quality entering the CCWD system.

Bay Area Water Quality and Reliability Program

The Bay Area Water Quality and Reliability Program would encourage participating Bay Area partners, including Alameda County Water District, Alameda County Flood Control & Water Conservation District, Bay Area Water Users Association, Contra Costa Water District, EBMUD, San Francisco, and the Santa Clara Valley Water District (SCVWD), to develop and coordinate regional exchange projects to improve water quality and supply reliability. This project would include the cooperation of these agencies in operating their water supplies for the benefit of the entire Bay Area region as well as the potential construction of interconnects between existing water supplies. This program is in the preliminary planning stages. No specific projects have been proposed and evaluated in detail.

North Bay Aqueduct Intake Project

The North Bay Aqueduct Intake Project would construct a new intake for the North Bay Aqueduct to increase the flow in the aqueduct. It will involve the construction of pipeline corridors and connection points to the existing North Bay Aqueduct. Possible intake points are the Deep Water Ship Channel, Sutter/Elk Slough, Steamboat Slough, Miner Slough, and Main Stem Sacramento River. Environmental analysis is expected to begin in 2009.

San Luis Reservoir Low Point Improvement Project

The San Luis Low Point Improvement Project would use one or a combination of alternatives, including treatment options, bypasses, and other storage options, to reduce the risk of "low point" water levels. High temperatures and factors in San Luis Reservoir create conditions that foster algae growth. The water quality within the algal blooms is not suitable for agricultural water users with drip irrigation systems in San Benito County or for municipal and industrial water users relying on existing water treatment facilities in Santa Clara County. Typically, low point conditions occur when water levels in San Luis Reservoir reach an elevation of 369 feet above mean sea level or approximately 300 taf when the water is approximately 35 feet above the top of the Lower Pacheco Intake. If water levels fall below 369 feet, the San Felipe Division's use of CVP supplies could be limited by algae-related water quality effects. San Luis Reservoir is the only delivery route for the San Felipe Division's CVP supplies authorized under their current CVP Water Service Contracts. Reclamation, working with Santa Clara Valley Water District (SCVWD), is exploring options to address the low point problem.

The alternatives being considered to avoid water quality problems for the SCVWD and to increase the effective storage capacity of the reservoir include, but are not limited to:

- conjunctive use with administrative actions,
- lowering the San Felipe Division intake facilities, and
- expansion of Pacheco Reservoir.

A NOP/NOI to prepare an EIS/EIR was published in August 2008, and the EIS/EIR is expected to be released in 2010. Implementation of this project would provide operational flexibility of the San Luis Reservoir and improve reliability of water deliveries to CVP contractors.

Franks Tract

DWR and Reclamation propose to implement the Franks Tract Project to improve water quality and fisheries conditions in the Delta. DWR and Reclamation are evaluating installing operable gates to control the flow of water at key locations (Threemile Slough and/or West False River) to reduce sea water intrusion, and to positively influence movement of fish species of concern to areas that provide favorable habitat conditions. By protecting fish resources, this project also would improve operational reliability of the SWP and CVP because curtailments in water exports (pumping restrictions) are likely to be less frequent. The overall purpose of the Franks Tract Project is to modify hydrodynamic conditions to protect and improve water quality in the central and south Delta, protect and enhance conditions for fish species of concern in the western and central Delta, and achieve greater operational flexibility for pump operations in the south Delta.

Two-Gates Fish Demonstration Project

The Two-Gates Fish Demonstration Project (Demonstration Project) is an experimental project intended to evaluate the ability to provide temporary protection to delta smelt from entrainment at the CVP and SWP export facilities by controlling water movement in the central Delta channels. It includes constructing, operating, and maintaining “butterfly gates” in Old River and Connection Slough for up to a 5-year period to affect water movement when turbidity and salinity conditions are expected to support migration of delta smelt. Currently, entrainment of delta smelt is managed by controlling negative net flows in Old and Middle Rivers (OMR) within parameters set forth in the CVP/SWP Operations BOs (U.S. Fish and Wildlife Service 2008b; National Marine Fisheries Service 2009a).

The Proposed Action is designed to have the operational flexibility to test hypotheses related to the protection of delta smelt within the current operational constraints. It includes a monitoring component that is intended to evaluate whether operable gates can control water quality factors, such as turbidity and salinity. Monitoring data would be used to guide real-time operation of the gates, verify the model predictions, evaluate effects of the Demonstration Project on delta smelt and other affected aquatic species, and modify operational procedures as needed. Real-time operation of CVP and SWP in conjunction with the Proposed Action is expected to reduce delta smelt entrainment, without adversely impacting other listed species.

Consolidated Place of Use

DWR and Reclamation have obtained approval from State Water Board to consolidate portions of the SWP and CVP places of use in various counties in California for 2 years. These SWP and CVP places of use include the following 35 counties: Trinity, Shasta, Tehama, Glenn, Butte, Colusa, Sutter, Yuba, Yolo, Placer, Sacramento, El Dorado, Solano, Fresno, Tulare, Madera, Kern, Kings, Stanislaus, San Joaquin, Merced, Napa, Contra Costa, Alameda, Santa Clara, San Benito, Madera, San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, San Bernardino, and Riverside.

Consolidation of the SWP and CVP places of use allows DWR and Reclamation to more effectively and efficiently utilize the operational flexibility of the combined SWP and CVP facilities to facilitate water transfers and exchanges and provide water to the combined SWP and CVP service areas to minimize the potential impacts of the current critical water shortage within California.

All transfers or exchanges are conducted in accordance with the following parameters:

- For any transfer of SWP or CVP water through the Delta, DWR and Reclamation will continue to operate the Projects in accordance with the USFWS Operations BO for Delta smelt (U.S. Fish and Wildlife Service 2008);
- Carriage loss will be deducted from any water transferred through the Delta;
- The total quantity of water delivered to SWP or CVP contractors will not exceed historic average deliveries;
- Transfers or exchanges shall not result in the net decrease of San Joaquin River or Sacramento River flow over the 2-year period; and
- Transfers or exchanges shall not result in the net decrease of any Eastside CVP water from the San Joaquin Valley over the 2-year period.

As noted above, this program would not result in an increase of deliveries above average historic deliveries and like all export-related activities would require compliance with applicable regulations including the Operation BOs. Because the Operation BOs include measures which USFWS and NMFS concluded avoid jeopardy to delta smelt and salmon (including export restrictions under some conditions), and because pumping at the Intertie can be reduced or eliminated as a result of export restrictions, the Consolidated Place of Use would not contribute to cumulative impacts.

Drought Water Bank

In response to 3 consecutive dry years, State and Federal contractors participated in the 2009 Drought Water Bank (DWB). To implement the DWB, DWR purchases water from willing sellers upstream of the Delta and the water is conveyed, using SWP or CVP facilities, to water users that are at risk of experiencing water shortages due to drought conditions and that require supplemental water supplies to meet anticipated demands.

Reclamation participates in the DWB pursuant to Section 101 of the Reclamation States Emergency Drought Relief Act of 1991 to ensure that operations of the two projects can be coordinated effectively to maximize the ability of the DWB to move water from willing sellers to buyers to address critical water needs. Reclamation reviews and approves, as appropriate, proposed transfers by CVP contractors in accordance with the Interim Guidelines for the Implementation of Water Transfers under the CVPIA.

Operations of the DWB will continue through February 2010; however, the majority of the transfers have already occurred for 2009 (July–September). A similar program will be implemented in 2010 and is anticipated to begin in March. It is likely that this program would be implemented in subsequent dry years. All of these transfers would be implemented in compliance with applicable regulations, including those required under the Operations BOs. Because the Operations BOs include measures which USFWS and NMFS concluded avoid jeopardy to delta smelt and salmon (including export restrictions under some conditions), and because pumping at the Intertie can be reduced or eliminated as a result of export restrictions, DWB would not contribute to cumulative impacts.

San Luis Unit Long-Term Water Service Contract and other Long-Term CVP Contracts

Reclamation is responsible for operational control of the CVP including operations and maintenance of federal facilities and securing payment for the cost of water delivered pursuant to water service contracts with the federal government. In addition, as a duly authorized representative of the Secretary of the Interior, Reclamation administers all actions pertaining to the establishment of water service contracts. The San Luis Unit Water Service Contract is currently being renegotiated.

The purpose of the renegotiation is to renew long-term water service contracts, delivering CVP water for agricultural irrigation or for M&I uses to the nine service contractors within the San Luis Unit, consistent with Reclamation authority and all applicable state and federal laws, including the CVPIA (H.R. 429, Public Law 102-575). The project alternatives will include the terms and conditions of the long-term contracts and tiered water pricing. The long-term contract renewals are needed to:

- Continue the beneficial use of water in the San Luis Unit.
- Incorporate certain administrative conditions into the renewed contracts to ensure CVP continued compliance with current federal Reclamation law and other applicable statues; and
- Allow the continued reimbursement to the federal government for costs related to CVP construction and operation.
- Satisfy the statutory requirements for renewal of the existing San Luis Unit water services contracts.

The renewal of this contract, continuance of other existing contracts, and future renewals of contracts do not result in cumulative operational impacts beyond what is described for the OCAP when combined with the impacts of the Intertie. The Intertie impacts are a result of changes in export operations, which like water contract deliveries, are governed by the Operations BOs and other biological and water quality restrictions.

CALFED Ecosystem Restoration Program

The goals of the CALFED Ecosystem Restoration Program (ERP) are to:

- recover 19 at-risk native species and contribute to the recovery of 25 additional species;
- rehabilitate natural processes related to hydrology, stream channels, sediment, floodplains and ecosystem water quality;
- maintain and enhance fish populations critical to commercial, sport and recreational fisheries;
- protect and restore functional habitats, including aquatic, upland and riparian, to allow species to thrive;
- reduce the negative impacts of invasive species and prevent additional introductions that compete with and destroy native species; and
- improve and maintain water and sediment quality to better support ecosystem health and allow species to flourish.

The ERP plan, which is divided into the Sacramento, San Joaquin, and Delta and Eastside Tributary regions, includes the following kinds of actions:

- develop and implement habitat management and restoration actions, including restoration of river corridors and floodplains, reconstruction of channel-floodplain interactions, and restoration of Delta aquatic habitats;
- restore habitat that would specifically benefit one or more at-risk species;
- implement fish passage programs and conduct passage studies;
- continue major fish screen projects and conduct studies to improve knowledge of their effects;
- restore geomorphic processes in stream and riparian corridors;
- implement actions to improve understanding of at-risk species;
- develop understanding and technologies to reduce the impacts of irrigation drainage on the San Joaquin River and reduce transport of contaminant (selenium) loads carried by the San Joaquin to the Delta and the Bay; and
- implement actions to prevent, control, and reduce impacts from nonnative invasive species.

ERP actions contribute to cumulative benefits on fish and wildlife species, habitats, and ecological processes.

Suisun Management Plan

Reclamation, USFWS, and DFG are currently NEPA and CEQA lead agencies in the development of a management plan to restore 5,000 to 7,000 acres of tidal wetlands and enhance existing seasonal wetlands in Suisun Marsh. The plan would be implemented over 30 years and is expected to contribute to the recovery of many terrestrial and aquatic species. The EIS/EIR for the plan is expected to be complete in 2009.

CALFED Levees Program

The goal of the CALFED Levees Program is to uniformly improve Delta levees by modifying cross sections, raising levee height, widening levee crown, flattening levee slopes, or constructing stability berms. Estimates predict that there are 520 miles of levees in need of improvement and maintenance to meet the PL 84-99 standard for Delta levees. The levees program continues to implement levee improvements throughout the Delta, including the south Delta area.

Sacramento Valley Water Management Agreement (Phase 8)

The State Water Board has held proceedings regarding the responsibility for meeting the flow-related water quality standards in the Delta established by the Delta WQCP (D-1641). The State Water Board hearings have focused on which users should provide this water, and Phase 8 focuses on the Sacramento Valley users. The Sacramento Valley Water Management Agreement (SVWMA) is an alternative to the State Water Board's Phase 8 proceedings. The SVWMA, entered into by DWR, Reclamation, Sacramento water users, and export water users, provides for a variety of local water management projects that will increase water supplies cumulatively. An environmental document is being prepared for the program.

Bay Delta Conservation Strategy

The Bay Delta Conservation Plan (BDCP) is a plan to provide for the recovery of endangered and sensitive species and their habitats in the Delta in a way that also will provide for the protection and restoration of water supplies. The BDCP will identify and implement conservation strategies to improve the overall ecological health of the Delta; identify and implement ecologically friendly ways to move fresh water through and/or around the Delta; address toxic pollutants, invasive species, and impairments to water quality; and provide a framework and funding to implement the plan over time.

Alternatives being evaluated include conveyance options using through-Delta, peripheral aqueduct, or a combination of both strategies. The restoration options include various degrees of restoration in the Delta and Suisun Marsh. The final plan and the EIS/EIR are expected to be complete in 2010.

State Route 4 Bypass Project

Caltrans is modifying SR 4 in an effort to ease traffic through the cities of Brentwood and Oakley and to provide access to the growing areas of southeast Antioch and western Brentwood. The project is being developed cooperatively by Caltrans, Contra Costa County, and the Cities of Antioch, Brentwood, and Oakley. The highway will be relocated east of Oakley and on the eastern edge of Brentwood. The project is currently under construction.

Mountain House Community

Trimark Communities has started development of a new community in the western portion of San Joaquin County along the Alameda–San Joaquin County line and north of Interstate 205. At full buildout a total of 16,105 residential units on 4,784 acres would be developed. Mountain House is located directly south of Old River and west of Patterson Pass Road, and will include residential, commercial, and some industrial development. It has been designed to accommodate all the needs of the expected 43,522 residents, including housing, jobs, retail, commercial, open space, and public services, such as schools, emergency services, and roads. The EIR was completed in 1994. Construction began in 2003.

River Islands Development

The Cambay Group, Inc. is proposing to develop approximately 4,990 acres of agricultural land and open space known as the River Islands at Lathrop Project. The project applicant intends to build a mixed-use residential/commercial development on Stewart Tract and Paradise Cut. Stewart Tract is an inbound island bounded by Paradise Cut, the San Joaquin River, and Old River. Paradise Cut consists of a flood control bypass connecting the San Joaquin River and Old River in the Delta. This mixed-use development is expected to include a town center, employment center, dock facilities, residences, and golf courses. It is expected to generate 31,680 residents and 16,751 jobs at full buildout. The Draft Subsequent EIR was completed in October of 2002 and buildout of the development is planned for 2025.

East Altamont Energy Center

Calpine Corporation plans to construct an energy center with the intent to market power from hydroelectric plants, such as Shasta and Folsom dams, to other entities, such as merchant power plants. The center would be located on a 174-acre parcel of land approximately 1 mile west of the San Joaquin County line and 1 mile southeast of the Contra Costa County line. The actual footprint of the plant would be approximately 55 acres, with the remainder of the parcel available for agricultural leases. Water for cooling and other power plant processes would be provided by Byron Bethany Irrigation District. The plant is expected to have a 30 to 50 year operating life. Environmental documentation equivalent to an EIS/EIR (Revised Presiding Member's Proposed Decision) was completed in January 2003 and approval from the Energy Commission was granted in August 2003.

San Joaquin River Restoration Program

The SJRRP is a direct result of a Stipulation of Settlement (Settlement) reached in September 2006 after more than 18 years of litigation of the lawsuit challenging the renewal of long-term water service contract between the United States and CVP Friant Division contractors. The Settling Parties include U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council (NRDC), and the Friant Water Users Authority (FWUA). The Settlement received Federal court approval in October 2006. The San Joaquin River Restoration Settlement Act (Act), included in the Omnibus Public Land Management Act of 2009, was signed by the President on March 30, 2009 and became Public Law 111-11. The Act authorizes and directs the Secretary of the Interior to fully implement the Settlement. The Settlement is based on two goals: To restore and maintain fish populations in “good condition” in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish; and to reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement. The program is scheduled to have a draft Programmatic EIS/EIR by late 2009.

Water Facilities Expansion Project

The City of Sacramento is in the process of expanding and replacing facilities at the E. A. Fairbairn Water Treatment Plant (WTP) and the Sacramento River WTP. The purpose of this project is to allow the City to reliably meet increasing water demands and to allow diversions to be shifted from the American River to the Sacramento River. The Fairbairn WTP is being expanded from approximately 90 mgd to 200 mgd. The Sacramento River WTP is being expanded from approximately 110 mgd to 160 mgd. Construction at both plants includes some new facilities as well as improvements to some of the existing facilities. It is expected that the Fairbairn WTP construction will be completed within approximately 32 months, while construction at the Sacramento River WTP is expected to be completed within approximately 34 months. Construction at both facilities may ultimately require up to 164,000 linear feet of transmission pipeline improvements. A final EIR was completed for this project in November of 2000, and construction of the project began in October of 2001.

Other Development Projects

The Cities of Tracy, Byron, and Brentwood, as well as the Town of Discovery Bay, each propose multiple development projects ranging is size and impacts. Developments include new residential and commercial areas and associated infrastructure; updating, expanding, or creating water treatment and delivery systems; and waste management facilities such as landfills and recycling centers. Additionally, it is likely that future conditions will also include additional development beyond what is currently identified.

6.3 Summary of Cumulative Effects by Resource

As described above, the cumulative analysis relies on both quantitative and qualitative methods. The quantitative analysis is based on the 2008 CVP/SWP Longterm Operations Plan and USFWS Operations BO for smelt. In general, this analysis provides the cumulative operational effects for current and near-future projects combined with the Intertie. These operational effects are linked to water supply, hydrodynamics, water quality, and fish. These resources are also evaluated qualitatively because not all future projects were included in the OCAP modeling or have enough detail to model cumulatively.

The discussion of the cumulative water supply changes that could be expected under future with-project conditions is intended to show the potential for improving future water supply reliability and to provide quantified hydrological information that is used to judge cumulative impacts on specific resources, including Delta water quality and fisheries conditions. Therefore, significance conclusions are not disclosed for cumulative water supply changes, but are disclosed for resource impacts that are influenced by water supply changes.

6.3.1 Water Supply

Cumulative water supply impacts are the changes in the environment that result from the incremental impact of the Intertie when added to other closely related past, present, and reasonably foreseeable future projects. The physical impacts in the environment resulting from changes in water supply would be the combination of effects in the reservoirs that store the water supply, in the rivers that convey the water supply, in the Bay-Delta where the water supply is diverted, and in the areas where the water supply is delivered and used.

Combining the cumulative projects that were modeled in the CALSIM simulations for OCAP with other possible storage and conveyance projects, including Shasta Reservoir Enlargement, North-of-Delta Off-Stream Storage, Los Vaqueros Reservoir Expansion, In-Delta Storage, Upper San Joaquin River Basin Storage Investigation, a peripheral canal (under BDCP), Long-Term CVP Contracts, and increases at Banks Pumping Plant permitted capacity (to 10,300 cfs) could result in increased water supplies available for export in those years when water otherwise would have been unavailable for storage and export. Operating one or more of these projects could also result in modification of the timing and magnitude of upstream reservoir releases in wet years. It is assumed that these types of projects could have positive effects on Delta water supply and resources by improving the amount and timing of flow to the Delta, providing flexibility in timing of storage and release of water for exports, and increasing the amount and timing of water used to protect sensitive aquatic species in upstream tributaries and Delta channels.

The Proposed Intertie Action has little potential to contribute to any adverse cumulative impacts (i.e., limits) related to water supply. Implementation of the proposed action would not contribute to any cumulative impacts on water supply restrictions, but is instead intended to improve reliability by increasing operational flexibility at Jones Pumping Plant. Combined with the other projects listed above, it is expected that the overall water supply reliability would improve. The Intertie would result in a small increase in overall water deliveries from the Delta, but it is expected that this water would be supplemental for existing CVP contractors and therefore the area of use for this water would not change. Many of the other projects are intended to create a more reliable supply and/or delivery system through storage or conveyance facilities.

In addition to the various projects listed above, the USFWS Operations BO for delta smelt RPA includes several additional CVP and SWP pumping restrictions (implemented as Old and Middle River reverse flow limits) to protect delta smelt and other fish from entrainment. These new restrictions in the months of January-June are likely to reduce the allowable total pumping by CVP and SWP and increase the need for full capacity pumping in the months of July-December. This will make the Intertie project more valuable for maintaining the maximum possible CVP water supply reliability with the existing south Delta intakes. The cumulative effects of those projects and restrictions may be significant for water supply, but the Intertie's contribution to offset this cumulative loss of water supply is small.

6.3.2 Delta Tidal Hydraulics

Proposed Action pumping will not have any greater effects on south Delta tidal hydraulics than were simulated for the Future No Action. As stated in Section 3.1, the DSM2 simulations compare tidal hydraulic conditions for the No Action and with implementation of the Intertie Proposed Action. As the general simulations of the full range of possible future CVP and SWP pumping has demonstrated, the effects on high and low tide elevations is limited to what has been observed for many years under full summer pumping of about 11,280 cfs maximum pumping (i.e., CVP 4,600 cfs and SWP 6,680 cfs). Although future additional pumping at the Banks Pumping Plant is possible, the tidal hydraulic effects of this additional export pumping on tidal conditions in the south Delta are not increased by the Proposed Action (increased winter CVP pumping from 4,200 cfs to 4,600 cfs). Other projects that change exports, diversions, and outflows may contribute to cumulative effects on tidal hydraulics, but the Intertie does not contribute to these effects. Additionally, the Intertie would be regulated under the new USFWS Operations BO for delta smelt RPA outflow and reverse flow restrictions, further reducing the potential for effects on tidal hydraulics. Therefore, there are no cumulative effects of the Proposed Action on south Delta tidal hydraulics.

6.3.3 Water Quality

Cumulative future water quality impacts in the Delta can result from future changes in river inflow water quality, as well as future conditions of reduced Delta outflow. As described in Section 3.3, Water Quality, there are no substantial changes in water quality as a result of the Proposed Intertie Action. Other projects that may be implemented in the future have the potential to adversely affect water quality, while several others may provide water quality benefits. Other potential future changes in inflow water quality, or increased discharges of treated wastewater, in the Delta are expected, but are independent of the Intertie. In addition, several of the reasonably foreseeable projects could result in improved water quality throughout the system and particularly within the Delta. These projects would generally result in increased flows into the Delta, increased exports from the Delta for water supply purposes, and increased Delta outflows for environmental and water quality (i.e., salinity control) purposes.

There is a limit to the magnitude of the future salinity changes expected in the Delta channels. The D-1641 objectives for maximum EC are routinely satisfied by CVP and SWP operations in the Delta. Delta outflow is therefore already highly regulated, and these minimum required Delta outflows will continue to be maintained in the future. Water quality objectives for salinity at Vernalis are also expected to maintain the future San Joaquin River EC at about the No Action conditions. Some future projects (e.g., recirculation and San Joaquin River restoration) may improve the Vernalis salinity. The Intertie does not make any substantial contribution to these potential cumulative water quality effects in the Bay-Delta.

6.3.4 Fish

The potential cumulative fisheries resource impacts of past, present, and reasonably foreseeable projects (including the Intertie) have been evaluated quantitatively and qualitatively during ESA consultation with USFWS and NMFS for the coordinated operations of the CVP and SWP (OCAP). Not all projects and not all fish species were included in the CVP/SWP Longterm Operations Plan or in the subsequent analyses by USFWS and NMFS. A qualitative evaluation of potential cumulative effects of the Intertie on Delta fish is described below.

Chinook Salmon and Central Valley Steelhead

In the Delta, anticipated effects of CVP and SWP operations (OCAP) include modification of migration and rearing habitat conditions, and increased entrainment of salmonid juveniles and adults. The expected increase in entrainment rates is assumed to be related to potential increases in salmonid diversions into the central Delta through the DCC and Georgiana Slough, altered Delta hydrology, and direct loss of juvenile salmon and steelhead at the CVP and SWP pumping facilities. The Delta effects are reduced by the real-time adjustments in operations of the DCC gates, HORB, and by the use of b(2) water and the EWA to reduce exports during periods of high fish density. Overall cumulative impacts on Chinook salmon and central valley steelhead from operations under OCAP are considered significant. To reduce these impacts to a no-jeopardy level, NMFS has required implementation of mitigation measures (RPA) to reduce impacts of water supply operations.

Other cumulative projects, both upstream and in the Bay-Delta may have similar effects on Chinook and steelhead. However, any future projects will be required to implement guidance for minimum flows, temperature controls, and habitat protection and restoration given by NMFS and DFG to protect Chinook and steelhead in these upstream habitat areas below dams and diversions. The Intertie will not contribute substantially to any future cumulative effects on Chinook or steelhead.

Delta Smelt

Incidental take of delta smelt will occur from operation of the SWP and CVP pumps, SDIP gates, Intertie, and other Delta components of OCAP. This cumulative impact on delta smelt abundance is considered significant. To minimize this effect, Reclamation and DWR will implement the required RPA actions described in the USFWS Operations BO for delta smelt (summarized above).

Implementation of these actions is expected to minimize the cumulative effects of the CVP and SWP Delta operations (including the Intertie) on delta smelt. Other future projects have the potential to contribute to adverse (or beneficial) effects on delta smelt. However, the RPA reductions in CVP and SWP pumping during the period of spawning and juvenile rearing in the Delta (December–June) are assumed to have a beneficial effect on the delta smelt population abundance, and to be adequate to offset the cumulative effects from future upstream storage or diversion projects. The Intertie would have a slightly beneficial effect on adult delta smelt, and the Intertie does not contribute to any substantial cumulative impact on other life stages of delta smelt, because all potential cumulative impacts are assumed to be adequately mitigated by the USFWS Operations BO RPA.

Splittail and Striped Bass

Both of these fish spawn upstream of the Delta and the juveniles migrate through the Delta in the spring and early summer. The Intertie would have only small effects on entrainment of these juvenile fish, which are very abundant during their migrations periods. There may be many other factors contributing to the abundance of these fish besides Delta habitat and migration conditions. Cumulative effects on both of these fish may be significant. However, the Intertie will not contribute substantially to these cumulative effects.

Longfin Smelt and Green Sturgeon

Longfin smelt generally spawns in the freshwater Delta and low salinity zone in Suisun Bay, and rears in Suisun Bay and San Pablo and central San Francisco Bay. Although juvenile longfin smelt are salvaged in April and May of low outflow years, the Intertie effects on entrainment were found to be small (less than 1%). Other potential cumulative effects are assumed to be avoided by the USFWS RPA for the Operations BO for delta smelt. The Intertie will not contribute substantially to the cumulative effects on longfin smelt.

Green sturgeon spawn upstream in the Sacramento River, and their juveniles rear for several months in the riverine habitat. Their migration through the Delta apparently does not expose many juveniles to entrainment, as judged by the low salvage numbers (less than 200 a year). Many other factors potentially influence green sturgeon in the estuary or in the Ocean. The Intertie has been shown to have no substantial effect on green sturgeon entrainment. Because the Delta conditions influence green sturgeon only briefly, during adult and juvenile migration, the Intertie will not contribute substantially to cumulative effects on green sturgeon.

6.3.5 Geology, Seismicity, and Soils

The Intertie, in combination with other local and regional projects, could contribute to regional impacts and hazards associated with geology, seismicity, and soils. The effects of Intertie alternatives are primarily related to localized project impacts or seismic hazards in the vicinity of proposed project features. These impacts include the potential for structural damage as a result of liquefaction, ground shaking, development on expansive soils; and slope instability, erosion, and sedimentation during construction. All of the impacts are mitigated by incorporating standard construction and structural measures into project design and construction. No impacts related to operation of the Intertie were identified for this resource area.

Cumulative impacts would result from construction activities and development in the same regional area as the Intertie that may be subject to geologic, seismic, or soil erosion damage and could be reduced by implementing measures similar to those described for Intertie, such as a SWPPP and compliance with the Alameda County General Ordinance Code. Although these combined impacts could be cumulatively significant, implementing the measures identified for the Intertie in Section 3.4 would reduce the Intertie's contribution to these cumulative impacts.

6.3.6 Transportation, Air Quality, Climate Change, and Noise

Implementation of Intertie alternatives, with other projects occurring at the same time in the same vicinity, have the potential to create short-term cumulative impacts on transportation, air quality, and noise caused by increased movement and use of construction vehicles and equipment, especially in the area south of I-580. No major developments or projects are known to be planned in this area, but Mountain House and River Islands developments, as well as the East Altamont Power Facility, may be under construction during the time Intertie is implemented, resulting in significant cumulative impacts associated with temporary and permanent reductions in levels of service on existing roads and exceedance of air and noise thresholds from these major developments. Additionally, Alternative 4 has the potential to make a considerable contribution of GHG emissions to the global climate change effects if power for Banks Pumping does not use CVP hydroelectric power or the temporary pipeline uses non-electric pumps. However, Alternatives 2 and 3 would rely solely on hydroelectric CVP power for operation and construction-related emissions would be minimal. Other projects in the area would also make considerable contributions to climate change effects.

Alternatives 2 and 3 would result in very minor changes in air emissions and noise due to operation of the pumps, and mitigation would further reduce effects. When Alternative 4 is constructed, there would be an increase of air, noise, and traffic impacts associated with construction activities. Noise from operation of the temporary pumps under Alternative 4 has the potential to contribute to a substantial adverse cumulative effect because noise from the pumps is predicted to exceed applicable Alameda County noise ordinance standards. However, implementation of Mitigation Measure NZ-MM-2 would eliminate the noise contribution from operation of pumps under Alternative 4 to any substantial cumulative adverse noise effect. Air quality effects from these pumps would be governed by the permit regulations in the county so that they could not exceed the threshold for emissions. None of the Intertie alternatives would have a substantial contribution to transportation effects during operations. Other projects in the area would add approximately 70,000 people to the area, requiring the use of existing and planned roads.

Although these combined impacts could be significant, the Intertie's contribution is minimal and implementing the measures identified for the Intertie in Sections 3.5 through 3.7 would ensure that the Intertie's contribution to these cumulative impacts is minimal.

6.3.7 Vegetation and Wildlife

Many of the projects listed above would result in impacts on vegetation and wildlife resources. However, most of the projects are not located near the Intertie alternatives and habitats are not contiguous. Local development projects and other projects that could affect ruderal grasslands and agricultural lands or habitats for red-legged frog, California tiger salamander, Swainson's hawk, San Joaquin kit fox, American badger, or Western burrowing owl, combined with the Intertie, would result in significant cumulative effects. However, the Intertie will result in only a minor loss of these habitat types, especially compared to other projects in the region. Additionally, implementing the measures identified for the Intertie in Sections 4.2 and 4.3 would ensure that Intertie's contribution to these cumulative impacts is minimal, and there would be no significant cumulative effect.

6.3.8 Utilities, Public Services, and Energy

Implementation of Intertie alternatives in combination with other projects in the same area as the Intertie have the potential to result in cumulative effects related to utilities, public services, and energy. Alternatives 2 and 3 would require new aboveground utility lines and a permanent increase of energy, although this energy would be just 1% of the total energy generated by CVP power facilities. Alternative 4 would require a similar increase in CVP power use and an infrequent minor increase in power related to construction and operation of the temporary intertie. Thus, Intertie impacts on power production and energy are considered minimal and are not discussed further as cumulative impacts even though other development projects would increase the demand for power production and energy. Cumulative impacts associated with conflicts with utilities lines are considered minor because standard construction practices would be required to identify and relocate utility lines for all local projects. Construction and operation of Intertie alternatives would also not contribute to significant cumulative impacts on local public services because of the localized nature of project construction, the rural area in which the project would be constructed, and the short construction timeframe.

6.3.9 Socioeconomics

The Intertie would result in minor and temporary increases in employment and personal income and demand for housing. The Intertie would only contribute a small and unsubstantial amount to these changes, which would occur only over a 15-month period. As such, the Intertie does not have contribute to a significant cumulative effect.

6.3.10 Visual Resources

Clearing, excavating, and grading activities associated with construction of approved and planned development in the surrounding area could result in adverse short-term changes to views. Planned development also could alter the visual character of the area in the long term and affect the area's visual amenities, including open space and views of the nearby foothills and surrounding agricultural lands. Future development, roadway construction and improvements, and other associated projects also could incrementally add to ambient atmospheric lighting. Implementation of Mitigation Measures VIS-MM-1 (apply minimum lighting standards), VIS-MM-2 (construct facilities and infrastructure with low-sheen and non-reflective surface materials), and VIS-MM-3 (limit construction to daylight hours near residents) would reduce the project's incremental impact on visual resources.

6.3.11 Cultural Resources

With implementation of the identified measures, the Proposed Action would avoid adverse effects on historic properties and would not directly or indirectly destroy a unique paleontological resource or unique geologic feature or cause unauthorized disturbance of any human remains. No impacts on cultural resources (including historic properties and human remains) would result from implementation of the Proposed Action that would contribute to a significant cumulative impact on cultural resources.

6.3.12 Public Health and Environmental Hazards

Implementation of the Intertie in combination with other water supply projects (as presented above) and other local and regional projects could contribute to potential public health impacts and environmental hazards. As described in Section 5.5, the effect of the Intertie alternatives is related to a temporary increase in risk to people from use of hazardous materials during construction and operation, and the potential risk of disturbance to the overhead powerlines during construction. The potential cumulative impacts associated with potential changes in public health and environmental hazards is considered minor because construction-related hazards would be temporary, the implementation of the Safety Plan reduces the likelihood of an effect, and public health effects from exposure to hazardous materials would be reduced by standard construction and public health measures during the construction period. There would be no significant cumulative effect.

6.3.13 Land Use

The Proposed Action includes only a minor conversion of grassland and the operation of the Intertie is consistent and compatible with existing surrounding land uses. As such, the project does not contribute to any significant cumulative impacts.

Chapter 7 Growth-Inducing Impacts

7.1 Introduction

NEPA requires that an EIS discuss how a project, if implemented, could induce growth. This chapter analyzes the potential growth-inducing impacts of Alternatives 2, 3, and 4 and includes:

- a summary of the conclusions of the analysis,
- background information related to water supply and growth-inducement,
- the methodology used to analyze growth-inducing impacts,
- the results of the analysis, and
- the impact conclusions.

7.2 Summary of Analysis Conclusions

Each Intertie alternative could remove an obstacle to growth and could encourage or facilitate other activities that could result in environmental effects. The direct effects of the project, through the stimulation of the local economy by project construction, are not expected to accommodate or induce growth. However, the indirect effects of the project, resulting from increases in water supplies for those receiving water exported from the Delta, could accommodate additional growth. This growth could result in impacts on special-status species, changes in stormwater runoff quantity and quality, the modification of slopes, and impacts on air and water quality, traffic, noise, various public services, and other sensitive resources. Mitigation of these impacts, should they occur, would be the responsibility of the local jurisdictions in which the growth would occur. The impacts of this growth, if any, would be analyzed either in General Plan EIRs for the local jurisdictions or in project-level CEQA compliance documents. Mitigation measures could include locating the growth in areas where sensitive resources are not located, minimizing the loss of these resources, or replacing any loss.

Each of the alternatives have a similar potential for growth-related impacts because they would all result in similar increases in south-of-Delta water deliveries. The following supporting material provides a more detailed evaluation on which these general conclusions are based.

7.3 Context and Background

The information contained in this section is needed to provide context to the analysis and to help the reader understand the structure of the analysis. This background information includes:

- the legal requirements for analyzing growth-inducing impacts in NEPA documents;
- the guidance provided by the CALFED ROD regarding growth-inducing impacts;
- a brief description of Senate Bill (SB) 610 and SB 221 of 2001, which address the relationship between water supply and land use planning; and
- a summary of growth projections for south of Delta counties receiving CVP water.

7.3.1 NEPA Requirements

Under authority of NEPA, CEQ Regulations require EISs to consider the potential indirect impacts of a proposed action. The indirect effects of an action are those that occur later in time or farther away in distance, but are still reasonably foreseeable, and "may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate" (40 CFR Section 1508.8[b]).

Evaluation of the growth-inducing effects of the Intertie is based on a qualitative analysis of the direct effects of constructing and operating the Intertie, and the indirect effects that could result from use of the additional increment of water supply provided by the Intertie in the CVP contractor service areas. The evaluation of growth effects is based on water supply analyses that conclude that the water supply reliability for CVP contractors would incrementally improve with implementation of the Intertie. Specifically, this evaluation of potential growth-inducing impacts addresses whether the project would directly or indirectly: foster economic, population, or housing growth; remove obstacles to growth; increase population growth that would tax community service facilities; or encourage or facilitate other activities that cause significant environmental effects.

7.3.2 Guidance in the CALFED Programmatic Record of Decision

The Intertie is considered a CALFED project because it is specifically included in the CALFED ROD. For background, therefore, it is useful to understand what conclusions were included in the CALFED ROD regarding the relationship between increased water supply and growth. The following text is excerpted from CALFED ROD, Attachment 1—CEQA Requirements, CEQA Findings of Fact (August 28, 2000); the full text is incorporated by reference. It is important to note, however, that the Intertie EIS stands on its own and does not rely on the analysis contained in the CALFED Programmatic EIS/EIR. It includes an independently developed analysis of the impacts of the Intertie, including the analysis of growth-inducing impacts.

> The Preferred Program Alternative is expected to result in an improvement in water supply reliability for beneficial use in the Bay Region, Sacramento River

Region, and San Joaquin River Region, and South-of-Delta SWP and CVP Service Areas…. Modifications in Delta conveyance will result in improved water supply reliability, protection and improvement of Delta water quality, improvements in ecosystem health, and reduced risk of supply disruption due to catastrophic breaching of Delta levees.

Consistent with the stated purposes of the CALFED Program since its outset in 1995, it is not the intent of this Program to address or solve all of the water supply problems in California. The CALFED Program is directly or indirectly tied to a number of specific project proposals that would help toward meeting California's water needs for a wide variety of beneficial uses. CALFED is an important piece of a much larger picture that is the continuing responsibility of local, regional, State and Federal jurisdictions.

There are differences of opinion as to whether improvements in water supply reliability would stimulate growth. The causal link between the CALFED Program and any increase in population or economic growth, or the construction of additional housing is speculative at this time. However, because this issue cannot be determined with certainty at this programmatic level of analysis, the assumption was made for this document that the improvement in water supply reliability that is associated with the Program could stimulate growth. This assumption assures that the EIS/EIR discloses the environmental consequences, at a programmatic level, associated with growth in the event that Program actions ultimately lead to this type of change.

At this programmatic level, it is unknown what level of growth or the likely location of any increases in population or construction of additional housing would take place. Increases in the population in the solution area are projected over the next 30 years, regardless of CALFED actions. When population growth occurs, it could lead to additional adverse impacts in certain locations, which local, regional, State, and Federal agencies will need to address when more information on those impacts and how to mitigate them is known. These impacts could include impacts on water quality and air quality, transportation, loss of open space, and other resource areas addressed in the EIS/EIR.

When additional growth occurs, these changes will be subject to local land use and regulatory decisions by individual cities and counties in the areas where they occur. Future development at the local level is guided by many considerations, only one of which is the reliability of water supply. These other factors include the policies in local general plans and zoning ordinance restrictions; the availability of a wide range of community services and infrastructure, such as sewage treatment facilities and transportation infrastructure; the availability of developable land; the types and availability of employment opportunities; and the analysis and conclusions based on an environmental review of proposed projects pursuant to CEQA. When additional population growth or new development occurs, and additional information is available, local, regional, State, and Federal governments will need to consider and address these potential adverse environmental impacts and methods to avoid or mitigate them.

7.3.3 Relationship to Senate Bill 610 and Senate Bill 221, 2001

Land use planning agencies in California plan growth based on a number of different factors, many unrelated to available water supplies, including economic factors and population dynamics. Also, according to California law, water suppliers are required to serve the needs of users within their service areas (see, e.g., *Swanson v. Marin Municipal Water Dist.* (1976) 56 Cal.App.3d 512, 524 [water district has a "continuing obligation to exert every reasonable effort to augment its available water supply in order to meet increasing demands"]).

The coordination between water supply and land use planning was strengthened in 2001 by the passage of SB 610 and SB 221, which require cities and counties to obtain assessments of the availability of water to supply new developments over a certain size and to obtain assurance from water suppliers that sufficient water is available before approving these new developments. The combined effect of SB 610 and SB 221 is to impose upon cities and counties the ultimate responsibility for determining the sufficiency and availability of water as part of their environmental review and approval processes. In addition, a recent court case (*Save Our Peninsula Committee v. Monterey County Board of Supervisors* [2001] 87 Cal.App.4th 99) discussed how water supply sufficiency and the impacts of the proposed project on limited local supply sources were the key factors in deciding the adequacy of an EIR. Water supply availability in this instance was also clearly a determining factor in whether development was allowable.

SB 610 and 221 require only that water supply agencies inform land use jurisdictions regarding the availability of water supplies, type of infrastructure necessary to deliver the water, and impact of new development on supply reliability. SB 610 allows local land use agencies to approve development despite a water agency's conclusion that the supplier's reliability levels would be compromised. Specifically, a water supplier could report to the local land use agency that water supplies are insufficient and development could still proceed, should the land use authority decide to procure alternate supplies or, in the case of SB 610, adopt a statement of overriding considerations with respect to significant water supply impacts. Further, while SB 610 and SB 221 do attempt to increase the consideration of water supply factors in development decision-making, many proposed projects are not of a large enough scale to trigger the requirement to prepare a water supply assessment pursuant to SB 610 (500 or more residences, nonresidential uses that would supply more than 1,000 persons, or mixed-use projects that would have a water demand equivalent to the demand of 500 residential units).

7.3.4 Growth Projections

There is no doubt that California is expected to experience substantial growth over the next several decades. Numerous state, regional, and local agencies prepare estimates of growth to assist in planning for the effects of that growth, including the need for water supply, additional housing, roads and bridges, sewerage infrastructure, schools, hospitals, and police and fire services and to mitigate the projected negative impacts. Table 7-1 shows the population growth between 2000 and 2050 (in 10-year increments) projected by the California Department of Finance for all counties south of the Delta that could receive additional water as a result of the Intertie (i.e., counties that currently receive water from south-of-Delta CVP facilities).

Table 7-1. South-of-the-Delta Population Forecast for Counties Receiving CVP Water

County	2000	2010	2020	2030	2040	2050
Alameda	1,453,078	1,550,133	1,663,481	1,791,721	1,923,505	2,047,658
Contra Costa	956,497	1,075,931	1,237,544	1,422,840	1,609,257	1,812,242
Fresno	804,508	983,478	1,201,792	1,429,228	1,670,542	1,928,411
Kern	665,519	871,728	1,086,113	1,352,627	1,707,239	2,106,024
Kings	130,202	164,535	205,707	250,516	299,770	352,750
Madera	124,696	162,114	212,874	273,456	344,455	413,569
Merced	211,481	273,935	348,690	439,905	541,161	652,355
San Benito	53,927	64,230	83,792	103,340	123,406	145,570
San Joaquin	569,083	741,417	965,094	1,205,198	1,477,473	1,783,973
Santa Clara	1,693,128	1,837,361	1,992,805	2,192,501	2,412,411	2,624,670
Stanislaus	451,190	559,708	699,144	857,893	1,014,365	1,191,344

Source: California Department of Finance 2007.

7.4 Methods Used

The growth-inducing impact of each Intertie alternative was evaluated by comparing the total amount of current deliveries to CVP contractors to the estimated changes in deliveries for each alternative.

Implementing the Intertie could result in growth through three mechanisms. Growth could occur in the vicinity of the project site in Alameda or San Joaquin counties as a result of the economic activity generated by construction of the Intertie facilities. Two types of operations-related impacts could occur: effects resulting from changes in agricultural land and water use patterns because of increased CVP water deliveries; and growth in urban areas resulting from increases in CVP water deliveries. Each of these three mechanisms is described below.

7.4.1 Construction-Related Effects

Assessing the growth-inducing impacts of the construction-related effects is relatively straightforward. As the construction-related effects of the Intertie are within the control of Reclamation, the level of analysis can be fairly detailed. The assessment of construction-related effects involves analyzing whether the relative magnitude of temporary and permanent jobs that would be created by the project would be large enough to require additional housing, or otherwise spur economic growth in the area surrounding the project, and determining whether that growth would have environmental impacts.

The construction of the Intertie would cause a temporary increase in employment in the project area. Construction would last up to 15 months, and it is assumed that approximately 60% of the workers would originate from the local study area. The increase in population created by construction workers and their dependents may need to be accommodated from available local housing. It is assumed that there would be approximately three persons per family. The total number of jobs created and the number of housing units needed to accommodate the workers were compared to the total population in the project area.

7.4.2 Effects Resulting from Changes in Agricultural Land and Water Use because of Increased Central Valley Project and State Water Project Deliveries

The assessment of agricultural effects involves determining whether any fallowed lands could be brought into production as a result of implementing the Intertie, and whether farming those lands would have environmental impacts. Such impacts would occur if this additional water would result in land and water use changes that had environmental effects. For instance, impacts could occur if agricultural lands that had previously lain fallow for several years and had become habitat for sensitive species were put back into production as a result of the water made available by Intertie alternatives.

Hydrologic modeling results were used to estimate increases in allocations to CVP agricultural water contractors resulting from the increased pumping rates associated with each alternative. Table 7-2 shows the increases in CVP allocations, for each water year type and averaged over the 82-year study period. Table 7-3 shows projected changes in deliveries to various groups of CVP contractors, derived from CALSIM II results. Tables 3.1-12 to 3.1-14 in Section 3.1, Water Supply and Delta Water Management, give the actual CVP deliveries for calendar years 2005, 2006, and 2007. Although there are some variations from year to year, the general allocation of CVP deliveries is identified. The exchange contractors received an average of 750 taf for these three years. The wildlife refuges' water supply allocations are determined from general water supply conditions each year and are unlikely to receive more deliveries from the Intertie. The refuge deliveries were about 330 taf for 2005 and 2006, and declined to 290 taf in 2007, which had a reduced CVP allocation because of limited supply. The municipal contractors have a higher allocation priority, and so are unlikely to receive additional water supply from the Intertie. Most of the Intertie increase in water supply is assumed to go to the agricultural contractors, according to their total contract amounts. Because Westlands Water District has the largest contract at 1,150 taf, they likely will receive the bulk of the Intertie increases (60%). Westlands water is used predominantly for agriculture, but there may be job-related opportunities for growth associated with a slightly increased supply. If all the Intertie water went to Westlands, this would increase their average delivery (i.e., reliability) by only about 3% of their total contract amount.

CALSIM modeling aggregates deliveries to each type of water use, so it was possible to compare where the additional water supply provided by the Intertie was delivered. CALSIM assumes that canal and reservoir evaporation losses were about 185 taf/yr for the No Action and the Intertie. The maximum assumed refuge deliveries were 280 taf, with an average of 273 taf/yr delivered for the No Action and the Intertie. The exchange contractors deliveries were a maximum of 875 taf/yr, with an average of 853 taf/yr delivered for the No Action and the Intertie. The maximum M&I deliveries were 148 taf/yr, the average No Action M&I deliveries were 125 taf/yr, and the average Intertie M&I deliveries were 127 taf/yr. The maximum agricultural deliveries were 1,835 taf/yr, the average No action agricultural deliveries were 1,060 taf/yr, and the average Intertie agricultural deliveries were 1,089 taf/yr. About 60% of this Intertie-generated increased water supply would go to Westlands Water District, according to their contract amount.

Table 7-2. Comparison of Average Changes to CVP Deliveries Resulting from Implementing the Intertie Alternatives by Water Year Type (taf)

Water Year Type (1922–1994)	Future No Action	Alt 2	Alt 3	Alt 4	Change under Alt 2	Change under Alt 3	Change under Alt 4
Wet	2,968	2,999	2,999	2,992	31	31	24
Above normal	2,760	2,810	2,810	2,798	50	50	38
Below normal	2,601	2,658	2,658	2,645	57	57	44
Dry	2,313	2,334	2,334	2,329	21	21	16
Critically dry	1,636	1,657	1,657	1,652	21	21	16
82-year average	2,536	2,571	2,571	2,563	35	35	27

Table 7-3. Estimated Changes in Average CVP Deliveries Occurring under Alternatives 2, 3, and 4 (taf)

Beneficiary	Contractor Type	Alt 2	Alt 3	Alt 4
Westlands Water District	Agricultural Service	20	20	17
San Luis Water District	Agricultural Service	3	3	2
Panoche Water District	Agricultural Service	3	3	2
Other	Agricultural Service	7	7	4
Santa Clara Valley Water District	Municipal and Industrial	2	2	2
City of Tracy	Municipal and Industrial	0	0	0
San Benito County Water District	Municipal and Industrial	0	0	0
Kern-Tulare Irrigation District	Cross Valley Canal	0	0	0
Lower Tule River Irrigation District	Cross Valley Canal	0	0	0
Pixley Irrigation District	Cross Valley Canal	0	0	0
Other	Cross Valley Canal	0	0	0
Grasslands Water District	Refuge	0	0	0
San Luis National Wildlife Refuge	Refuge	0	0	0
Mendota Wildlife Management Area	Refuge	0	0	0
Exchange Contractors	Mendota Pool Exchange	0	0	0
Total		**35**	**35**	**27**

7.4.3 Effects Resulting from Changes in Urban Land Use because of Increased Central Valley Project and State Water Project Deliveries

Making a connection between changes in the availability of water for urban uses resulting from implementing the Intertie and changes in growth patterns in particular jurisdictions (and the environmental impacts of that growth) is rather speculative.

While the allocations of any additional water made available by the Intertie to CVP contractors can be known, several of the CVP urban water contractors are water wholesalers who make independent decisions about which local jurisdictions or next-level wholesalers in their service area would receive additional water. Furthermore, these wholesalers may make allocations that vary over time depending on available supplies and shifting demands among retailers. Thus it is not possible to know where additional supplies from the export pumps ultimately would be delivered.

Further uncertainty is created by these factors:

- Some contractors such as the Santa Clara Valley Water District have multiple sources of water that provide varying amounts of water over time or with varying reliability, making it difficult to determine whether an increment of additional CVP water would remove a barrier to growth or rather be put to use offsetting existing groundwater pumping or other surface water supplies.
- Most of the CVP contractors provide water primarily for agricultural uses, but it is possible that under certain conditions, water could be transferred to M&I users.
- Some local jurisdictions have sufficient supplies to serve all projected growth in their general plans, so additional supplies would not induce or accommodate additional growth.
- Growth in some jurisdictions may be limited by water supplies but also may be constrained by other factors, such as the availability of land, utilities (such as sewer service and electrical service), transportation facilities, schools, wastewater treatment facilities, or local growth management ordinances. These other factors may continue to limit growth, even if water supply reliability increases.
- Jurisdictions where growth is limited by water supply can attempt to obtain water from new sources if additional water is not provided through this project.
- Some retailers and jurisdictions have the ability to store water during years when supplies are plentiful and hold it over to be used in years when supplies are scarce. This makes it more difficult to assess the growth-related effects of additional supplies for local jurisdictions.
- Local jurisdictions, not water suppliers, have control over land use decisions, both how much and where growth will occur. It would be extremely difficult to determine specific lands that would be developed as a result of the additional increment of water provided by the Intertie, and what resources would be affected by that additional growth.

In areas that rely on the CVP and in which growth is limited by water supplies, providing additional water could lead to additional growth.

In summary, it would be remote and speculative to identify specific pieces of land that would be developed and specific resource impacts that would occur as a result of implementing the Intertie alternatives, and NEPA does not require such an analysis if it is too remotely connected to the proposed project alternatives or too speculative. However, it is possible to describe, in general terms, the amount of additional water that could be provided to each CVP contractor as a result of operational changes stemming from implementing the Intertie (as shown in Table 7-3) and to roughly calculate the maximum amount of new development that could be supported from the water provided to urban suppliers.

Therefore, the analysis of these effects is focused on assessing the additional CVP supplies for M&I users that may result from implementing Intertie alternatives and a general discussion of the total amount of growth that could occur and the types of effects that could result from that amount of additional growth.

7.4.4 Determining How Much Additional Water May Result from the Intertie and the Associated Urban Growth

Hydrologic modeling results were used to estimate increases in deliveries to CVP contractors for each alternative. The CALSIM II results compared deliveries under No Action for all water year types for all Intertie alternatives. The maximum increase in deliveries was used to estimate the maximum land use changes, although it is assumed that not all of the increase in deliveries attributable to the Intertie would be applied to growth-related land use changes. This represents the most conservative estimate of growth effects, and Reclamation acknowledges that these effects are remote given that not all of the additional water would be applied to growth. Only a portion, if any, of this growth likely would occur as a result of Intertie alternatives.

7.5 Results

7.5.1 Construction-Related Effects

Over the duration of Intertie construction, up to approximately 74 jobs would be created directly under Alternatives 2 and 3, and 27 jobs would be created under Alternative 4. This increase in employment is not expected to cause the population in the project area to increase. Currently there are approximately 782,196 housing units in the two-county area; therefore, the increase in demand for housing attributable to the proposed project alternatives would be minimal and would be met by existing supplies.

Because the population in the project area is approximately 2.3 million, the increase in population under each alternative would not be expected to cause housing or other economic development and, therefore, would not result in the project being considered growth-inducing as a result of construction.

7.5.2 Effects Resulting from Changes in Agricultural Land and Water Use because of Increased Central Valley Project Deliveries

Currently the CVP delivers approximately 7.0 maf per year to 253 contractors. Table 7-2 indicates that CVP deliveries under Alternatives 2, 3, and 4 would increase on average approximately 35 taf, 35 taf, and 27 taf, respectively. The greatest increase in deliveries would be to Westlands Water District (Table 7-3) because it has the largest south-of-Delta CVP contract.

As the Intertie would result in an increase in water supply and water supply reliability, it is assumed that it has the potential to remove an obstacle to growth, and therefore is growth-inducing. The incremental increase in water supply is likely to be used primarily for agricultural land, but because this water could be transferred to M&I users and some CVP contractors supply water for M&I uses, the Intertie could be growth-inducing. The maximum amount of growth that could be attributed to the Intertie is based on the full amount of additional water expected to be derived from the Intertie. However, it is expected that any land uses changes resulting from the Intertie would be much less than this because:

- water would be delivered to the same service areas and places of use as it has been historically;
- water would be used to compensate for recent reductions of historical deliveries/supplies to CVP contractors;
- water would be delivered in the same manner, physically identical, to past CVP deliveries;
- there would be no change in the contract amounts of CVP contractors;
- there are other sources of water available to some water districts; and
- the largest amount of water being made available is less than a 1% increase over the approximate 7-maf CVP deliveries on average.

7.5.3 Effects Resulting from Changes in Urban Land Use because of Increased Central Valley Project Deliveries

Alternative 2

Table 7-3 shows that only a minor increase (35 taf) in CVP M&I deliveries is expected to result from Intertie alternatives.

Based on an average per capita consumption of 0.2 acre-feet per person per year, the additional 35 taf of water as a result of constructing and operating the Intertie could support approximately 175,000 additional people and their employment. This estimate assumes that all of the additional water would be used by M&I and for new development. It is not known, however, how much, if any, of this additional water would be allocated to new development. Therefore, this represents the maximum possible increase resulting from Alternative 2.

Alternative 3

Alternative 3 would result in the same increase in water supply as Alternative 2. Therefore, it could result in growth associated with 175,000 additional people and their employment. This estimate assumes that all of the additional water would be used by M&I and for new development. It is not known, however, how much, if any, of this additional water would be allocated to new development. Therefore, this represents the maximum possible increase resulting from Alternative 3.

Alternative 4

Alternative 4 would result in an average increase in water supply of 27 taf. As such, it could result in growth associated with 135,000 additional people and their employment, although this is the maximum amount of growth and it is not certain that any of this water would be allocated to new development.

7.6 Impact Conclusions

Each alternative could remove an obstacle to growth. Although the effects of the project through the cultivation of once-fallowed agricultural lands or through the stimulation of the local economy by project construction are not expected to accommodate or induce growth, the increase in water supplies for those receiving water exported from the Delta could accommodate additional growth. This growth could result in the conversion of agricultural and other open land to urban uses that may adversely affect agricultural and biological resources (including special-status species and other sensitive resources) at those locations subject to such conversion. In addition, this conversion could lead to changes in stormwater runoff quantity and quality, and impacts on cultural resources. Increases in population could lead to impacts on air and water quality, traffic and noise conditions, and increases in the demand for such public services as schools, fire, police, sewer, solid waste disposal, and electrical and gas utilities. In addition, the expansion of such services could result in additional adverse impacts. Local jurisdictions could impose feasible mitigation measures on development that would reduce or eliminate these impacts, but as the location of any new growth cannot reasonably be predicted, estimating the potential for this would also be remote and speculative.

It would be extremely speculative to identify specific areas where growth could occur or the indirect effects on specific community service facilities in a particular service area. Overall, a small potential exists that implementation of the Intertie could have some effect on growth and community facilities in service areas identified in Table 7-3, but these effects, if they occur, likely would be extremely small, especially compared to other social and economic variables that can influence growth and services.

Mitigation of these impacts, should they occur, would be the responsibility of the local jurisdictions in which the growth would occur, not Reclamation. The impacts of this growth, if any, would be (and in some cases have been) analyzed either in general plan EIRs for the local jurisdictions or in project-level CEQA compliance documents. Mitigation measures could include locating the growth in areas where sensitive resources are absent, minimizing the loss of these resources, or replacing any loss.

7.7 Comparison of Alternatives

The analysis above addressed the growth-inducing impacts of each alternative. Table 7-2 provides a comparison of the changes in average CVP water deliveries by water year type for Alternatives 2, 3, and 4.

Because each of the alternatives achieves the same general increase in water supply, they all have a similar potential for growth, with Alternatives 2 and 3 being slightly higher than Alternative 4. The location and extent of the impacts of any growth induced by each alternative cannot be known at this time. Growth-related effects would be the responsibility of local jurisdictions to identify and mitigate. However, little or no actual growth is expected to occur as a result of Intertie alternatives.

Chapter 8 List of Preparers

8.1 Introduction

Following is a list of persons who contributed to preparation of this EIS. This list is consistent with the requirements set forth in NEPA (Section 15129 of the State CEQA Guidelines).

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