Appendix A

Distribution List

Final
Program Environmental Impact Statement/Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM

Final
July 2012

Distribution List

This appendix provides a list of those Federal, State, and local agencies, as well as U.S. members of Congress, members of the California Legislature, Indian Tribes, libraries, count boards of supervisors, organizations (including businesses), and individuals that have been identified to receive a copy of this Final PEIS/R. The document is available for viewing on the SJRRP public Web site at *www.restoresjr.net*.

Federal Agencies

Bureau of Indian Affairs

Bureau of Land Management, San Joaquin River Gorge

Department of the Interior Office of Environmental Policy and Compliance

Environmental Protection Agency, Environmental Review Office

Environmental Protection Agency, Region 9, CED-2, Com. & Ecosystem Division

Environmental Protection Agency, WTR-3

Federal Emergency Management Agency, Region IX

National Marine Fisheries Service

National Park Service, Pacific West Region

Natural Resource Conservation Service

U.S. Army Corps of Engineers

U.S. Army Corps of Engineers Regulatory Program

U.S. Army Corps of Engineers, Sacramento District

U.S. Coast Guard

U.S. Coast Guard, Division of Boating Safety

U.S. Department of Agriculture Forest Service

U.S. Department of Agriculture Forest Service, Sierra National Forest

U.S. Fish & Wildlife Service

U.S. Fish & Wildlife Service, Central Valley Joint Venture

U.S. Fish & Wildlife Service, Merced and San Luis National Wildlife Refuges

U.S. Geological Survey, California Water Science Center

United States Congress

U.S. Representative Dennis Cardoza (18th District)

U.S. Representative Jim Costa (20th District)

U.S. Representative Jeff Denham (19th District)

U.S. Representative Sam Farr (17th District)

U.S. Representative Kevin McCarthy (22nd District)

U.S. Representative Jim McNerney (11th District)

U.S. Representative Devin Nunes (21st District)

U.S. Senator Barbara Boxer

U.S. Senator Dianne Feinstein

State Agencies

California Air Resources Board

California Business, Transportation, and Housing Agency

California Coastal Commission

California Department of Boating and Waterways

California Department of Conservation

California Department of Fish and Game

California Department of Food and Agriculture

California Department of Forestry and Fire Protection

California Department of Parks and Recreation

California Department of Toxic Substances Control

California Department of Transportation, District 10

California Department of Transportation, District 6

California Emergency Management Agency

California Environmental Protection Agency

California Fish and Game Commission

California Highway Patrol

California Natural Resources Agency

California Office of Historic Preservation

California State Lands Commission

California State University, Stanislaus

Central Valley Flood Protection Board

Central Valley Regional Water Quality Control Board

Delta Protection Commission

Delta Stewardship Council

Native American Heritage Commission

San Joaquin River Conservancy

State Clearinghouse

State Water Resources Control Board

University of California, Water Resources Center Archives

California Legislature

California State Senate, 14th District. Tom Berryhill

California State Senate, 12th District. Anthony Cannella

California State Assembly, 34th District. Connie Conway

California State Assembly, 17th District. Cathleen Galgiana

California State Assembly, 29th District. Linda Halderman

California State Assembly, 6th District. Jared Huffman

California State Assembly, 31st District. Henry Perea

California State Senate, 16th District. Michael Rubio

California State Assembly, 30th District. David Valadao

Tribes

American Indian Council of Mariposa County

American Indian Movement

Big Sandy Rancheria

Buena Vista Rancheria

Central Valley Miwok Tribe

Chicken Ranch Rancheria

Choinumni Tribe

Cold Springs Rancheria

Dumna Tribal Government

Ione Band of Miwok Indians

Jackson Rancheria

Kern Valley Indian Council

North Fork Rancheria

Picayne Rancheria of Chukchansi Indians

Southern Sierra Miwok Nation

Table Mountain Rancheria

Tachi Yokut Tribe

Traditional Choinumni Tribe

Tule River Tribe

Tuolumne Rancheria

United Auburn Indian Community of the Auburn Rancheria

Libraries

Fresno Central Branch Library

Los Banos Public Library

Sacramento Public Library

Visalia Branch Library

Willows Public Library

Yolo County Library

Yolo County Library, Davis Branch

Local Agencies

Alameda County Planning Department

Alameda County Water District

Aliso Water District

Alpaugh Irrigation District

Anderson-Cottonwood Irrigation District

Arvin-Edison Water Storage District

Atwell Island Water District

Banta-Carbona Irrigation District

Bella Vista Water District

Broadview Water District

Butte Slough Irrigation Company

Byron-Bethany Irrigation District

Carter Mutual Water District

Cawelo Water District

Centinella Water District

Central California Irrigation District

Central Delta Water Agency

Central San Joaquin Water Conservation District

Central Valley Project Water Association

Chowchilla Water District

City of Avenal

City of Coalinga

City of Dos Palos

City of Firebaugh

City of Folsom

City of Fresno

City of Huron

City of Lindsay

City of Los Banos

City of Madera

City of Mendota

City of Merced

City of Merced, Planning Department

City of Orange Cove

City of Redding

City of Roseville

City of Sacramento

City of Tracy

Clay Water District

Columbia Canal Company

Colusa County

Colusa County Water District

Colusa Drain Mutual Water Company

Consolidated Irrigation District

Contra Costa Water District

Corcoran Irrigation District

Corning Water District

Cortina Water District

Davis Water District

Deer Creek and Tule River Authority

Del Puerto Water District

Delano-Earlimart Irrigation District

Dos Palos Joint Powers Authority

Dunnigan Water District

Eagle Field Irrigation District

East Bay Municipal Utility District

East Contra Costa Irrigation District

Eastside Mutual Water District

El Camino Irrigation District

El Dorado County Water Agency

El Dorado Irrigation District

Exeter Irrigation District

Farmers Water District

Feather Water District

Firebaugh Canal Water District

Foresthill Public Utility District

Fresno County Clerk/Register of Voters

Fresno County Department of Public Works and Planning

Fresno County Economic Opportunities Commission

Fresno County Farm Bureau

Fresno County Office of Education

Fresno Irrigation District

Fresno Metropolitan Flood Control District

Fresno Sheriff's Department

Friant Water Authority

Friant Water Users Authority

Garfield Water District

Glenn-Colusa Irrigation District

Grassland Water District

Gravelly Ford Water District

Henry Miller Reclamation District #2131

International Water District

Ivanhoe Irrigation District

James Irrigation District

Kaweah Delta Water Conservation District

Kern County Water Agency

Kern-Tulare Water District

Kings County Administrative Office

Kings River Conservation District

Kings River Water Association

Laguna Water District

Lewis Creek Water District

Lindmore Irrigation District

Lindsay-Strathmore Irrigation District

Los Banos Wildlife Management Area

Lower San Joaquin Levee District

Lower Tule River Irrigation District

Madera City Council

Madera County Agricultural Commissioner’s Office

Madera County Clerk’s Office

Madera County Farm Bureau

Madera County Planning Department

Madera County Resource Management District

Madera County Sheriff's Department

Madera Irrigation District

Maxwell Irrigation District

Merced County Clerk’s Office

Merced County Farm Bureau

Merced County Sheriff's Department

Mercy Springs Water District

Meridian Farms Water Company

Metropolitan Water District

Mid-Valley Water Authority

Mid-Valley Water District

Modesto Irrigation District

Myers-March Mutual Water Company

Natomas Central Mutual Water Company

Natural Resources Defense Council

North Delta Water Agency

North San Joaquin Water Conservation District

Northern California Power Agency

Oakdale Irrigation District

Omochumne-Hartnell Water District

Orange Cove Irrigation District

Orland-Artois Water District

Oro Loma Water District

Pacheco Water District

Pajaro Valley Water Management Agency

Panoche Water District

Patterson Irrigation District

Pelger Mutual Water Company

Pixley Irrigation District

Placer County Water Agency

Pleasant Grove-Verona Mutual Water Company

Pleasant Valley Water District

Porterville Irrigation District

Princeton-Codora-Glenn Irrigation District

Proberta Water District

Provident Irrigation District

Reclamation District No. 108

Reclamation District No. 770

Reclamation District No. 830

Reclamation District No. 1004

Reclamation District No. 1606

Regional Water Authority

Roberts Ditch Irrigation Company

Root Creek Water District

Rosedale-Rio Bravo Water Storage District

Sacramento Area Flood Control Agency

Sacramento County Public Works, Planning Department

Sacramento County Water Agency

Sacramento Groundwater Agency

Sacramento Municipal Utility District

Sacramento River Water Contractors Authority

Sacramento Suburban Water District

San Benito County Water District

San Joaquin County Flood Control and Water Conservation District

San Joaquin County Planning Department

San Joaquin Valley Air Pollution Control District

San Juan Water District

San Luis & Delta-Mendota Water Authority

San Luis Canal Company

San Luis Water District

Santa Clara Valley Water District

Santa Nella County Water District

Saucelito Irrigation District

Semitropic Water Storage District

Shafter-Wasco Irrigation District

Shasta County Water Agency

South Delta Water Agency

Southern San Joaquin Municipal Utility District

Stanislaus County

Stanislaus County Environmental Review Committee

Stockton East Water District

Stone Corral Irrigation District

Stony Creek Water District

Sutter Mutual Water Company

Sutter-Extension Water District

Swinford Tract Irrigation District

Tea Pot Dome Water District

Tehama-Colusa Canal Authority

Terra Bella Irrigation District

The West Side Irrigation District

Thomes Creek Water District

Tisdale Irrigation & Drainage Company

Tranquility Irrigation District

Tranquility Public Utility District

Tri-Valley Water District

Tulare County

Tulare County Planning and Development

Tulare Irrigation District

Tuolumne Utilities District

Turlock Irrigation District

Turner Island Water District

Union Public Utility District

West Stanislaus Irrigation District

Westlands Water District

Westside Water District

Widren Water District

Willow Creek Mutual Water Company

Woodbridge Irrigation District

County Boards of Supervisors

Alameda County Board of Supervisors

Contra Costa County Board of Supervisors

Fresno County Board of Supervisors

Kern County Board of Supervisors

Kings County Board of Supervisors

Madera County Board of Supervisors

Mariposa County Board of Supervisors

Merced County Board of Supervisors

Sacramento County Board of Supervisors

San Joaquin County Board of Supervisors

Stanislaus County Board of Supervisors

Tulare County Board of Supervisors

Organizations and Businesses

120 Duck Club

Agricultural Council of California

AquAlliance

Association of California Water Agencies

Barger Farms

Bowles Farming Company

Bownick Partnership

California Association of Resource Conservation Districts

California Audubon Society

California Bass Federation

California Farm Bureau Federation

California Farm Water Coalition

California Native Plant Society

California Sportfishing Protection Alliance

California State Counties Association

California State Water Contractors

California Striped Bass Association

California Valley Land Company, Inc.

California Water Impact Network

California Waterfowl Association

CalTrout

Cardella Family Limited Partnership

Coalition for Urban/Rural Environmental Stewardship

D&D Pombo LLC

Deer Creek Watershed Conservancy

Ducks Unlimited

Environmental Defense Fund

Forbes, Yore and McGinn Corporation

Fresno Fly Fishers for Conservation

Friends of the San Joaquin

Great Valley Center

James Maiorino and Annette Maiorino Trust

Kings River Conservancy

Mill Creek Conservancy

Millerton Area Watershed Coalition

Millerton Lake Area Chamber of Commerce

Pacific Coast Federation of Fishermen's Associations and Institute for Fisheries Research

Pacific Gas and Electric, Technical and Ecological Services

Planning and Conservation League

PRBO Conservation Science

Revive the San Joaquin

River Partners

River Tree Volunteers

San Joaquin River Association

San Joaquin River Exchange Contractors Water Authority

San Joaquin River Parkway and Conservation Trust

San Joaquin River Parkway and Conservation Trust

San Joaquin River Resources Management Coalition

San Joaquin Tributary Association

Sierra and Foothills Citizen Alliance

The Bay Institute

The Nature Conservancy

The Water Agency, Inc.

Traditional Mono Basket

Tree Fresno

TreeTOPS

Turner Island Farms

Upper San Joaquin Stewardship Council

Water Education Foundation

Water Quality Improvement SPA

Individuals

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Ms. Jolie-Anne Ainsley

Mr. Johnny Andrews

Mr. James Areias

Mr. Barry Baker

Mr. Barry H. Bauer

Mr. Thomas M. Berliner

Mr. and Mrs. Shane and Becky Burkhart

Mr. Daniel Burns

Ms. Carolyn Butts

Mr. James Cameron

Ms. Cecilia Cardoza

Mr. Mike Case

Mr. Roy Catania

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Mr. Shawn Coburn

Mr. Joe Coelho, Coelho Family Trust and River Ranch LLC

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Mr. Tom Ehrich

Mr. Steve Emmert

Mr. Steve Fausone, Redfern Ranches

Mr. Douglas Federighi, Castle Duck Club

Mr. Dennis Fox

Mr. Robert Frusetta

Mr. Don Gragnani

Mr. John Gragnani

Mr. Mark Grossi

Mr. Lawrence and Richard Harman

Mr. Steve Haugen

Ms. Laura Heckman and Family

Mr. Nelson W. Howell

Mr. Paul Hunger

Mr. Richie Iest, Iest Family Farms and Accommodators, Inc.

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Mr. Thomas Keene

Mr. Robert Kelly

Mr. Ray Knight

Mr. and Mrs. Reno and Suzanna Lanfranco

Mr. G. Fred Lee and Anne Jones-Lee

Mr. Alex Lehman

Mr. Jessi Limas, Sr.

Mr. Bowman Looney

Mr. James Lopes

Mr. John M. Lotkowski

Main Stone Corporation Inc.

Mr. Brian Maiorino

Mr. John Mancebo and Ms. Becky Mancebo

Mr. Gary Martin, Pikalok Farming

Ms. Mari Martin, Locke Ranch and Pikalok Farming

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Mr. Tony Mellilo

Menefee River Ranch Co.

Mr. Edward Merlic

Ms. Patricia Miller

Mr. Patrick Miller

Mr. Louis Moosios

Mr. Jim Morehead and Ms. Betty Morehead

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Mr. Ken Schroeder

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Mr. Mike Stearns

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Mr. Tom Teixeira

Mr. Rob Tull

Mr. and Mrs. Michael and Wendy Vander Dussen

Mr. Darrell Vincent

Mr. Robert Waldron

Mr. Bill Ward, BB Limited

Mr. Peter Weber

Mr. Dennis Westcot

Mr. Mike Widhalm

Ms. Wendy Willis and Mr. Michael Willis

Appendix B

Central Valley Steelhead (*Oncorhynchus mykiss*) Monitoring Plan for the San Joaquin River Restoration Program

Final
Program Environmental Impact Statement/Report

Reclamation is currently implementing the attached Central Valley Steelhead (*Oncorhynchus mykiss*) Monitoring Plan for the San Joaquin River Restoration Program *in coordination with National Marine Fisheries Service as part of the Water Year 2012 Interim Flows Program. Reclamation would continue to implement and adapt the attached plan, in coordination with National Marine Fisheries Service, until sufficient habitat and channel improvements to support salmonids are complete.*

Central Valley Steelhead (*Oncorhynchus mykiss*) Monitoring Plan for the San Joaquin River Restoration Program

Statement of Need:

Spring interim flows occurring from February 1 to June 1 could attract adult steelhead into the restoration area. Attracted steelhead would not have access to appropriate spawning habitat due to a number of impassable barriers. Bureau of Reclamation (Reclamation) in coordination with the Fisheries Management Work Group has proposed a Steelhead Monitoring Plan to facilitate detection of steelhead on the San Joaquin River (SJR) upstream of the Merced River confluence and transport to suitable habitats downstream of the mouth of the Merced River.

Fall interim flows occurring from October 1 to December 1 could also attract adult steelhead into the restoration area if the interim flows are higher than the flows in the SJR tributaries. However, during fall interim flows, the Hills Ferry Barrier (HFB) is in place just upstream of the confluence with the Merced River and ongoing fish monitoring occurs at HFB. Steelhead that reach the HFB could be detected and potentially trapped. In the fall of 2010, a trap was installed by the California Department of Fish and Game (CDFG) and operated by Reclamation, Denver Technical Service Center to assess the barrier's effectiveness. Some fall-run Chinook salmon were able to pass the barrier during the 2010 interim flow period, so the effectiveness of HFB is in question (Portz et al. 2011). No steelhead were detected, however bar spacing on the trap could allow steelhead that are smaller and slimmer than salmon to escape.

Background:

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit challenging the renewal of long-term water service contracts between the United States and the Central Valley Project Friant Division Long-Term Contractors. After more than 18 years of litigation of this lawsuit, known as NRDC, et al. v Kirk Rodgers, et al., a Settlement was reached. On September 13, 2006, the Settling Parties, including NRDC, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement, which was subsequently approved by the U.S. Eastern District Court of California on October 23, 2006. The Settlement establishes two primary goals: (1) Restoration Goal – To restore and maintain fish populations in "good condition" in the mainstem 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 (2) Water Management Goal – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement. These goals will require developing a fisheries management plan that implements an adaptive management approach that includes professional environmental review, review of structural modifications and designs, and technical support to provide the best quality data to define problems, prioritize actions, and increase the confidence in future decisions.

The potential routes for migratory fish such as the Central Valley (CV) steelhead (Oncorhynchus mykiss) are believed to have been historically abundant in the SJR. Although little detailed information on steelhead distribution and abundance is available (Lindley et al. 2006, McEwan

2001), they are mostly distributed higher in watersheds with large river systems than Chinook salmon (Oncorhynchus tshawytscha; Voight and Gale 1998, as cited in McEwan 2001). Therefore, steelhead may have spawned at least as far upstream as the natural barrier located at the present-day site of Mammoth Pool and the upper reaches of SJR tributaries. Modeling of potential steelhead habitat by Lindley et al. (2006) suggests that apportion of the upper SJR basin historically supported an independent steelhead population. However, much of the habitat downstream from this population's modeled distribution may have been unsuitable for rearing because of high summer water temperatures (Lindley et al. 2006). Lindley et al. (2006) concluded that suitable steelhead habitat existed historically in all major SJR tributaries, although to a lesser degree than in stream systems in the Cascades, Coast Range, and Northern Sierra Nevada. Additionally, steelhead are historically documented in the Tuolumne and Kings river systems (McEwan 2001).

Steelhead abundance and distribution in the SJR basin have substantially decreased (McEwan 2001), and steelhead have been extirpated from the restoration area due to the construction of Friant Dam. Based on their review of factors contributing to steelhead declines in the Central Valley, McEwan and Jackson (1996) concluded that basin-wide population declines were related to water development and flow management that resulted in habitat loss. Dams have blocked access to historical spawning and rearing habitat upstream, forcing steelhead to spawn and rear in the lower portion of the rivers where water temperatures are often high enough to be lethal (Yoshiyama et al. 1996, McEwan 2001, Lindley et al. 2006). However, steelhead continue to persist in low numbers in the Stanislaus, Tuolumne, and Merced river systems (McEwan 2001, Zimmerman et al. 2008). CV steelhead distinct population segment includes tributaries to the SJR that drain the western slopes of the Sierra Nevada Mountains (i.e., Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla, Fresno, upper San Joaquin, Kings, Kaweah, and Kern rivers, and Caliente Creek; NMFS 2009). However, CV steelhead are currently extirpated from all waters upstream of the Merced-San Joaquin river confluence (Eilers et al. 2010).

Monitoring of CV steelhead populations in the SJR and its tributaries is especially challenging due to extremely low abundance of fish. CV steelhead populations are depressed to the point where monitoring opportunities are limited because sample sizes are too low to use statistical analyses (Eilers et al. 2010), and depressed to the point that even determination of presence is difficult.

Study Site:

The Restoration Area for the San Joaquin River Restoration Program (SJRRP) includes the SJR between Friant Dam and it's confluence with the Merced River. For this study, the monitoring will be from Sack Dam to the confluence of the Merced River. Sack Dam will be the upstream extent because it is impassable in low water year types.

Five sampling methods have been developed for this proposed adult steelhead monitoring plan.

Sampling Method 1: Raft Mounted Electroshocker

Electrofishing is a common method used in monitoring steelhead population (e.g., Mill and Deer creeks, and Feather, American, Mokelumne, Stanislaus, and Merced rivers). One potential drawback for using electrofishing in rivers involves the difficulty in obtaining permits due to the possibility of injuring fish in anadromous salmonid waters (Eilers 2008). However, electrofishing effectiveness and safety have improved over time (Bonar et al. 2009). Design specifications to reduce injury to fish, and a comprehensive review of electrofishing literature can be found in Snyder (2003). Sampling frequency will be monthly from December through March of the following year. Capture of the same fish multiple times is be anticipated, thus monthly sampling is important to ensure fish recovery from stress between capture. Raft mounted electroshockers will be used in order to navigate through shallow waters of the sampling locations (i.e., Mud Slough, Salt Slough, Newman Wasteway, Eastside Bypass, Mariposa Bypass, Sand Slough Control Structure, and base of Sack Dam). Electrofishing methods would refer to the NMFS guidelines for sampling waters with anadromous fish. However, the guidelines are for backpack electrofishing, but researchers are not precluded from using other techniques or equipments as long as NMFS are given substantial proof that proposed techniques or equipments are necessary for the study and that listed species are safeguarded (NMFS 2000). Additional permitting is necessary under this method.

This option has a high potential to be successfully implemented during 2012 spring interim flows. The significant constraints to this method are permitting and access to appropriate sampling locations.

Sampling Method 2: Fyke nets with wing walls and fish traps

Migrating adult steelhead are difficult to monitor using techniques commonly used (e.g., carcass surveys, snorkel surveys, redd counts) to assess salmon populations due to their unique life-history traits. Steelhead, unlike salmon, may not die after spawning. Therefore, carcasses may not be available for a mark-recapture survey. In addition, steelhead migrate and spawn during the late-fall, winter, and spring months when rivers have periods of pulse flows (e.g., VAMP), high flows (e.g., flood releases), and turbid water conditions. A fyke net with wing walls and traps is the proposed sampling method to overcome difficulty of monitoring adult steelhead.

Fyke nets have long been used to capture migrating fish to monitor their yearly changes and abundances. This net tends to be the most useful in capturing fish that follow the shorelines at different times of the day during fish migration season. These nets are constructed of 3.7-cm mesh formed over a 1.5 m x 0.5 m rectangular lead hoop with 0.95 cm diameter solid round stock and three 1.5-m diameter hoops. The traps contain two 5 m long throats with 15 or 25 cm diameter throats, and have a zipper for easy fish removal. Wings will be 1.8 m deep and 48.8 m long. A buoy will be affixed with a 10-m length of rope. Nets will be held in place with 22-kg anchors and will be deployed in sampling locations (i.e., upstream of the confluence of the Merced River, the mouths of Mud, Slough, Salt Slough, Newman Wasteway, and existing structure at Sack Dam). This proposed technique will be implemented once the HFB is removed around mid-December and will remain deployed at the sampling locations until March 15. The traps will be checked daily so the likelihood of fish being physically injured is low. Adult steelhead that get captured will be sampled, tagged, and released. Data from this trap will give an actual count of steelhead abundance migrating in the upper reaches of the SJR.

Fyke nets will be used in lieu fyke traps for several reasons: fyke nets are relatively inexpensive and easy to install, are not a boat passage impediment (can be pushed down in the water column for boat passage), easily replaced if damaged, easy to transport, and no permitting required to transport. Although, CDFG wire fyke trap can catch fish in high flows, it will require a crane to remove the trap out of water under increased hydraulic pressure and in the event that the trap becomes silted.

Sampling Method 3: Steelhead specific trammel nets

Trammel nets are most common as stationary gear to block off channels with low velocities or no flows. However, they can also be used to drift in short durations (e.g., 20 min) on high velocity water. A short duration drifting of trammel net is necessary to prevent fish from being entangled for a long period of time. Trammel nets are advantageous and relatively efficient in turbid waters. This net consist of three parallel vertical layers of netting, the inner net has a very small mesh size, while the outer nets have mesh size large enough for fish pass. The larger and smaller mesh size nets form a pocket when fish try to swim through. Similar to seine nets, trammel nets are equipped with floats attached to the head rope and lead weights along the ground rope. For safety reasons, brightly colored floats will be used to attach to the head rope so boaters and other recreationists can avoid entangling themselves, their boats, and/or their fishing gears with the nets while floated. To ensure safety of steelhead, fisheries biologists tending the nets follow at a close distance to observe, reduce risk of entanglement, and retrieve nets in short time intervals. Sampling time will depend on the number of fish and bycatch caught at each location.

Sampling will begin during adult steelhead migration (mid-December until mid-March) on a number of habitats on the SJR where steelhead may be present. Additional permitting is necessary under this method.

Fish Handling and Relocation

For all sampling methods listed above, captured adult CV steelhead will be subject to standard handling and transporting procedures. Captured steelhead will be recorded, measured (i.e., fork length and total length), sexed (if possible), sampled for scales and tissues, and checked for injuries and presence of tags. Additionally, fish will be Floy tagged with a unique identification number to document any recaptures that may occur in the study area.

Captured steelhead would be transported downstream of the mouth of the Merced River in transport tanks following proposed transport protocols. The transport tanks will be immediately filled with river water prior to transport using a portable screened water pump. Captured steelhead will be moved in and out of the transport truck using a water-filled vessel to help minimize stress and loss of slime. Oxygen gas will be supplied to the transport tanks using compress oxygen gas cylinders and micro-bubble diffusers to maintain dissolved oxygen levels at near saturation during transport. Transport water will be supplemented with sodium chloride to decrease ionic gradient as another way to minimize stress. The truck will be stopped after 30 minutes of transportation and each hour thereafter for visual inspection of the life-support system and fish wellbeing. Water will be tempered to the receiving water at the predetermined release location before transferring fish, by pumping receiving water directly into the transport tank until the temperature reaches that of the release water.

Contacts

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Appendix C

CVP/SWP Long-Term Operations Sensitivity Analyses

Final
Program Environmental Impact Statement/Report

SAN JOAQUIN RIVER
RESTORATION PROGRAM

Final
July 2012

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Attachments

Tables

Figures

List of Abbreviations and Acronyms

BMP	Best Management Practice
BO	Biological Opinion
CCWD	Contra Costa Water District
CD	compact disc
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CO_{2e}	carbon dioxide equivalent
CVP	Central Valley Project
CVPM	Central Valley Planning Model
CWA	Clean Water Act
D-1641	Decision 1641
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DMC	Delta Mendota Canal
DO	Dissolved Oxygen
DSM2	Delta Simulation Model 2
EO	Executive Order
GHG	greenhouse gas
I/O	as input/output
IMPLAN	IMPact Analysis for PLANning
ITA	Indian Trust Asset
LSZ	low salinity zone
msl	mean sea level
mt	metric ton
NMFS	National Marine Fisheries Service
NO_X	nitrogen
OMR	Old and Middle River
PEIS/R	Program Environmental Impact Statement/Environmental Impact Report
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter with an aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 micrometers or less

Reclamation	U.S. Department of the Interior, Bureau of Reclamation
ROG	reactive organic gas
RPA	reasonable and prudent alternative
SJVAPCD	San Joaquin Valley Air Pollution Control District
SWP	State Water Project
SWRCB	State Water Resource Control Board
TAC	toxic air contaminant
TAF	thousand acre-feet
USFWS	U.S. Fish and Wildlife Service
VAMP	Vernalis Adaptive Management Program
Water Level Response Plan	*Response Plan for Water Level Concerns in the South Delta Under Water Rights Decision 1641*

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Chapter 1.0 Introduction

This appendix evaluates the sensitivity of environmental effects presented in the Draft Program Environmental Impact Statement/Environmental Impact Report (PEIS/R) to potential changes in Central Valley Project (CVP) and State Water Project (SWP) operations. Specifically, the sensitivity analyses presented in this appendix evaluate the action alternatives under a range of potential implementations of the reasonable and prudent alternatives (RPA) presented in the U.S. Fish and Wildlife Service's (USFWS) 2008 Biological Opinion (BO) on the Coordinated Operations of the CVP and SWP (2008 USFWS CVP/SWP Operations BO) and the National Marine Fisheries Service's (NMFS) 2009 Final Biological and Conference Opinion on the Long-Term Operations of the CVP and SWP (2009 NMFS CVP/SWP Operations BO).

The sensitivity analyses results demonstrate that the overall impact mechanisms and significance determinations presented in the Draft PEIS/R would not change under a baseline that includes the RPAs set forth in the 2008 USFWS CVP/SWP Operations BO and 2009 NMFS CVP/SWP Operations BO. The sensitivity analyses do not add significant new information to the PEIS/R because 1) there are no new significant impacts that were not disclosed in the Draft PEIS/R, 2) there are no substantial increases in the severity of any environmental impact disclosed in the Draft PEIS/R, and 3) there are no feasible project alternatives or mitigation measures that would clearly lessen environmental impacts available because of the sensitivity analysis. The new information added to the PEIS/R through this sensitivity analysis merely clarifies, amplifies, and makes insignificant modifications to the analysis contained in the Draft PEIS/R. The sensitivity analyses also provide information in response to several commenters regarding the 2008 USFWS CVP/SWP Operations BO and 2009 NMFS CVP/SWP Operations BO. As the sensitivity analyses show, there are no changes necessary to the impact methodologies, impact conclusions, and mitigation contained in the Draft PEIS/R. The sensitivity analyses merely provide additional analyses to evaluate the potential for the RPAs to change the anticipated effects of the action alternatives from those presented in the Draft PEIS/R, and to address commenter questions regarding potential differences in results by using the two different sets of operational conditions.

1.1 Purpose of the Sensitivity Analyses

The analyses presented in the Draft PEIS/R were based, in part, on a water supply operations modeling tool, CalSim-II. The CalSim-II simulations conducted in support of the Draft PEIS/R were performed in advance of the release of the 2008 USFWS CVP/SWP Operations BO and 2009 NMFS CVP/SWP Operations BO. These BOs contain a number of RPAs that have the potential to significantly impact both CVP and SWP project operations and operations of other, non-CVP or non-SWP facilities. Currently, the U.S. Department of the Interior, Bureau of Reclamation (Reclamation) and NMFS have not agreed upon an appropriate representation of the full set of RPAs in the

CalSim-II model. Reclamation and NMFS continue to discuss the implementation of the RPAs into a singular CalSim-II baseline, but no final baseline has been established. For informational purposes, sensitivity analyses were performed to represent a comprehensive range of RPA implementations. The purpose of the sensitivity analysis is to evaluate the potential for the RPAs to change the anticipated effects of the action alternatives from those presented in the Draft PEIS/R. The analysis is not designed to identify the potential impacts of the RPAs, and no comparisons were made between simulations with and without the RPAs.

1.2 Overview of Methodology

The methodology used for the sensitivity analyses included the following parameters: the portions of the study area included in the sensitivity analyses included the San Joaquin River from the Merced River to the Sacramento-San Joaquin Delta (Delta), the Delta, and CVP/SWP water service areas, including the Friant Division of the CVP; the level of development was set at 2005 for modeling purposes; and existing conditions, Alternative A1, and Alternative A2 were evaluated. Each of these parameters is described below. The methodology used for these analyses is described in further detail in Chapter 3.0, "Tools and Methodology."

1.2.1 Study Area

As described in Chapter 3.0 of the Draft PEIS/R, "Considerations for Describing the Affected Environment and Environmental Consequences," the study area was broadly defined to evaluate potential direct, indirect, and cumulative effects within five geographic areas:

- San Joaquin River upstream from Friant Dam, including Millerton Lake
- San Joaquin River from Friant Dam to the Merced River confluence (Restoration Area, which includes Reaches 1 through 5 and the flood bypasses, as shown in Figure 1-2)
- San Joaquin River from the Merced River to the Delta
- Delta
- CVP/SWP water service areas, including the Friant Division of the CVP

Impacts related to construction or occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. Therefore, this appendix evaluates the potential for changes in impacts within the following three geographic areas:

- San Joaquin River from the Merced River to the Delta
- Delta
- CVP/SWP water service areas, including the Friant Division of the CVP

1.2.2 Level of Development

Analyses presented in the Draft PEIS/R generally included results at two levels of development. In the Draft PEIS/R, the existing conditions are simulated using a 2005 level of development, while potential future conditions are simulated using a 2030 level of development. Parameters used in the 2005 level of development are a depiction of the current environment. The 2030 level of development was also presented in the Draft PEIS/R to explore how the system may perform under an assumed future set of physical and institutional circumstances. This future setting was developed by assuming 2030 level of development, land use, facilities, and operational objectives.

The 2005 level of development alone is analyzed in this appendix because it provides sufficient disclosure of the potential for the anticipated effects of the program alternatives to change from those presented in the Draft PEIS/R. The 2030 level of development is not analyzed in this appendix to avoid compounding the uncertainties inherent in the future level of development and in the potential implementation of the RPAs.

1.2.3 Alternatives Evaluated

The sensitivity analyses were performed at the existing level of development (2005) for the existing conditions and Alternatives A1 and A2. As described in the Draft PEIS/R, the action alternatives differ in two ways. The first is the way water is recaptured (Delta only or Delta plus existing San Joaquin River diversions without or with new pumping infrastructure below the Merced River). The second is the amount of flow that is routed through Reach 4B1 (at least 475 cubic feet per second (cfs) or at least 4,500 cfs).

The way water is recaptured (Delta only or Delta plus existing San Joaquin River diversions without or with new pumping infrastructure below the Merced River) differentiates Alternatives A1 and A2 from B1 and B2, and from C1 and C2. The RPAs influence the quantity and timing of water recapture under each alternative. Alternatives A1 and A2 represent the maximum potential change in Delta conditions under all action alternatives, including maximum potential changes in flow along the San Joaquin River between the Merced River and the Delta and Delta inflows and pumping, and would therefore have the greatest potential for change under the RPAs.

The amount of flow that is routed through Reach 4B1 (at least 475 cfs or at least 4,500 cfs) differentiates Alternatives A1, B1, and C1 from Alternatives A2, B2, and C2. The RPAs would have no effect on this flow routing. Therefore, the results of the sensitivity analyses capture the potential effects of both Alternatives A1 and A2.

As previously mentioned, the purpose of the sensitivity analysis is to evaluate the potential for the RPAs to change the anticipated effects of the action alternatives from those presented in the Draft PEIS/R. To meet this goal, a new baseline (existing conditions with the RPAs in place), and new alternatives (Alternatives A1 and A2 also with the RPAs in place), were compared to determine the effects of the action alternatives with the RPAs in place. These effects are then compared to the effects of the action alternatives without the RPAs in place, as presented in the Draft PEIS/R, to determine whether there is potential for the RPAs to change the anticipated effects of the action alternatives from those presented in the Draft PEIS/R.

1.3 Organization of this Appendix

This appendix is organized as shown below.

- **Chapter 1.0, "Introduction,"** describes the purpose of the sensitivity analyses, provides an overview of the methodology applied in the analyses, explains which portions of the study area are considered in the sensitivity analyses, and summarizes the organization of the appendix.

- **Chapter 2.0, "Summary of Results,"** summarizes the results of these analyses for each resource topic.

- **Chapter 3.0, "Tools and Methodology,"** describes the tools and methodology used for this analysis, and key differences between this analysis and that documented in the Draft PEIS/R.

- **Chapters 4.0** through **25.0** present the results of the sensitivity analyses for each of 22 resource topics, and discuss the potential changes in the level of significance determinations presented in the Draft PEIS/R. The order, numbering, and titles of these chapters parallel the order, numbering, and titles of the resource-specific chapters in the Draft PEIS/R (such that Chapter 4.0 is titled "Air Quality" in both the Draft PEIS/R and in this appendix, and so on through Chapter 25.0, "Visual Resources").

- **Chapter 26.0, "Cumulative Impacts,"** discusses the potential for cumulative impacts to differ from those presented in the Draft PEIS/R.

- **Chapter 27.0, "References,"** provides a bibliography of sources cited throughout this appendix.

- **Attachments** contain background information that supports this appendix, including modeling output in the form of DSS files, provided on compact discs (CD).

Chapter 2.0 Summary of Results

The results of these sensitivity analyses are presented in Table 2-1 by resource topic. This table parallels the summary of impacts presented in the executive summary of the Draft PEIS/R, as modified by Chapter 4.0, “Errata,” of this Final PEIS/R, to facilitate comparison.

Results of the sensitivity analyses pertaining to environmental justice and cumulative impacts are presented in Table 2-2 and Table 2-3, respectively. These tables parallel Table 9-10, presented in Chapter 9.0 of the Draft PEIS/R, “Environmental Justice,” and Table ES-9, presented in the executive summary of the Draft PEIS/R, as modified by Chapter 4.0, “Errata,” of this Final PEIS/R, respectively, to facilitate comparison.

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Air Quality: Program-Level						
AIR-1: Construction-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	PS	AIR-1: Prepare Project-Level Quantitative Analysis of Construction-Related Emissions and Implement Measures to Minimize Emissions	PSU	No[1]	No[1]
AIR-2: Operations-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-3: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-4: Exposure of Sensitive Receptors to Odor Emissions	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
Air Quality: Project-Level						
AIR-5: Construction-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
AIR-6: Operations-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Air Quality: Project-Level (contd.)						
AIR-7: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-8: Exposure of Sensitive Receptors to Odor Emissions	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Biological Resources – Fisheries: Program-Level						
FSH-1: Changes in Water Temperatures in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-2: Changes in Pollutant Discharge in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-3: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Program-Level (contd.)						
FSH-4: Construction-Related Changes in Habitat Conditions in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-5: Displacement from Preferred or Required Habitat, Injury, or Mortality in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-6: Changes in Habitat Conditions in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-7: Changes in Diversions and Entrainment in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-8: Changes in Predation Levels in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Program-Level (contd.)						
FSH-9: Changes in Food Web Support in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-10: Effects to Fall-Run Chinook Salmon from Hybridization Resulting from Reintroduction of Spring-Run Chinook Salmon to the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-11: Effects of Disease on Fisheries in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-12: Changes in Diversions and Entrainment in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
FSH-13: Changes in Water Temperatures in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Program-Level (contd.)						
FSH-14: Displacement from Preferred or Required Habitat, Injury, or Mortality in the San Joaquin River Between Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
Biological Resources – Fisheries: Project-Level						
FSH-15: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Upstream from Friant Dam	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-16: Changes in Pollutant Discharge and Mobilization in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]
FSH-17: Changes in Sediment Discharge and Turbidity in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-18: Changes in Fish Habitat Conditions in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-19: Changes in Diversions and Entrainment in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-20: Changes in Predation Levels in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-21: Changes in Food Web Support in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-22: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-23: Changes in Pollutant Discharge and Mobilization in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-24: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-25: Changes in Fish Habitat Conditions in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-26: Changes in Diversions and Entrainment in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-27: Changes in Predation Levels in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-28: Changes in Food Web Support in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-29: Effects of Disease on Fisheries in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-30: Changes in Chinook Salmon and Steelhead Habitat in the Merced, Tuolumne, and Stanislaus Rivers	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-31: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the Delta	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-32: Changes in Pollutant Discharge and Mobilization in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
FSH-33: Changes in Sediment Discharge and Turbidity in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-34: Changes in Fish Habitat Conditions in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
FSH-35: Changes in Diversions and Entrainment in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-36: Changes in Predation Levels in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
FSH-37: Changes in Food Web Support in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-38: Salinity Changes in the Delta	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-39: Changes to Delta Inflow and Flow Patterns in the Delta	No-Action	PS	--	PS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Program-Level						
VEG-1: Substantially Alter Riparian Habitat and Other Sensitive Communities in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[1,2]	No[1,2]
VEG-2: Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-3: Facilitate Increase in Distribution and Abundance of Invasive Plants in the Restoration Area	No-Action	SU	--	SU	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-4: Substantially Affect Special-Status Plant Species in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-5: Substantially Reduce Habitat or Populations of Special-Status Animals in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Program-Level (contd.)						
VEG-6: Substantially Alter Designated Critical Habitat in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-7: Conflict with Adopted Conservation Plans in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[1,2]	No[1,2]
VEG-8: Substantially Alter Riparian Habitat and Other Sensitive Communities Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-9: Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-10: Facilitate Increase in Distribution and Abundance of Invasive Plants Between the Merced River and the Delta	No-Action	SU	--	SU	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Program-Level (contd.)						
VEG-11: Substantially Alter Special-Status Plant Species Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-12: Substantially Reduce Habitat or Populations of Special-Status Animals Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-13: Substantially Alter Designated Critical Habitat Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-14: Conflict with Adopted Conservation Plans Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Biological Resources – Vegetation and Wildlife: Project-Level						
VEG-15: Effects of Surface Water Fluctuation on Biological Resources Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-16: Substantially Alter Riparian Habitat and Other Sensitive Communities in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
VEG-17: Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-18: Facilitate Increase in Distribution and Abundance of Invasive Plants in Sensitive Natural Communities in the Restoration Area	No-Action	SU	--	SU	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-19: Substantially Affect Delta Button-Celery and Other Special-Status Plant Species in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Project-Level (contd.)						
VEG-20: Substantially Reduce Habitat or Populations of Special-Status Animal Species in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-21: Substantially Alter Designated Critical Habitat in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-22: Conflict with Provisions of Adopted Habitat Conservation Plans, Natural Community Conservation Plans, and Other Approved Local, Regional, or State Conservation Plans in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
VEG-23: Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Project-Level (contd.)						
VEG-24: Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans in the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
VEG-25: Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans in the CVP/SWP Water Service Areas	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Climate Change and Greenhouse Gas Emissions: Program-Level						
CLM-1: Construction-Related Emissions of GHGs	A1 & A2	PS	CLM-1: Implement All Feasible Measures to Reduce Emissions	PSU	No[1]	No[1]
CLM-2: Operational Emissions of GHGs	A1 & A2	LTS	--	LTS	No[2,3]	No[2,3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Climate Change and Greenhouse Gas Emissions: Project-Level						
CLM-3: Construction-Related Emissions of GHGs	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
CLM-4: Operational Emissions of GHGs	A1 & A2	PS	CLM-1: Implement All Feasible Measures to Reduce Emissions	PSU	No[3]	No[3]
Cultural Resources: Program-Level						
CUL-1: Disturbance or Destruction of Cultural Resources Within the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	CUL-1: Comply with Section 106 of the NHPA or Equivalent	LTS	No[2]	No[2]
Cultural Resources: Project-Level						
CUL-2: Disturbance or Destruction of Cultural Resources Around Millerton Lake	No-Action	LTS	--	LTS	NA	NA
	A1 & A2	PS	CUL-2: Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement	LTS	No[2]	No[2]
CUL-3: Disturbance or Destruction of Cultural Resources in the Restoration Area	No-Action	LTS	--	LTS	NA	NA
	A1 & A2	PS	CUL-2: Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Cultural Resources: Project-Level (contd.)						
CUL-4: Disturbance or Destruction of Cultural Resources Along the San Joaquin River Downstream from the Merced River	No-Action	LTS	--	LTS	NA	NA
	A1 & A2	PS	CUL-2: Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement	LTS	No[3]	No[3]
Geology and Soils: Program-Level						
GEO-1: Potential Localized Soil Erosion, Sedimentation, and Inadvertent Permanent Soil Loss	No-Action	LTS	--	No Impact	--	--
	A1 & A2	PS	GEO-1: Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities	LTS	No[1]	No[1]
GEO-2: Potential Loss of Availability of a Known Mineral Resource of Value	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Geology and Soils: Project-Level						
GEO-3: Potential Localized Soil Erosion, Sedimentation, and Inadvertent Permanent Soil Loss	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Geology and Soils: Project-Level (contd.)						
GEO-4: Potential Increase in Channel Erosion, Sediment Transport, and Meander Migration from San Joaquin River Flows	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
GEO-5: Potential Loss of Availability of a Known Mineral Resource of Value	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Hydrology – Flood Management: Program-Level						
FLD-1: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding, Including Flooding as a Result of the Failure or a Levee or Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	FLD-1: Implement Design Standards to Minimize Risk of Loss, Injury, or Death Involving Flooding	LTS	No[3]	No[3]
FLD-2: Substantially Reduce Opportunities for Levee and Flood System Facilities Inspection and Maintenance	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Flood Management: Program-Level (contd.)						
FLD-3: Substantially Alter the existing Drainage Pattern of the Site or Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-Site	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
FLD-4: Placement of Structures Within a 100-Year Flood Hazard Area Structures That Would Impede or Redirect Flood Flows	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FLD-5: Placement of Housing Within a 100-Year Flood Hazard Area, as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Hydrology – Flood Management: Project-Level						
FLD-6: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding, Including Flooding as a Result of the Failure or a Levee or Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FLD-7: Substantially Reduce Opportunities for Levee and Flood System Facilities Inspection and Maintenance	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
FLD-8: Substantially Alter the Existing Drainage Pattern of the Site or Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-Site	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Flood Management: Project-Level (contd.)						
FLD-9: Placement of Structures Within a 100-Year Flood Hazard Area Structures That Would Impede or Redirect Flood Flows	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]
FLD-10: Placement of Housing Within a 100-Year Flood Hazard Area, as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
Hydrology – Groundwater: Program-Level						
GRW-1: Temporary Construction-Related Effects on Groundwater Quality	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	PS	GRW-1a: Prepare and Implement a Stormwater Pollution Prevention Plan That Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities GRW-1b: Conduct Phase I Environmental Site Assessments	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Hydrology – Groundwater: Project-Level						
GRW-2: Changes in Groundwater Levels Along the San Joaquin River from Friant Dam to the Merced River Confluence	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
GRW-3: Changes in Groundwater Quality Along the San Joaquin River from Friant Dam to the Merced River Confluence	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
GRW-4: Changes in Groundwater Levels in CVP/SWP Water Service Areas	No-Action	PSU	--	PSU	--	--
	A1 & A2	PSU	--	PSU	No[3]	No[3]
GRW-5: Changes in Groundwater Quality in CVP/SWP Water Service Areas	No-Action	PSU	--	PSU	--	--
	A1 & A2	PSU	--	PSU	No[3]	No[3]
Hydrology – Surface Water Supplies and Facilities Operations: Program-Level						
SWS-1: Changes in Diversion Capacities	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	SWS-1: Provide Alternate Temporary or Permanent River Access to Avoid Diversion Losses	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Surface Water Supplies and Facilities Operations: Project-Level						
SWS-2: Change in Water Levels in the Old River near the Tracy Road Bridge	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWS-3: Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWS-4: Change in Water Levels in the Middle River near the Howard Road Bridge	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWS-5: Change in Recurrence of Delta Excess Conditions	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Hydrology – Surface Water Quality: Program-Level						
SWQ-1: Temporary Construction-Related Effects on Surface Water Quality in the San Joaquin River from Friant Dam to the Merced River, San Joaquin River from the Merced River to the Delta, the Delta, and CVP/SWP Water Service Areas	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	PS	SWQ-1A: Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities SWQ-1B: Conduct and Comply with Phase I Environmental Site Assessments in the Restoration Area	LTS	No[1,2]	No[1,2]
SWQ-2: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the CVP/SWP Water Service Areas	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Surface Water Quality: Project-Level						
SWQ-3: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in Millerton Lake	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
SWQ-4: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the San Joaquin River from Friant Dam to the Merced River	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
SWQ-5: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the San Joaquin River from the Merced River to the Delta	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Hydrology – Surface Water Quality: Project-Level (contd.)						
SWQ-6: Effects on X2 Position	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]
SWQ-7: Delta Salinity in San Joaquin River at Vernalis, San Joaquin River at Brandt Bridge, Old River near Middle River, and Old River at Tracy Road Bridge	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
SWQ-8: Delta Salinity in San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWQ-9: Delta Water Quality at Contra Costa Water District's Contra Costa Canal Pumping Plant No. 1, Old River at Los Vaqueros Intake, and Proposed Victoria Canal Intake, and City of Stockton's Proposed Delta Intake	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Surface Water Quality: Project-Level (contd.)						
SWQ-10: Water Quality in the Delta-Mendota Canal at Jones Pumping Plant and in the West Canal at the Clifton Court Forebay	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
Indian Trust Assets: Program-Level						
ITA-1: Affect Land Minerals, Federally Reserved Hunting and Fishing Rights, Federally Reserved Water Rights, and Instream Flows Associated With Trust Land	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]
Indian Trust Assets: Project-Level						
ITA-2: Affect Land, Minerals, Federally Reserved Hunting and Fishing Rights, Federally Reserved Water Rights, and Instream Flows Associated With Trust Land	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Land Use Planning and Agricultural Resources: Program-Level						
LUP-1: Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	No-Action	SU	--	SU	--	--
	A1& A2	Significant	LUP-1a: Design and Implement Levee Setbacks to Preserve Agricultural Productivity of Important Farmland to the Extent Possible and Comply with the Surface Mining and Reclamation Act LUP-1b: Minimize Impacts on Williamson Act-Contracted Lands, Comply with Government Code Sections 51290-51293, and Coordinate with Landowners and Agricultural Operators	SU	No[1,2]	No[1,2]
LUP-2: Conversion of Riparian Forest to Non-Forest Uses	No-Action	LTS	--	LTS	--	--
	A1& A2	LTS	--	LTS	No[1,2]	No[1,2]
LUP-3: Conflict with Adopted Land Use Plans, Goals, Policies, and Ordinances of Affected Jurisdictions	No-Action	No Impact	--	No Impact	--	--
	A1& A2	SU	--	SU	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Land Use Planning and Agricultural Resources: Project-Level						
LUP-4: Physically Divide or Disrupt an Established Community	No-Action	No Impact	--	No Impact	--	--
	A1& A2	PS	LUP-4: Implement Vehicular Traffic Detour Planning	LTS	No[1]	No[1]
LUP-5: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation	No-Action	No Impact	--	No Impact	--	--
	A1& A2	PS	LUP-5: Preserve Agricultural Productivity of Important Farmland to Minimize Effects of Inundation and Saturation Effects	PSU	No[1]	No[1]
LUP-6: Diminishment of Agricultural Production by Increased Orchard and Vineyard Diseases	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[1]	No[1]
LUP-7: Potential Conversion of Riparian Forest Because of Altered Inundation	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS and Beneficial	--	LTS and Beneficial	No[1]	No[1]
LUP-8: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries	No-Action	No Impact	--	No Impact	--	--
	A1& A2	SU	--	SU	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Noise: Program-Level						
NOI-1: Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-1: Implement Measures to Reduce Temporary and Short-Term Noise Levels from Construction-Related Equipment Near Sensitive Receptors	PSU	No[1]	No[1]
NOI-2: Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-2: Implement Measures to Reduce Temporary Noise Levels from Construction-Related Traffic Increases Near Sensitive Receptors	PSU	No[1]	No[1]
NOI-3: Exposure of Sensitive Receptors to Long-Term Operation-Related Noise Levels from Stationary Sources	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	LTS	NOI-3: Implement Measures to Reduce Long-Term Operation-Related Noise Levels from Stationary Sources on Sensitive Receptors	LTS	No[1]	No[1]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Noise: Program-Level (contd.)						
NOI-4: Exposure of Sensitive Receptors to Increased Noise from Borrow Site-Related Activities	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-4: Implement Measures to Reduce Borrow Site Noise Levels Near Sensitive Receptors	LTS	No[1,2]	No[1,2]
NOI-5: Exposure of Sensitive Receptors to or Generation of Excessive Groundborne Vibration	No-Action	Too Speculative for Meaningful Consideration		Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-5: Implement Measures to Reduce Temporary and Short-term Groundborne Noise and Vibration Levels Near Sensitive Receptors	LTS	No[1]	No[1]
Noise: Project-Level						
NOI-6: Effects of the Reoperation of Friant Dam on the Noise Environment	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
Paleontological Resources: Program-Level						
PAL-1: Possible Damage to or Destruction of Unique Paleontological Resources	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	PAL-1: Stop Work if Paleontological Resources Are Encountered During Earthmoving Activities and Implement Recovery Plan	LTS	No[1]	No[1]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Paleontological Resources: Project-Level						
PAL-2: Possible Damage to or Destruction of Unique Paleontological Resources	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]
Power and Energy: Program-Level						
PWR-1: Decrease in CVP and SWP Energy Generation	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]
PWR-2: Increase in CVP and SWP Energy Consumption	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]
PWR-3: Increased Energy Consumption as a Result of Construction Activities	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
PWR-4: Increased Energy Consumption Within Friant Division	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	---	No Impact	No[1,3]	No[1,3]
Power and Energy: Project-Level						
PWR-5: Decrease in CVP and SWP Energy Generation	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Power and Energy: Project-Level (contd.)						
PWR-6: Increase in CVP and SWP Energy Consumption	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
PWR-7: Change in Energy Generation at Friant Dam	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
PWR-8: Increased Energy Consumption Within Friant Division	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Public Health and Hazardous Materials: Program-Level						
PHH-1: Exposure of Construction Workers and Others to Hazardous Materials	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-1: Conduct Phase I Environmental Site Assessments	LTS	No[1,2]	No[1,2]
PHH-2: Creation of a Substantial Hazard to the Public or the Environment Through the Use of Hazardous Materials	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
PHH-3: Exposure to Naturally Occurring Asbestos	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,2]	No[1,2]
PHH-4: Exposure to Diseases	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-4: Implement Workplace Precautions against West Nile Virus and Valley Fever	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Public Health and Hazardous Materials: Program-Level (contd.)						
PHH-5: Creation of a Substantial Hazard to School Safety	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-5: Minimize Hazards to School Safety	LTS	No[1,2]	No[1,2]
PHH-6: Creation of a Substantial Hazard from Idle and Abandoned Wells	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-6: Minimize Hazards from Idle and Abandoned Wells	LTS	No[1,2]	No[1,2]
PHH-7: Creation of a Substantial Hazard from Wildland Fires	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
PHH-8: Creation of a Substantial Hazard to Aircraft Safety	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
Public Health and Hazardous Materials: Project-Level						
PHH-9: Exposure to Diseases in the San Joaquin River Upstream from Friant Dam, in the Restoration Area, and in the San Joaquin River from Merced River to the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-9: Coordinate with and Support Vector Control District(s)	LTS	No[2,3]	No[2,3]
PHH-10: Exposure to Diseases in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Recreation: Program-Level						
REC-1: Increased Use of Facilities at Millerton Lake State Recreation Area and Demand for Recreation Opportunities at Millerton Lake and Vicinity	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]
REC-2: Increased Use of Recreation Facilities and Demand for Recreation Opportunities in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
REC-3: Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1	LTS	--	LTS	No[1,2]	No[1,2]
	A2	PS	REC-3: Restore Recreation Access and Facilities Affected by Construction, Operation, and Maintenance from Settlement Actions in the San Luis Unit of the San Luis National Wildlife Refuge	LTS	No[1,2]	No[1,2]
REC-4: Effects of Reintroducing Salmon to the Restoration Area on Reach 1 Angling Opportunities	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	REC-4: Enhance Fishing Access and Fish Populations on the Kings River below Pine Flat Dam	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Recreation: Program-Level (contd.)						
REC-5: Effects on Reach 1 Warm-Water Angling Opportunities from Program Actions Within the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	REC-5: Enhance Warm-Water Fishing Access and Fish Populations in the Vicinity of the San Joaquin River below Friant Dam	LTS	No[2]	No[2]
REC-6: Effects on Wildlife-Based Recreation Opportunities from Enhanced Wildlife Habitat Conditions Caused by Program Actions Within the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
REC-7: Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities on the San Joaquin River Between Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Recreation: Program-Level (contd.)						
REC-8: Effects of Reintroducing Salmon to the San Joaquin River Between Friant Dam and the Merced River on Angling Opportunities Downstream	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2,3]	No[2,3]
Recreation: Project-Level						
REC-9: Effects on Recreation Opportunities from Earlier Seasonal Drawdown of Millerton Lake Related to Timing of Release of Interim and Restoration Flows	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	REC-9: Extend Millerton Lake Boat Ramps or Construct a New Low-Water Ramp to Allow Boat Launching at the Lower Pool Elevations that May Result from Interim and Restoration Flows During Dry and Critical-High Years	LTS	No[2]	No[2]
REC-10: Effects on Recreation Facilities from Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Recreation: Project-Level (contd.)						
REC-11: Effects on Swimming or Wading and Fishing Opportunities from Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
REC-12: Effects on Boating Opportunities from Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	Significant	REC-12: Develop and Implement Recreation Outreach Program	LTS	No[2]	No[2]
REC-13: Effects on Wildlife-Based Recreation Opportunities from Enhanced Wildlife Habitat Conditions Related to Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
REC-14: Effects on Warm-Water Fishing Opportunities from Enhanced Fish Populations Related to Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Recreation: Project-Level (contd.)						
REC-15: Effects on Warm-Water Fishing Opportunities from Increased Flow in the San Joaquin River from the Merced River to the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
REC-16:Effects on Warm-Water and Cold-Water Fishing Opportunities from Increased Flow into the Sacramento-San Joaquin Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
Socioeconomics: Program-Level						
SOC-1: Change in Regional Employment Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS and Beneficial	--	LTS and Beneficial	No[1,2]	No[1,2]
SOC-2: Change in Regional Population Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[1,2]	No[1,2]
SOC-3: Change in Regional Housing Demand	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Socioeconomics: Project-Level						
SOC-4: Change in Regional Employment Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
SOC-5: Change in Regional Population Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
SOC-6: Change in Regional Housing Demand	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
SOC-7: Physical Decay in Communities	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
Transportation and Infrastructure: Program-Level						
TRN-1: Reduced Traffic Circulation and Roadway Capacity	No-Action	LTS	--	LTS	--	--
	A1 & A2	PS	TRN-1: Minimize Short-term Impacts on Traffic Circulation and Roadway Capacity	PSU	No[1,2]	No[1,2]
TRN-2: Creation of a Hazard as a Result of a Design Feature	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-2: Avoid Disruption of Subsurface Utility Facilities	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs: Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Transportation and Infrastructure: Program-Level (contd.)						
TRN-3: Reduced Emergency Access	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-1: Minimize Short-term Impacts on Traffic Circulation and Roadway Capacity	LTS	No[1,2]	No[1,2]
TRN-4: Reduced Bicycle and Pedestrian Circulation	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-4: Minimize Impacts on Public Bicycle and Pedestrian Circulation Facilities	LTS	No[1,2]	No[1,2]
Transportation and Infrastructure: Project-Level						
TRN-5: Reduced Traffic Circulation and Roadway Capacity	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
TRN-6: Creation of a Hazard as a Result of a Design Feature	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,2]	No[1,2]
TRN-7: Inadequate Emergency Access	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-7: Implement Vehicular Traffic Detour Planning	LTS	No[3]	No[3]
TRN-8: Reduced Bicycle and Pedestrian Circulation	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Utilities and Service Systems: Program-Level						
UTL-1: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
UTL-2: Potential Reduction in Ability of Facilities in the Restoration Area to Meet Wastewater Treatment Requirements	No-Action	LTS	–	LTS	--	--
	A1 & A2	PS	UTL-2: Obtain Required Permits for Hatchery Wastewater Discharges and Implement Best Management Practices to Reduce Pollutant Discharges	LTS	No[2]	No[2]
UTL-3: Potential for Insufficient Water Supply and Resources in the Restoration Area	No-Action	PS	–	PS	--	--
	A1 & A2	Too Speculative for Meaningful Consideration	–	Too Speculative for Meaningful Consideration	No[2]	No[2]
UTL-4: Potential for Generation of Solid Waste in the Restoration Area in Excess of Permitted Landfill Capacity	No-Action	LTS	–	LTS	--	--
	A1 & A2	PS	UTL-4: Identify Landfills with Adequate Permitted Capacity to Accept Solid Waste Generated by Settlement Activities and Dispose of Waste in Accordance with Applicable Regulations	LTS	No[1,2]	No[1,2]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Utilities and Service Systems: Program-Level (contd.)						
UTL-5: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services in the Restoration Area	No-Action	LTS	–	LTS	--	--
	A1 & A2	LTS	–	LTS	No[1,2]	No[1,2]
UTL-6: Potential for Insufficient Existing Water Supply and Resources Between the Merced River and the Delta	No-Action	PS	–	PS	--	--
	A1 & A2	LTS	–	LTS	No[1]	No[1]
UTL-7: Potential for Generation of Solid Waste Between the Merced River and the Delta in Excess of Permitted Landfill Capacity	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]
UTL-8: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services Between the Merced River and the Delta	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Utilities and Services Systems: Project-Level						
UTL-9: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	No-Action	PS	–	PS	--	--
	A1 & A2	No Impact	–	No Impact	No[2]	No[2]
UTL-10: Potential Reduction in Ability of Facilities in the Restoration Area to Meet Wastewater Treatment Requirements	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[2]	No[2]
UTL-11: Potential for Insufficient Existing Water Supply and Resources	No-Action	PS	–	PS	--	--
	A1 & A2	PSU	–	PSU	No[3]	No[3]
UTL-12: Potential for Generation of Solid Waste in the Restoration Area in Excess of Permitted Landfill Capacity	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[2,3]	No[2,3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Utilities and Services Systems: Project-Level (contd.)						
UTL-13: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services in the Restoration Area	No-Action	LTS	–	LTS	--	--
	A1 & A2	LTS	–	LTS	No[2]	No[2]
UTL-14: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities Between the Merced River and the Delta	No-Action	No Impact	–	No Impact	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]
UTL-15: Potential Reduction in Ability of Facilities Between the Merced River and the Delta to Meet Wastewater Treatment Requirements	No-Action	No Impact	–	No Impact	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]
UTL-17: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services Between the Merced River and the Delta	No-Action	No Impact	–	No Impact	--	--
	A1 & A2	LTS	–	LTS	No[3]	No[3]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Visual Resources: Program-Level						
VIS-1: Temporary and Short-Term Construction-Related Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No-Action	No-Impact	--	No-Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VIS-2: Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	VIS-2: Screen New Facilities and Minimize Adverse Visual Impacts	PSU	No[1,2]	No[1,2]
VIS-3: Substantial Changes in Light or Glare	No-Action	No-Impact	--	No-Impact	--	--
	A1 & A2	PS	VIS-3: Establish and Require Conformance to Lighting Standards, and Prepare and Implement a Lighting Plan	LTS	No[1,2]	No[1,2]
Visual Resources: Project-Level						
VIS-4: Effects of Friant Dam Reoperation on Scenic Vistas, Scenic Resources, and Existing Visual Character Upstream from Friant Dam	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]

Table 2-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Visual Resources: Project-Level (contd.)						
VIS-5: Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character Downstream from Friant Dam	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in Chapters 4.0 through 25.0.
[4] Impacts and mitigation measures are presented as modified in Appendix B of this Final PEIS/R, "Errata."

Key:
-- = not applicable
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
GHG = greenhouse gas
LTS = less than significant
NHPA = National Historic Preservation Act
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative
SU = significant and unavoidable
SWP = State Water Project
X2 = the distance upstream from the Golden Gate Bridge where tidally-averaged salinity is equal to 2 parts per thousand

Table 2-2.
Impacts Potentially Causing Adverse Environmental Justice Effects

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Alternative	**Impact**	**Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**	**Change in Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**
Environmental Justice: Program-Level			
No-Action	AIR-1: Construction-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-2: Long-Term Operations-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-3: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	Yes	--
	AIR-4: Exposure of Sensitive Receptors to Odor Emissions	No	--
	FSH-1: Changes in Water Temperatures in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-2: Changes in Pollutant Discharge in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-3: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	VEG-3: Facilitate Increase in Distribution and Abundance of Invasive Plants in the Restoration Area	No	--
	VEG-10: Facilitate Increase in Distribution and Abundance of Invasive Plants Between the Merced River and the Delta	No	--
	LUP-1: Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	Yes	--
	UTL-1: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	Yes	--
	UTL-3: Potential for Insufficient Water Supply and Resources in the Restoration Area	Yes	--
	UTL-6: Potential for Insufficient Existing Water Supply and Resources Between the Merced River and the Delta	Yes	--

Table 2-2.
Impacts Potentially Causing Adverse Environmental Justice Effects (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Alternative	**Impact**	**Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**	**Change in Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**
Environmental Justice: Program-Level (contd.)			
A1 & A2	AIR-1: Construction-Related Emissions of Criteria Air Pollutants and Precursors	Yes	No[1]
	CLM-1: Construction-Related Emissions of GHGs in the Restoration Area	No	No[1]
	LUP-1: Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	Yes	No[1,2]
	LUP-3: Conflict with Adopted Land Use Plans, Goals, Policies, and Ordinances of Affected Jurisdictions	Yes	No[1,2]
	NOI-1: Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise	Yes	No[1]
	NOI-2: Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels	Yes	No[1]
	TRN-1: Reduced Traffic Circulation and Roadway Capacity	Yes	No[1,2]
	VIS-2: Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No	No[1,2]
Environmental Justice: Project-Level			
No-Action	AIR-5: Construction-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-6: Operations-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-7: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	Yes	--
	AIR-8: Exposure of Sensitive Receptors to Odor Emissions	No	--

Table 2-2.
Impacts Potentially Causing Adverse Environmental Justice Effects (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Environmental Justice: Project-Level (contd.)			
No-Action	FSH-15: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Upstream from Friant Dam	Yes	--
	FSH-22: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-23: Changes in Pollutant Discharge and Mobilization in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-24: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-31: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the Delta	Yes	--
	FSH-38: Salinity Changes in the Delta	No	--
	FSH-39: Changes to Delta Inflow and Flow Patterns in the Delta	Yes	--
	VEG-18: Facilitate Increase in Distribution and Abundance of Invasive Plants in Sensitive Natural Communities in the Restoration Area	No	--
	GRW-4: Changes in Groundwater Levels in CVP/SWP Water Service Areas	Yes	--
	GRW-5: Changes in Groundwater Quality in CVP/SWP Water Service Areas	Yes	--
	SWS-5: Change in Recurrence of Delta Excess Conditions	No	--
	UTL-9: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	Yes	--

Table 2-2.
Impacts Potentially Causing Adverse Environmental Justice Effects (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Environmental Justice: Program-Level (contd.)			
No-Action	UTL-11: Potential for Insufficient Water Supply and Resources	Yes	--
A1 & A2	CLM-4: Operational Emissions of GHGs in the Delta	No	No[3]
	GRW-4: Changes in Groundwater Levels in CVP/SWP Water Service Areas	Yes	No[3]
	GRW-5: Changes in Groundwater Quality in CVP/SWP Water Service Areas	Yes	No[3]
	LUP-5: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation	Yes	No[3]
	LUP-8: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries	Yes	No[3]
	UTL-11: Potential for Insufficient Existing Water Supply and Resources	Yes	No[3]

Notes:
1 Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
2 Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
3 Conclusions are based on further analyses as presented in Chapter 9.0, "Environmental Justice."
4 Impacts and mitigation measures are presented as modified in Appendix B of this Final PEIS/R, "Errata."

Key:
-- = not applicable
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
GHG = greenhouse gas
RPA = reasonable and prudent alternative
SWP = State Water Project

Table 2-3.
Summary of Cumulative Impacts and Summary of Changes in Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R		Sensitivity Analyses of Program Alternatives with RPAs
Resource Topic	**Impacts**	**Change in Potential Cumulative Impacts**
Air Quality	Construction-Related Emissions of Criteria Air Pollutants and Precursors	No[1,2]
Biological Resources – Fisheries	Potential Direct Mortality or Reduced Fecundity of Wild Fall-Run Chinook Salmon in San Joaquin River Tributaries Resulting from Disease Outbreak	No[3]
Biological Resources – Vegetation and Wildlife	None	No[3]
Climate Change	Cumulative impacts associated with climate change are discussed in Chapter 7.0, “Climate Change and Greenhouse Gas Emissions.”	Cumulative impacts associated with climate change are discussed in Chapter 7.0, “Climate Change and Greenhouse Gas Emissions.”
Cultural Resources	Disturbance or Destruction of Cultural Resources	No[3]
Geology and Soils	None	No[3]
Hydrology – Flood Management	None	No[3]
Hydrology – Groundwater	Changes in Groundwater Levels and Groundwater Quality in CVP/SWP Water Service Areas	No[3]
Hydrology – Surface Water Supply and Facilities Operations	Change in Contra Costa Water District Water Supplies	No[3]
Hydrology – Surface Water Quality	None	No[3]
Indian Trust Assets	None	No[3]
Land Use Planning and Agricultural Resources	Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	No[1,2]
	Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation	No[2]
	Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries	No[3]
Noise	Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise	No[1,2]
	Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels	No[2]
Paleontological Resources	None	No[1]
Power and Energy	None	No[3]
Public Health and Hazardous Materials	None	No[3]
Recreation	None	No[3]
Socioeconomics	None	No[3]

Table 2-3.
Summary of Cumulative Impacts and Summary of Changes in Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R		Sensitivity Analyses of Program Alternatives with RPAs
Resource Topic	**Impacts**	**Change in Potential Cumulative Impacts**
Transportation and Infrastructure	None	No[3]
Utilities and Service Systems	Reduced Water Supplies for Friant Division Water Contractors	No[3]
Visual Resources	Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No[2]

Notes:

[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.

[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.

[3] Conclusions are based on further analyses as presented in Chapter 26.0, "Cumulative Impacts."

Key:
PEIS/R = Program Environmental Impact Statement/Environmental Impact Report
RPA = reasonable and prudent alternative
RPA = reasonable and prudent alternative
SWP = State Water Project

Chapter 3.0 Tools and Methodology

The tools and methodology used in assessing the potential impacts of the program alternatives are described in the Draft PEIS/R, including: CalSim-II (water operations model), Delta Simulation Model 2 (DSM2) (Delta water quality model), Schmidt Tool and Mass Balance Method (regional groundwater tools), Central Valley Planning Model (CVPM) (agricultural economics), IMPact Analysis for PLANning (IMPLAN) (regional economics), and Long_Term_Gen (long-term power model). For a basic description of these tools and their application, please refer to Appendix H of the Draft PEIS/R, "Modeling." Only CalSim-II was modified for these analyses to represent the RPA scenarios; the other tools are the same as those applied in the Draft PEIS/R. The key differences in the methodologies applied in the Draft PEIS/R and in these analyses are described below for each of these tools.

3.1 Water Operations

CalSim-II is a water supply operations model that includes CVP, SWP, and Friant Division water supply operations. The model simulates an 82-year period of hydrologic record (1922 to 2003) on a monthly time step. CalSim-II assumes a constant set of demands, facilities, and operation rules for all 82 years. CalSim-II was used to simulate potential water supply operations of the existing conditions and of Alternatives A1 and A2. Model results were used directly for water supply impact analyses, and indirectly to set overall water operation guidelines for other analyses. CalSim-II output is provided in the Water Operations Modeling Output – CalSim-II Attachment, provided with this appendix on CD.

The CalSim-II simulations for the sensitivity analyses were developed in an attempt to capture the range of potential operation change that could occur under any implementation scheme. The simulations were not refined in an attempt to develop "viable" or "reasonable" operations, meaning that potentially "unviable" or "unreasonable" operations were left in the simulations if they occurred. The final set of simulations defines an outer boundary of potential effects of Alternatives A1 and A2 given the uncertainty in any final implementation of the RPAs or definition of "viable" or "reasonable" operations. These simulations were then used to define an outer boundary of potential effects of implementing the Alternatives A1 and A2 under any final implementation of the RPAs. Use of these simulations outside of these sensitivity analyses does not represent Reclamation or DWR policy and may be misleading or factually incorrect.

The sensitivity analyses were performed by developing a set of potential RPA scenarios. CalSim-II was then used to simulate both the existing conditions and Alternatives A1 and A2 under each of the RPA scenarios. The difference between the existing conditions and Alternatives A1 and A2 under each RPA scenario was then compared to the results presented in the Draft PEIS/R to determine whether the RPAs would change the anticipated effects of the action alternatives from those presented in the Draft PEIS/R.

The sensitivity analyses were not developed to allow analysis of the differences between RPA scenarios, or the changes due to the RPA implementation. The differences between RPA scenarios are not caused by Alternatives A1 and A2; they are merely an outcome of the different assumed RPA implementation for each scenario. No comparisons are made between RPA scenarios in the analysis.

The uncertainty concerning representation of final implementation of the RPAs focuses on the San Joaquin River and the Stanislaus River. The RPAs considered for inclusion in this sensitivity analysis are selected to capture this uncertainty, and include the following RPAs from the 2009 NMFS CVP/SWP Operations BO:

- **RPA Action III:** Introduction to Stanislaus River/Eastside Division Actions – The BO specifies implementation of "VAMP-like flows" but gives no details on what these flows should be or how they would be implemented. Further complicating this issue is the fact that the current Vernalis Adaptive Management Program (VAMP) ended in 2011 and no new agreements have been reached to continue the current program. For the purpose of this sensitivity analysis the following three possible implementations are assumed:
  - No VAMP requirements or similar requirements.
  - Existing VAMP implementation from the version of CalSim used to support the PEIS/R is imposed before other RPAs on the San Joaquin River and the Stanislaus River.
  - Existing VAMP implementation from the version of CalSim used to support the PEIS/R is imposed after other RPAs on the San Joaquin River and the Stanislaus River.
- **RPA Action III.1.2:** Provide Cold Water Releases to Maintain Suitable Steelhead Temperatures – Presently there is speculation to explore developing a flow surrogate for this requirement. For the purposes of this sensitivity analysis, it is assumed that flow requirements on the Stanislaus River will meet Stanislaus temperature requirements; therefore, this parameter is not explicitly modeled.
- **RPA Action III.1.3:** Operate the East Side Division Dams to Meet the Minimum Flows, as Measured at Goodwin Dam – The flow requirements on the Stanislaus River centers on the way these requirements are imposed within the context of other requirements on the same river system and not on the magnitude of the flows. For the purposes of this sensitivity analysis, the standards are imposed but varied to be either the first flow requirement imposed or the last flow requirement imposed.

- **RPA Action IV.2.1:** San Joaquin River Inflow to Export Ratio – These are specified in the 2009 NMFS CVP/SWP Operations BO as an initial Phase I version and a later, more stringent Phase II. Because the sensitivity analysis is being performed to evaluate of the outer boundary of potential effects of implementing the action alternatives under any final implementation of the RPAs, the more stringent Phase II RPA implementation is used in all simulations.

- **RPA Action IV.2.3:** Old and Middle River Flow Management – The reverse Old and Middle Rivers (OMR) flow requirements vary based on a number of real-time variables that cannot be modeled, such as the presence of fish at specific locations. There has been considerable work expended to develop a surrogate approach to implementing the variable OMR flow requirements, which has resulted in a single possible implementation that is believed to be a reasonable representation of conditions expected to prevail over an extended time frame. For the purposes of this sensitivity analysis, this single implementation is maintained in all simulations.

- **CVP Operations:** Stockton East Water District Allocation – There is disagreement on whether Stockton East Water District should receive its full contract amount of water each year or a variable amount based on available water supply. For the purposes of this sensitivity analysis, the Stockton East Water District Allocation is varied between full allocations and allocation based on available water supply.

The sensitivity analyses were performed based on the existing conditions and Alternatives A1 and A2 (with a 2005 level of development, as described in Chapter 1.0, “Introduction”) with the six possible RPA scenarios shown in Table 3-1. The RPA implementation in this version of CalSim-II is documented in the Representation of U.S. Fish and Wildlife Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM-II Planning Studies - DRAFT Attachment and the Representation of National Marine Fisheries Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM-II Planning Studies Attachment to this appendix. This version of CalSim-II was then modified as required to implement the potential RPA implementations required for these analyses. These modifications are documented in the Draft Potential Fishery Impacts of San Joaquin River Restoration Sensitivity Analysis: CalSim Code Implementation Attachment.

Table 3-1.
RPA Scenarios Included in the Sensitivity Analyses

<table>
<tr><th>RPA Scenario</th><th>Goodwin Flow Requirements[1]</th><th>Stockton East</th><th>VAMP-Like Flows[1]</th><th>Stanislaus Temperature</th><th>SJR E/I Ratio and Vernalis Minimum</th><th>OMR Flow</th></tr>
<tr><td>No RPA</td><td colspan="6">As Used in the Biological Assessment</td></tr>
<tr><td>1</td><td rowspan="3">First</td><td>Variable based on available water supply</td><td>None</td><td rowspan="6">Met through Stanislaus Flow Requirements</td><td rowspan="6">Phase II</td><td rowspan="6">As Specified</td></tr>
<tr><td>2</td><td>100% of contract amount</td><td>None</td></tr>
<tr><td>3</td><td rowspan="2">Variable based on available water supply</td><td>First</td></tr>
<tr><td>4</td><td>Last</td><td>First</td></tr>
<tr><td>5</td><td>First</td><td rowspan="2">100% of contract amount</td><td>First</td></tr>
<tr><td>6</td><td>Last</td><td>First</td></tr>
</table>

Note:
[1] Refers to the order in which this requirement is implemented on the Stanislaus River and/or San Joaquin River, relative to other RPA requirements.

Key:
% = percent
E/I = export/import
OMR = Old and Middle River
RPA = reasonable and prudent alternative
SJR = San Joaquin River

3.2 Delta Water Quality

DSM2 was used with CalSim-II results to describe surface water elevation and water quality at selected locations in the Delta, for existing conditions and Alternatives A1 and A2. DSM2 is a hydrodynamic model of the Delta developed by DWR that simulates flow and salinity throughout the Delta. The model uses monthly CalSim-II Delta inflow and CVP/SWP pumping results and produces mean monthly flow and salinity values. All six RPA scenarios shown in Table 3-1 were also evaluated in DSM2. DSM2 output is provided in the Delta Simulation Modeling Output – DSM2 Attachment, provided with this appendix on CD.

3.3 Regional Groundwater

Two custom tools, developed in Excel for use in the PEIS/R, were used with simulated flow and delivery data to generate descriptions of regional depth to groundwater and groundwater pumping. One regional groundwater tool is based on relationships describing annual groundwater pumping and resulting groundwater level change developed during litigation studies by Dr. Kenneth D. Schmidt (2005 a, b). A second tool is based on regional aquifer parameters and available groundwater elevation information available from the DWR Water Data Library and Bulletin 118-03 (DWR 2003, 2010). These tools are not full groundwater models but used a water balance approach based on CalSim-II delivery output to produce the regional groundwater description.

The maximum potential decrease in surface water deliveries to the Friant Division; therefore, the maximum potential impact to groundwater depths in the Friant Division, would occur if none of the water released as Interim and Restoration flows was recaptured downstream and recirculated to the Friant Division. The maximum potential impact to groundwater depths would not change from that evaluated in the Draft PEIS/R (corresponding to no recapture of Interim and Restoration flows). The minimum potential decrease in surface water deliveries to the Friant Division; therefore, the minimum potential impact to groundwater depths in the Friant Division would occur with the maximum recapture of Interim and Restoration flows. Among the RPA scenarios, the maximum potential recapture of Interim and Restoration flows was observed under RPA scenario 5. Therefore, RPA scenario 5 was selected from the CalSim-II output and analyzed in the groundwater analysis tools described above to determine the minimum potential impact to surface water deliveries and corresponding groundwater depths.

3.4 Agricultural Economics

Agricultural economics are being described using a model based on the CVPM modeling platform. Based on the changes in water availability expected under the No-Action Alternative and Alternatives A1 and A2, CVPM predicts cropping patterns, land use, and water use in the Central Valley. These predictions are then used to calculate expected changes in net income resulting from each alternative. This model uses CalSim-II water delivery output and groundwater levels from the regional groundwater tool. For the reasons described above for regional groundwater analyses, RPA scenario 5 was selected from the CalSim-II water delivery output for analysis in CVPM, together with groundwater depths from the regional groundwater tool.

3.5 Regional Economics

Regional economics are being simulated using a model based on the IMPLAN modeling platform. IMPLAN modeling uses a branch of economics known as input/output (I/O) analysis. I/O models are based on data tables that trace the linkages of inter-industry purchases and sales within a given region, and within a given year. The I/O model yields "multipliers" that are used to calculate the total direct, indirect, and induced effects on jobs, income, and output generated per dollar of spending on various types of goods and services in the regional economic study area. This model uses output from the CVPM agricultural economics model, and could also use output from other models. For the reasons described above for regional groundwater analyses, RPA scenario 5 was selected from the CalSim-II output and analyzed in CVPM, and these results were used in the IMPLAN analyses.

3.6 Long-Term System Power

System power operations, both power generation and power use for pumping, are simulated using two power models. Long _Term_Gen and SWP_Power are Excel-based models developed by Reclamation and DWR to model CVP and SWP system power generation and pumping, respectively. These models use monthly water operations from CalSim-II to simulate monthly CVP and SWP plant and system power operations. As described in the Draft PEIS/R, the maximum potential change to CVP/SWP power generation and consumption corresponds to the maximum recapture of Interim and Restoration flows in the Delta. The maximum potential impact to long-term system power would not change from that evaluated in the Draft PEIS/R (corresponding to no recapture of Interim and Restoration flows).

The minimum potential change corresponds to the maximum recapture of Interim and Restoration flows in the Delta. Among the RPA scenarios, the maximum potential recapture of Interim and Restoration flows was observed under RPA scenario 5. Therefore, RPA scenario 5 was selected from the CalSim-II output and analyzed in the two power models described above to determine the minimum change in long-term system power.

Chapter 4.0 Air Quality

This chapter describes the potential for impacts of Alternatives A1 and A2 on air quality under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 4.0 of the Draft PEIS/R, "Air Quality." The discussion of potential impacts on air quality presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 4.1, "Environmental Setting" –** Describes existing air quality conditions along the San Joaquin River upstream from Friant Dam, within the Restoration Area, along the San Joaquin River from the Merced River to the Delta, within the Delta, and within the Friant Division.

- **Section 4.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to air quality conditions.

- **Section 4.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to air quality conditions to occur, the significance criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 4-1. As shown in Table 4-1, none of the impact conclusions of Alternatives A1 and A2 on air quality would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 4.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the changes in the level of significance as presented in Table 4-1.

Table 4-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Air Quality: Program-Level						
AIR-1: Construction-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	PS	AIR-1: Prepare Project-Level Quantitative Analysis of Construction-Related Emissions and Implement Measures to Minimize Emissions	PSU	No[1]	No[1]
AIR-2: Operations-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-3: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-4: Exposure of Sensitive Receptors to Odor Emissions	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]

Table 4-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Air Quality: Project-Level						
AIR-5: Construction-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
AIR-6: Operations-Related Emissions of Criteria Air Pollutants and Precursors	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-7: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
AIR-8: Exposure of Sensitive Receptors to Odor Emissions	No-Action	PSU	--	PSU	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU =potentially significant and unavoidable
RPA = reasonable and prudent alternative
SU = significant and unavoidable

4.1 Program-Level Impacts and Mitigation Measures

The potential program-level impact to air quality as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact AIR-1 (Alternatives A1 and A2): *Construction-Related Emissions of Criteria Air Pollutants and Precursors – Program-Level.* This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure AIR-1 (Alternatives A1 and A2): *Prepare Project-Level Quantitative Analysis of Construction-Related Emissions and Implement Measures to Minimize Emissions – Program-Level.* This mitigation measure is identical to Mitigation Measure AIR-1 (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Impact AIR-2 (Alternatives A1 and A2): *Operations-Related Emissions of Criteria Air Pollutants and Precursors – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, long-term operations-related emissions from mobile, area, and stationary sources associated with Alternatives A1 and A2 would not be expected to generate criteria air pollutants or precursors in excess of thresholds set by the San Joaquin Valley Air Pollution Control District (SJVAPCD) because these stationary sources would be subject to SJVAPCD's permitting process for keeping emissions from equipment within acceptable limits. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact AIR-3 (Alternatives A1 and A2): *Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, short- and long-term toxic air contaminant (TAC) emissions from mobile, area, and stationary sources associated with Alternatives A1 and A2 would not expose sensitive receptors to substantial pollutant concentrations in excess of SJVAPCD thresholds. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, some exposure of sensitive receptors to short-term emissions of diesel particulate matter would occur under Alternatives A1 and A2 as a result of construction activities. Construction activities would not be affected by the

RPAs. No new stationary sources of pollutants would be constructed under Alternatives A1 and A2, and use of existing recapture equipment would remain subject to the SJVAPCD permitting process, best available control technology, and offset requirements. As described in the Draft PEIS/R, the SJVAPCD permitting process would keep emissions from equipment within acceptable limits. Thus, operating existing pumping infrastructure under Alternatives A1 and A2 with the RPAs in place would not violate or contribute substantially to an existing or projected air quality violation, expose sensitive receptors to substantial pollutant concentrations, or conflict with air quality planning effects. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Impact AIR-4 (Alternatives A1 and A2): ***Exposure of Sensitive Receptors to Odor Emissions – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, short- and long-term odor emissions from mobile, area, and stationary sources associated with Alternatives A1 and A2 would not expose a substantial number of sensitive receptors to objectionable odors. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, some exposure of sensitive receptors to short-term odor sources, such as emissions from diesel equipment, would occur under Alternatives A1 and A2 as a result of construction activities. Construction activities would not be affected by the RPAs. Long-term odor sources would be related to evaporating water and anaerobic digestion processes caused by standing pools of water, or to the operation of a new hatchery. These long-term odor sources would occur within the Restoration Area. Impacts occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. Thus, Alternatives A1 and A2 with the RPAs in place would not expose a substantial number of sensitive receptors to objectionable odors. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

4.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to air quality would be considered potentially significant if the program alternatives would violate an air quality standard, contribute substantially to an existing or projected air quality violation, or conflict with or obstruct implementation of the California Air Resources Board (ARB) and SJVAPCD air planning efforts, or expose a substantial number of sensitive receptors to objectionable odors.

Impact AIR-5 (Alternatives A1 and A2): ***Construction-Related Emissions of Criteria Air Pollutants and Precursors – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. No temporary or short-term construction-related emissions would occur as a result of the project-level actions under Alternatives A1 and A2, and this would not change with the RPAs in place. The significance conclusion of this impact **would not change** from the Draft PEIS/R, and there would be no impact.

Impact AIR-6 (Alternatives A1 and A2): ***Operations-Related Emissions of Criteria Air Pollutants and Precursors – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Long-term operations-related emissions from mobile, area, and stationary sources associated with Alternatives A1 and A2 would not be expected to generate criteria air pollutants or precursors in excess of SJVAPCD thresholds because these stationary sources would be subject to SJVAPCD's permitting process for keeping emissions from equipment within acceptable limits, and this would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact AIR-7 (Alternatives A1 and A2): ***Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Pollutant emissions resulting from flow releases related to implementing any action alternative would not create substantial levels of TACs, and this would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Implementing project-level flows under any action alternative would not result in any stationary or area sources of TACs. Because virtually no new stationary or area sources would be created, TAC emissions would not expose sensitive receptors to substantial pollutant concentrations. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Impact AIR-8 (Alternatives A1 and A2): ***Exposure of Sensitive Receptors to Odor Emissions – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Pollutant emissions resulting from project-level actions under Alternatives A1 and A2 would not create substantial and objectionable odors and this would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Implementing project-level flows under any action alternative would not result in any major stationary or area sources of odors. Any odors related to increasing flows, such as odors from decaying aquatic vegetation or areas of standing water, would be local and minor. Any odors would be intermittent and would decrease rapidly with distance. Because of the minor and localized nature of any created odors, sensitive receptors are not anticipated to be exposed to objectionable odor concentrations. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Chapter 5.0 Biological Resources – Fisheries

This chapter describes the potential for impacts of Alternatives A1 and A2 to the fisheries under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 5.0 of the Draft PEIS/R, "Biological Resources – Fisheries." The discussion of potential impacts on fisheries presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 5.1, "Historical Perspective" –** Describes the historical conditions of aquatic habitat and fish communities in the San Joaquin River.

- **Section 5.2, "Environmental Setting" –** Describes existing fisheries conditions along the San Joaquin River upstream from Friant Dam, within the Restoration Area, along the San Joaquin River from the Merced River to the Delta, and within the Delta. Implementation of the Settlement is not anticipated to cause impacts to fisheries in CVP/SWP service areas.

- **Section 5.3, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to fisheries conditions.

- **Section 5.4, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to fisheries conditions to occur, the significance criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 5-1. As shown in Table 5-1, none of the potential impact conclusions of Alternatives A1 and A2 on fisheries would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 5.4 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 5-1.

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Fisheries: Program-Level						
FSH-1: Changes in Water Temperatures in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-2: Changes in Pollutant Discharge in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-3: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-4: Construction-Related Changes in Habitat Conditions in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Program-Level (contd.)						
FSH-5: Displacement from Preferred or Required Habitat, Injury, or Mortality in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-6: Changes in Habitat Conditions in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-7: Changes in Diversions and Entrainment in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-8: Changes in Predation Levels in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-9: Changes in Food Web Support in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Program-Level (contd.)						
FSH-10: Effects to Fall-Run Chinook Salmon from Hybridization Resulting from Reintroduction of Spring-Run Chinook Salmon to the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-11: Effects of Disease on Fisheries in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-12: Changes in Diversions and Entrainment in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
FSH-13: Changes in Water Temperatures in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Biological Resources – Fisheries: Program-Level (contd.)						
FSH-14: Displacement from Preferred or Required Habitat, Injury, or Mortality in the San Joaquin River Between Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
Biological Resources – Fisheries: Project-Level						
FSH-15: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Upstream from Friant Dam	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-16: Changes in Pollutant Discharge and Mobilization in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]
FSH-17: Changes in Sediment Discharge and Turbidity in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-18: Changes in Fish Habitat Conditions in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-19: Changes in Diversions and Entrainment in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-20: Changes in Predation Levels in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-21: Changes in Food Web Support in the San Joaquin River Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-22: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-23: Changes in Pollutant Discharge and Mobilization in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-24: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	No-Action	PS	--	PS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-25: Changes in Fish Habitat Conditions in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-26: Changes in Diversions and Entrainment in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FSH-27: Changes in Predation Levels in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-28: Changes in Food Web Support in the San Joaquin River Between Friant Dam and the Merced River	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
FSH-29: Effects of Disease on Fisheries in the San Joaquin River Between the Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-30: Changes in Chinook Salmon and Steelhead Habitat in the Merced, Tuolumne, and Stanislaus Rivers	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-31: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the Delta	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-32: Changes in Pollutant Discharge and Mobilization in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
FSH-33: Changes in Sediment Discharge and Turbidity in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 5-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Fisheries: Project-Level (contd.)						
FSH-34: Changes in Fish Habitat Conditions in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
FSH-35: Changes in Diversions and Entrainment in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-36: Changes in Predation Levels in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
FSH-37: Changes in Food Web Support in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-38: Salinity Changes in the Delta	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
FSH-39: Changes to Delta Inflow and Flow Patterns in the Delta	No-Action	PS	--	PS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key
-- = not applicable
CVP = Central Valley Project
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative
SU = significant and unavoidable
SWP = State Water Project

5.1 Program-Level Impacts

The potential program-level impact to fisheries as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

As described in Chapter 5.0 of the Draft PEIS/R, "Biological Resources – Fisheries," effects on fish would be considered significant if implementation, operation, or maintenance would do the following:

- Have a substantial adverse impact, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by California Department of Fish and Game (DFG), USFWS or NMFS.
- Interfere substantially with the movement of any native resident or migratory fish.
- Cause production and/or discharge of materials that pose a hazard to fish.
- Result in displacement of spawning fish such that year-class strength of any Federal or State special-status fish species or any commercially important fish species is substantially reduced.
- Substantially reduce the abundance, either directly or by reducing the amount or quality of habitat, of any life stage of a Federal or State special-status species or any commercially important fish species.
- Adversely modify designated critical habitat for any Federally listed species.

Impacts FSH-1 through FSH-9 occur between Friant Dam and the Merced River confluence. These impacts would not change with the RPAs in place, as described in Chapter 1.0, "Introduction." Therefore, these impacts are not discussed further in this chapter.

Impact FSH-10 (Alternatives A1 and A2): ***Effects to Fall-Run Chinook Salmon from Hybridization Resulting from Reintroduction of Spring-Run Chinook Salmon to the Restoration Area – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Under Alternatives A1 and A2, reintroduction of spring-run Chinook salmon could result in compromised genetic integrity and fitness of wild fall-run Chinook salmon stocks in the Merced, Tuolumne, and Stanislaus rivers if interbreeding between wild and hatchery fish occurred. Spring-run Chinook salmon tend to spawn between

August and October, while fall-run Chinook salmon generally spawn from October through December. Therefore, there is potential for some degree of hybridization between the two runs. A stock selection plan is being drafted by the Fisheries Management Work Group, along with a Hatchery and Genetics Management Plan, to help minimize potential genetic impacts to salmonids in the San Joaquin River and its tributaries. The RPAs would not change the potential for hybridization to occur. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact FSH-11 (Alternatives A1 and A2): ***Effects of Disease on Fisheries in the San Joaquin River Between the Merced River and the Delta – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Under Alternatives A1 and A2, reintroduced spring-run Chinook salmon could serve as disease sources and result in a disease outbreak among wild fall-run Chinook salmon in the major San Joaquin River tributaries. Disease organisms could be carried by broodstock from sources in the Sacramento River Basin, or by hatchery fish used to supplement the reintroduced spring-run Chinook salmon population. This could lead to direct mortality or reduced fecundity for the tributary populations of fall-run Chinook salmon because of disease. The RPAs would not change the potential for reintroduced spring-run Chinook salmon to spread disease or disease organisms. Implementing conservation measure SRCS-1 in the Conservation Strategy would reduce this impact to less than significant. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact FSH-12 (Alternatives A1 and A2): ***Changes in Diversions and Entrainment in the San Joaquin River Between the Merced River and the Delta – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, diversions and entrainment in the San Joaquin River between the Merced River and the Delta would not be affected by program-level actions under Alternatives A1 and A2. The impact conclusion **would not change** from the Draft PEIS/R, and would remain have no impact.

Impact FSH-13 (Alternatives A1 and A2): ***Changes in Water Temperatures in the San Joaquin River Between the Merced River and the Delta – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, water temperatures in the San Joaquin River between the Merced River and the Delta would not be affected by program-level actions under Alternatives A1 and A2. The impact conclusion **would not change** from the Draft PEIS/R, and would have no impact.

Impact FSH-14 (Alternatives A1 and A2): ***Displacement from Preferred or Required Habitat, Injury, or Mortality in the San Joaquin River Between Merced River and the Delta – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. Construction activities within the channel, along the riverbank, and in adjacent floodplains that have the potential to displace representative special-status and game fish species from preferred or required habitats would not occur under Alternatives A1 and A2, and would not change with the RPAs in place. The impact conclusion **would not change** from the Draft PEIS/R, and would have no impact.

5.2 Project-Level Impacts

Impacts FSH-15 through FSH-28 would occur between Friant Dam and the Merced River confluence. Therefore, these impacts would not change with implementation of the RPAs.

Impact FSH-29 (Alternatives A1 and A2): ***Effects of Disease on Fisheries in the San Joaquin River Between the Merced River and the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Implementing Interim and Restoration flows would provide access by San Joaquin River Basin fall-run Chinook salmon and steelhead to all reaches of the San Joaquin River from Friant Dam to the Merced River. The restoration of connectivity between these currently isolated populations has the potential to increase the risk of disease transmission, which could result in mortality or reduced fitness of San Joaquin River Basin fall-run Chinook salmon and steelhead. The main risk of the spread of disease is associated with the aquatic worm harvesting operation near the San Joaquin Fish Hatchery. The potential for the release of Interim and Restoration flows to indirectly lead to the spread of disease between currently isolated populations of salmonids would not change with the RPAs in place. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, the main risk of the spread of disease is associated with the aquatic worm harvesting operation near the San Joaquin Fish Hatchery. The aquatic worms feed on the solid waste from the hatchery's effluent. Findings from a preliminary study conducted by DFG in 2009 indicated that the dominant oligochaete harvested at the site is from the Family Lumbriculidae, though a small percentage of tubifex worms were observed (P. Adelizi pers. com.). The tubifex worm has been identified as the only known host of *Myxobolus cerebralis,* a parasite that causes whirling disease in salmonids. Although *Myxobolus cerebralis* is present in several watersheds in California, no adverse effects on salmon or trout populations have been observed in California (Modin 1998). In general, rainbow trout are more susceptible to the disease than steelhead (O'Grodnick 1979, Hoffman 1990). Furthermore, susceptibility to infection varies among stocks and individual fish (Markiw 1992). This impact was found to be less than significant in the Draft PEIS/R.

The potential for the release of Interim and Restoration flows to indirectly lead to the spread of disease between currently isolated populations of salmonids would not change with the RPAs in place. The impact conclusion **would not change** from the Draft PEIS/R from the Draft PEIS/R, and would remain less than significant.

Impact FSH-30 (Alternatives A1 and A2): ***Changes in Chinook Salmon and Steelhead Habitat in the Merced, Tuolumne, and Stanislaus Rivers – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, under Alternatives A1 and A2 flows in the tributaries would be similar to or greater than under the No-Action Alternative under all potential hydrologic conditions, and would almost always either meet the target flows. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, because all three tributary rivers share the responsibility of meeting VAMP flow requirements, the increase in the San Joaquin River flows caused by Interim and Restoration flows could cause changes in operations on all three tributaries. Only the New Melones Reservoir on the Stanislaus River is operated to meet the Vernalis water quality standard. Criteria for determining impacts to tributary fish were based on the flows in each tributary that are believed to provide the maximum habitat for each life stage of Chinook salmon and Central Valley steelhead. These flows, identified in Table 5-2 (Table 5-11 in the PEIS/R), were identified by NMFS based on several sources, including two instream flow incremental methodology studies conducted to calculate maximum weighted usable area of habitat for each life stage, studies conducted for FERC relicensing projects, and DFG modeling (USFWS 1993 and 1995, and 1997, DFG 2005, NMFS 2009).

Table 5-2.
Tributary Flows Assumed to Provide Maximum Habitat

Time Frame	Life Stage	Flow (cfs)
Merced River Chinook Salmon/Steehead[1]		
October 1 – December 31	Spawning	400
January 1 – March 15	Incubation/fry rearing	400
March 16 – June 15	Juvenile Rearing/Migration	1,500
June 15 – October 31	Juvenile rearing/Adult (steelhead)	250
Tuolumne River Chinook Salmon[2]		
October 1 – April 30	Spawning/Incubation/Fry Rearing	275
February 1 – October 31	Juvenile Rearing	150
January 1 – June 30	Juvenile Migration	1,100
Tuolumne River Steelhead[2]		
January 1 – December 31	All life stages	275
March 15 – June 30	Juvenile Migration	1,100
Stanislaus River Chinook Salmon[3]		
October 15 – December 31	Spawning	300
January 1 – February 28	Incubation/Fry Rearing	300
February 15 – March 15	Juvenile Rearing	200
March 15 – June 30	Juvenile Migration	2,000
Stanislaus River Steelhead[3]		
November 1 – Feb 28	Spawning	200
January 1 – March 31	Incubation/Fry Rearing	200
January 1 – December 31	Juvenile Rearing	150
March 15 – June 30	Juvenile Migration	2,000

Sources: USFWS 1993 and 1995, and 1997, DFG 2005, NMFS 2009

Notes:

[1] Because information is limited on steelhead, flows needed for Chinook salmon and steelhead are combined. Flows are based on information from the 1997 spawning habitat instream flow assessment and flow recommendations from the Anadromous Fish Restoration Program.

[2] Flows are based on the Stanislaus River Instream Flow Incremental Methodology report, and from results of the California Department of Fish and Game Chinook model.

[3] Flows are based on the Stanislaus River Instream Flow Incremental Methodology report, and from the 2009 Operations Criteria and Plan Biological Opinion– below-normal year

Key:
cfs = cubic feet per second

As described in the Draft PEIS/R, under Alternatives A1 and A2 flows on the tributaries would almost always either meet the target or, if not, then would not change from the No-Action Alternative or existing conditions. Flows on the tributaries compare to the target flows as follows:

- **Merced River –** In April of above-normal water years (San Joaquin Valley 60-20-20 Index), Merced River flows under Alternatives A1 and A2 are lower than under the No-Action Alternative. The decreases in flow in the Merced River that would occur in April of above normal water years, caused by the reservoirs refilling, would improve the ability to fill the reservoir occurring under the conditions in the action alternatives. This refilling of the reservoir would provide cooler water for release later in the year than would otherwise be available. For all life stages of Chinook salmon and steelhead, there are no differences in meeting the flow requirements from those described in the Draft PEIS/R and summarized above.

- **Tuolumne River –** Flows in the Tuolumne River would meet target flows under Alternatives A1 and A2. For each species and life stage, there are no differences in meeting the flow requirements from those described in the Draft PEIS/R and summarized above.

- **Stanislaus River –** Under the No-Action Alternative, simulated flows on the Stanislaus River in March of critical, dry and below normal water years (San Joaquin Valley 60-20-20 Index) would not always meet the flow standard set for migrating Chinook salmon and steelhead (2,000 cfs). Similarly, simulated flows on the Stanislaus River in March of critical, dry and below normal water years (San Joaquin Valley 60-20-20 Index) would not always meet the flow standard set for migrating Chinook salmon and steelhead (2,000 cfs) for Alternatives A1 and A2. Therefore, it is reasonable to anticipate that under Alternatives A1 and A2, flows would be released from New Melones Dam to benefit or minimize impacts to Stanislaus River salmonids. For both Chinook salmon and steelhead in all life stages, there are no differences in meeting the flow requirements from those described in the Draft PEIS/R and summarized above.

Because the tendency for flows on the tributaries to meet the flow targets for each species and life stage would not change with the RPAs in place, the impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact FSH-31 (Alternatives A1 and A2): *Changes in Water Temperatures and Dissolved Oxygen (DO) Concentrations in the Delta – Project-Level.* This impact was found to be less than significant in the Draft PEIS/R. With the implementation of the RPAs, Alternatives A1 and A2 would increase inflow from the San Joaquin River to the Delta during adult migration and smolt emigration periods of fall-run Chinook salmon and steelhead. Increased inflow is expected to have no effect on water temperatures in the Delta. Increased inflow is expected to improve DO conditions for migration of adult salmon and steelhead in the San Joaquin River. The improved conditions would likely have a beneficial effect on Central Valley fall-run Chinook salmon and Central Valley steelhead. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, the San Joaquin side of the Delta (south Delta) often has poor water temperature conditions for Delta fishes, especially during late summer and early fall (Nobriga et al. 2008, Feyrer 2004, Kimmerer 2004). Water temperatures are especially important for Chinook salmon and steelhead adults that migrate upstream in the San Joaquin River beginning in late summer, and smolts that migrate downstream through the Delta in the spring, because these fish have lower temperature tolerances than other Delta fish species. San Joaquin River inflow is expected to slightly increase during

October and November of all year types for all action alternatives, as shown in Figures 5-1 (Figure 5-7 of the Draft PEIS/R). Increased inflow is expected to have no effect on water temperatures in the Delta, while increased inflow is expected to improve DO conditions for migration of adult salmon and steelhead in the San Joaquin River. This impact was found to be less than significant in the Draft PEIS/R.

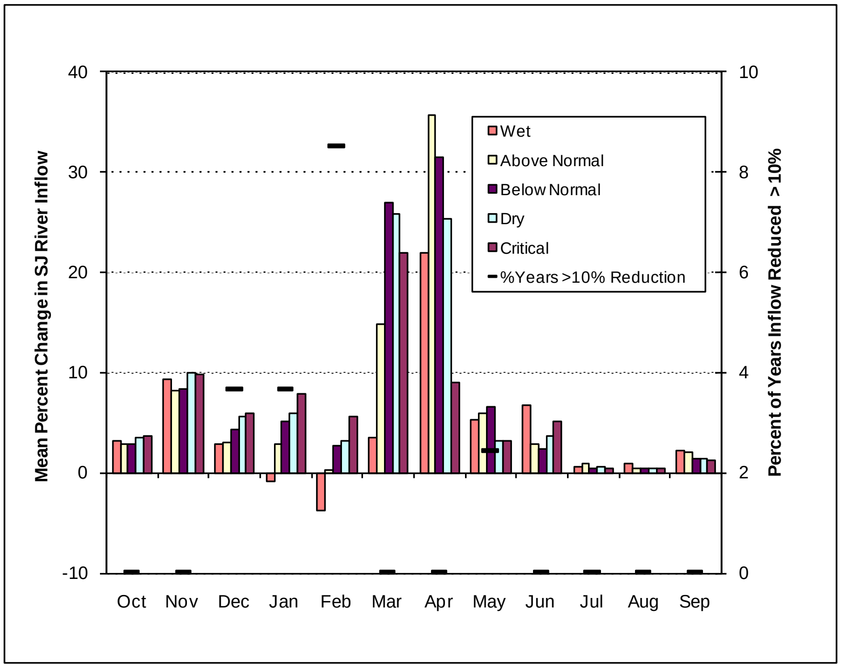
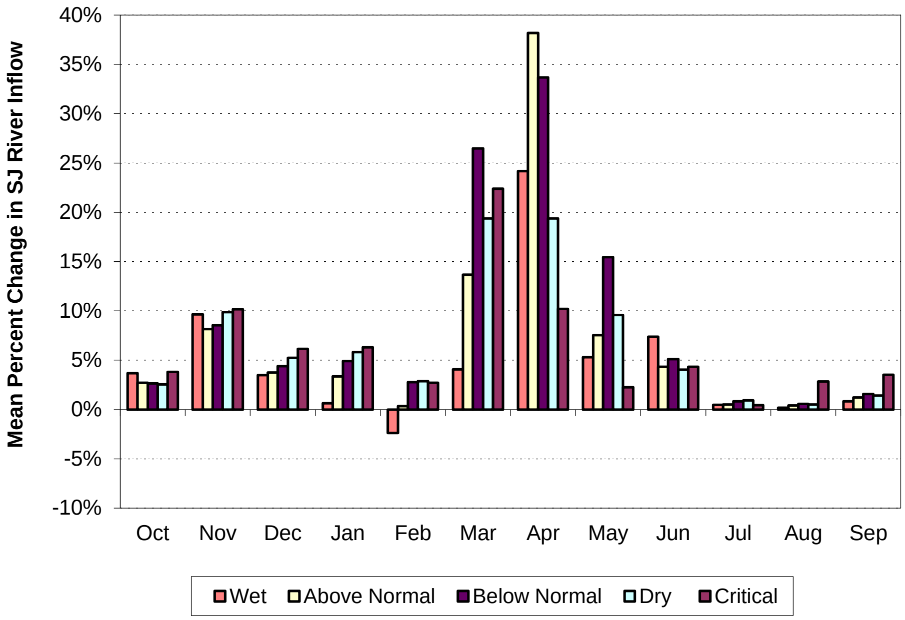


Figure 5-1.
Figure 5-7 of the Draft PEIS/R: Mean Percent Changes in San Joaquin River Flow at Vernalis and Percent of Years with Flow Reductions Greater Than 10 Percent Between Existing Conditions and Alternatives A1 Through C2, 2005 Level of Development

With the implementation of the RPAs, Alternatives A1 and A2 would typically increase San Joaquin River flow at Vernalis in May of Above Normal, Below Normal, and Dry water years, as shown in Figure 5-2. Alternatives A1 and A2 would result in greater than 10 percent flow reductions in some years, most typically in February, as shown in Table 5-3. Little change in inflow is expected in June through September under most RPA scenarios (see Chapter 3.0 of this Appendix, “Tools and Methodology,” for additional information on the RPA scenarios).

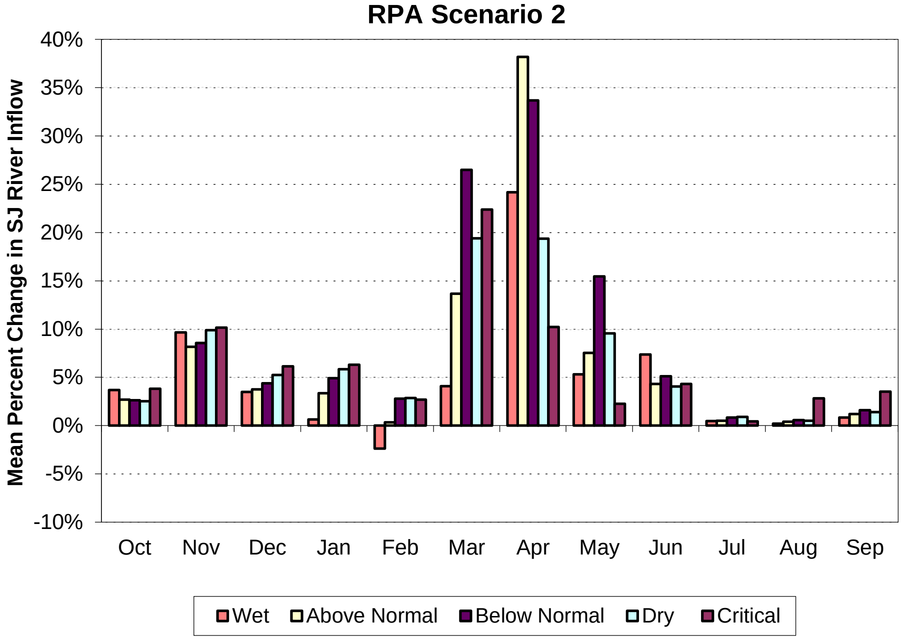
With the RPAs in place, the changes in inflow, and thus the changes in temperature and DO, would be similar under Alternatives A1 and A2 to those described in the Draft PEIS/R. The impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Changes Due to the Alternatives A1 and A2
RPA Scenario 1



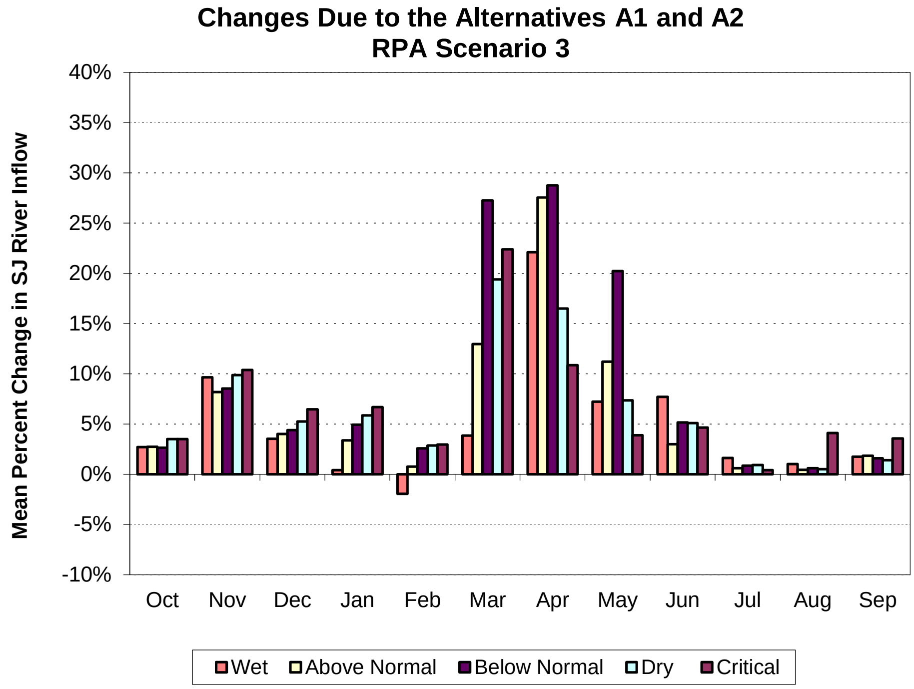
Key:
RPA = reasonable and prudent alternative

Changes Due to the Alternatives A1 and A2
RPA Scenario 2

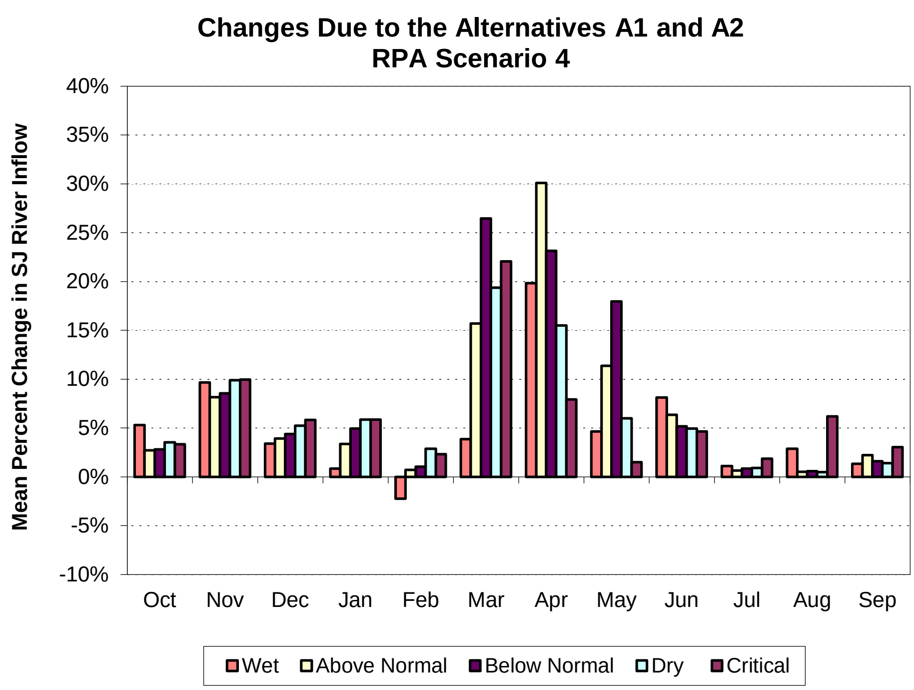


Key:
RPA = reasonable and prudent alternative

Figure 5-2.
Mean Percent Changes in San Joaquin River Flow at Vernalis

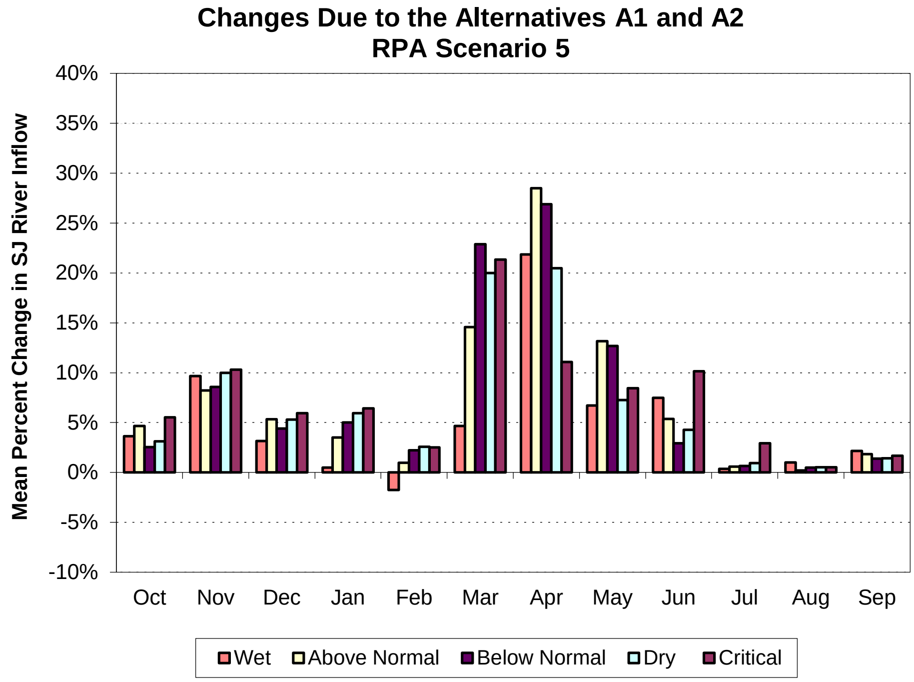


Key:
RPA = reasonable and prudent alternative

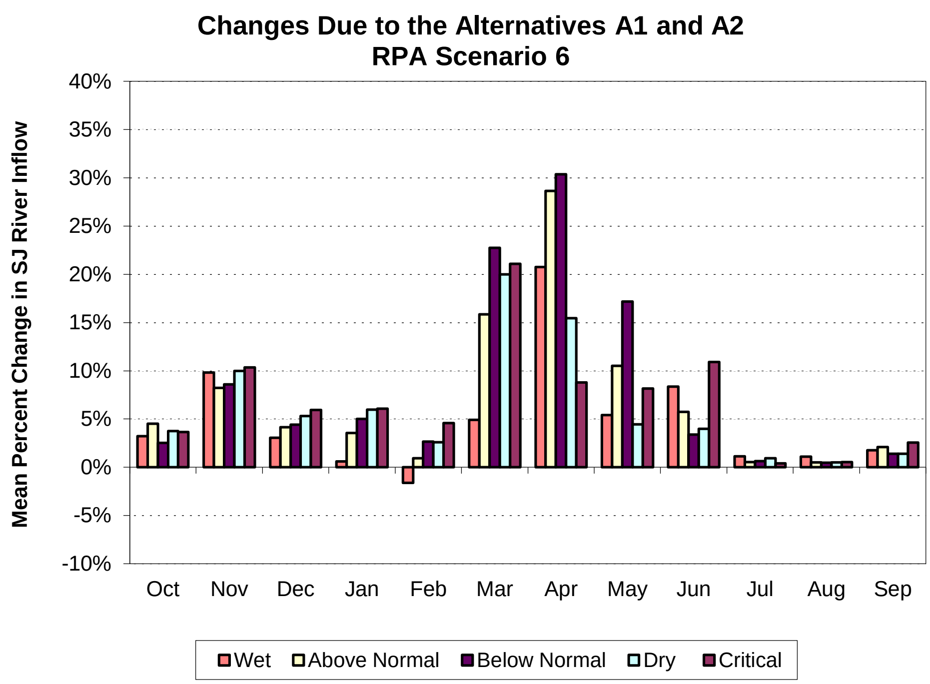


Key:
RPA = reasonable and prudent alternative

Figure 5-2.
Mean Percent Changes in San Joaquin River Flow at Vernalis (contd.)



Key:
RPA = reasonable and prudent alternative



Key:
RPA = reasonable and prudent alternative

Figure 5-2.
Mean Percent Changes in San Joaquin River Flow at Vernalis (contd.)

Table 5-3.
Percentage of Years for Which San Joaquin River Flows Decreased by More than 10 Percent

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Draft PEIS/R	0	0	2	4	9	0	0	1	0	0	0	0
RPA 1	0	0	0	1	2	0	0	1	0	0	0	0
RPA 2	2	2	1	2	5	2	0	0	6	0	2	6
RPA 3	1	0	0	1	5	0	0	1	0	0	0	0
RPA 4	0	0	0	1	4	0	1	2	0	0	0	0
RPA 5	0	0	0	1	5	0	0	1	0	0	0	0
RPA 6	0	0	0	1	4	0	0	1	0	0	0	0

Key:
PEIS/R = Programmatic Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

Impact FSH-32 (Alternatives A1 and A2): ***Changes in Pollutant Discharge and Mobilization in the Delta – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the implementation of the RPAs, under Alternatives A1 and A2 a minor local reduction in pollutants at the confluence of the San Joaquin River with the Delta would occur. This reduction would provide a less than significant and beneficial effect on Delta fishes. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

As described in the Draft PEIS/R, Alternatives A1 through C2 would increase San Joaquin River flow into the Delta. Water quality modeling results show that the increased flow would dilute salinity of San Joaquin River inflow (see Chapter 14.0 of the Draft PEIS/R, “Hydrology – Surface Water Quality”). Other pollutants in the river would be similarly diluted. This effect does not extend very far into the Delta, perhaps because much of the increased San Joaquin River water volume entering the Delta would be offset by exports at the Jones and Banks pumping plants. The dilution of pollutants is expected to have a localized beneficial effect on Delta fishes. This impact was found to be less than significant and beneficial in the Draft PEIS/R.

With the RPAs in place, Alternatives A1 and A2 would typically increase San Joaquin River flow at Vernalis, as previously described for Impact FSH-32. Water quality modeling results show that the increased flow would dilute salinity of San Joaquin River inflow (see Chapter 14.0 of this Appendix, “Hydrology – Surface Water Quality”). The impact conclusion would not change from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact FSH-33 (Alternatives A1 and A2): ***Changes in Sediment Discharge and Turbidity in the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the implementation of the RPAs, Alternatives A1 and A2 would not directly affect turbidity in the Delta, but could indirectly affect Delta fishes by moving fish away from the south Delta, where turbidity is generally low compared to other parts of the Delta. This indirect impact is expected to be less than significant to Delta fish species, including delta smelt and longfin smelt. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, Alternatives A1 through C2 would likely have a persistent indirect effect on the average turbidity to which Delta fishes would be exposed. The south Delta has turbidities substantially lower than other regions of the Delta (Nobriga et al. 2008). Alternatives A1 through C2 are not expected to affect this turbidity, but Alternatives A1 through C2 are expected to affect flow patterns in the south Delta by moving fish away from the south Delta, where turbidity is generally low compared to other parts of the Delta. Enhanced turbidity affords small-bodied fish species and life stages favorable conditions for reducing predation and enhancing feeding. This impact was found to be less than significant in the Draft PEIS/R.

With the implementation of the RPAs, Alternatives A1 and A2 would have similar effects on flow patterns in the south Delta as those described in the Draft PEIS/R. These flow patterns are expected to move fish away from the south Delta. This indirect impact is expected to be less than significant to Delta fish species, including delta smelt and longfin smelt. The impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Impact FSH-34 (Alternatives A1 and A2): ***Changes in Fish Habitat Conditions in the Delta – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the implementation of the RPAs, Alternatives A1 and A2 are expected to cause no direct effect on habitat connectivity in the Delta, but could potentially reduce the chances of fish entering the south Delta, where seasonally-installed barriers to control water levels and water quality may impede their migrations. Large fish such as adult Central Valley fall-run Chinook salmon and green and white sturgeon are especially vulnerable to the effects of such barriers. Additional protection would be provided to the fish because the action alternatives would be operated consistent with applicable laws, regulations, BOs, and court orders in place at the time the water was recaptured. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact FSH-35 (Alternatives A1 and A2): ***Changes in Diversions and Entrainment in the Delta– Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the implementation of the RPAs, Alternatives A1 and A2 would increase Delta exports during most months and water year types. The increased diversions would result in higher entrainment risks for fish located in the south Delta. However, increased San Joaquin River inflows, and ratios of the inflows to reverse flows predicted for Alternatives A1 and A2, are expected to reduce the number of fish at risk of entrainment. The increased risk of fish entrainment in the south Delta is expected to be somewhat offset by the reduction in numbers of fish at risk. Therefore, the impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, Alternatives A1 and A2 would result in increased diversions at Jones and Banks pumping plants during most months and year types, with especially large increases during April of all except Wet water year types, as shown in Figures 5-3 (Figures 5-9 of the Draft PEIS/R). The greatest increases (about 23 percent) are predicted for Dry water year types in February (Figure 5-3). April is expected to have the highest percent of years (more than 40 percent) with an increase in monthly Jones and Banks pumping plant diversion rates of greater than 10 percent. The higher diversion rates are expected to result in greater entrainment risk for fish in the south Delta. However, Alternatives A1 through C2 would increase San Joaquin River inflows, and the ratio of inflows to reverse flows, in Old and Middle rivers, which would help keep fish away from the south Delta. This effect of the increased inflows and ratios is expected to offset the increased entrainment risk of south Delta fish from increased exports, resulting in no net change in fish entrainment. This impact was found to be less than significant in the Draft PEIS/R.

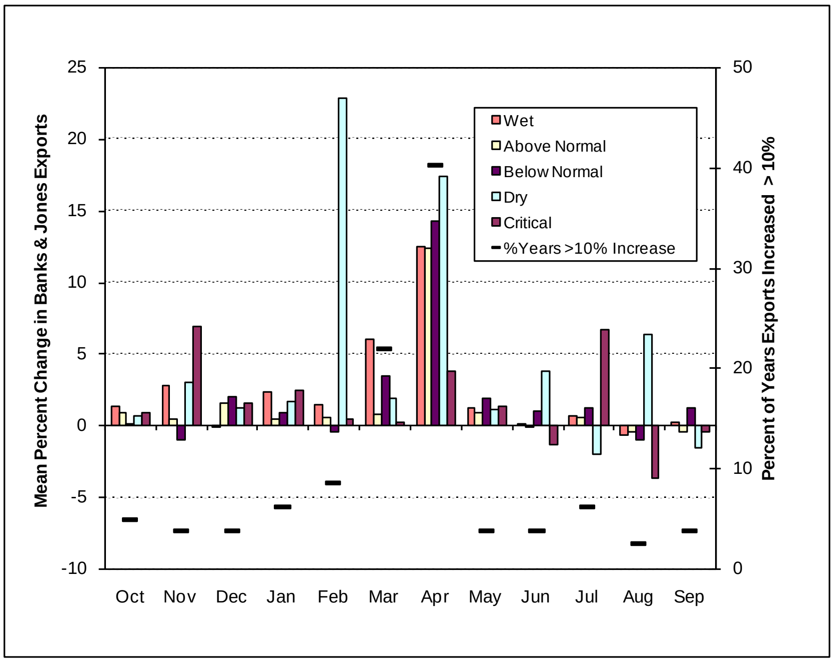
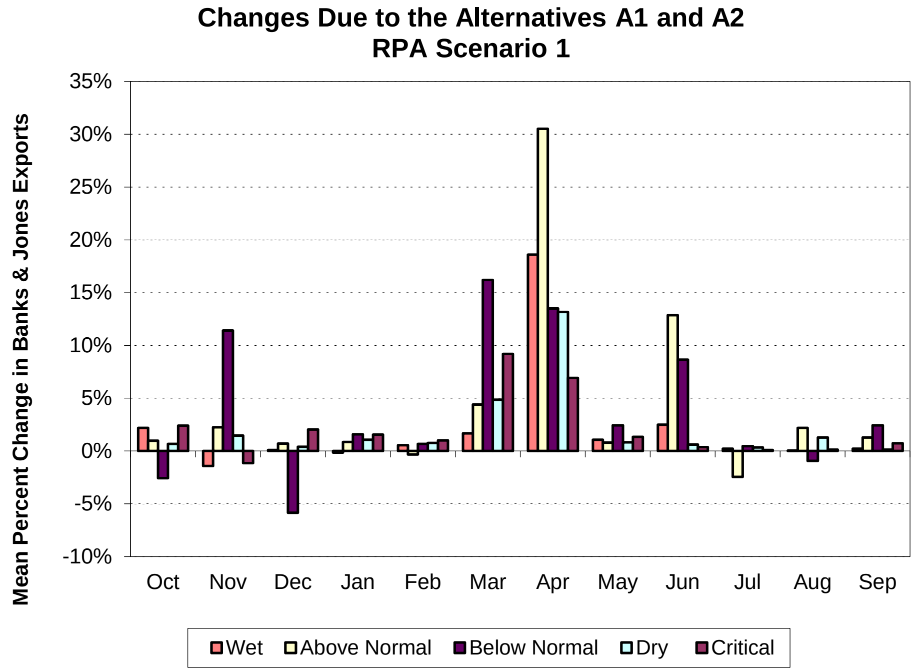


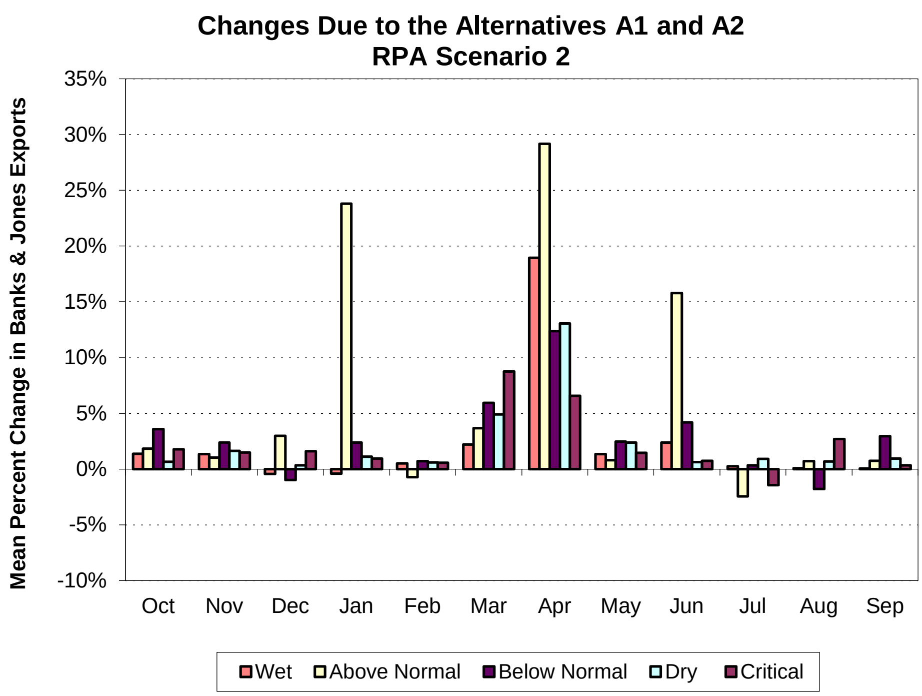
Figure 5-3.

Figure 5-9 of the Draft PEIS/R: Mean Percent Changes in Diversions at Banks and Jones Facilities and Percent of Years with Diversion Increases Greater Than 10 Percent Between Existing Conditions and Alternatives A1 Through C2, 2005 Level of Development

With the RPAs in place, Jones and Banks diversions would increase under Alternatives A1 and A2, as shown in Figure 5-4 and Table 5-4 while the ratio of San Joaquin River flow to diversions would decrease, as shown in Figure 5-5 and Table 5-5. The largest changes would occur in March, April, May, and June, when larval delta smelt and longfin smelt and juvenile steelhead and Chinook salmon are present in the Delta. These are the life stages most vulnerable to entrainment, suggesting that with the RPAs in place, Alternatives A1 and A2 would result in greater risk of fish entrainment than without the RPAs in place. In most water year types, April and May reverse OMR flows would increase (i.e., were more negative), as shown in Figure 5-6 and Table 5-6, increasing the risk of entrainment for fish in the south Delta. However, the ratio of San Joaquin River flow to OMR flow would also increase, as shown in Figure 5-7 and Table 5-7, which would help keep fish away from the south Delta. These changes are expected to reduce movement of fish into the south Delta and to reduce vulnerability to entrainment in the Jones and Banks diversions. The impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

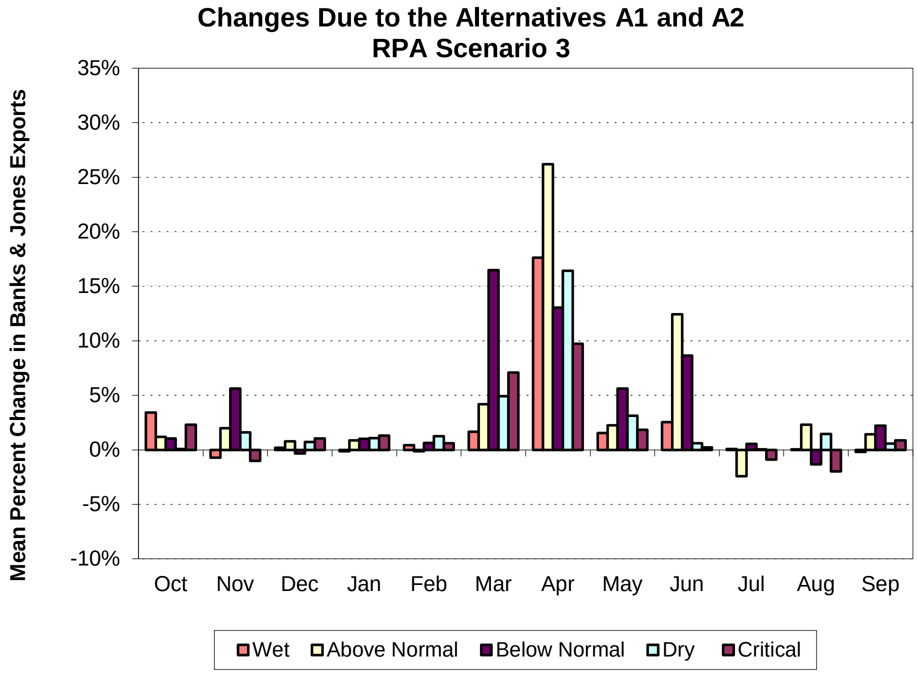


Key:
RPA = reasonable and prudent alternative

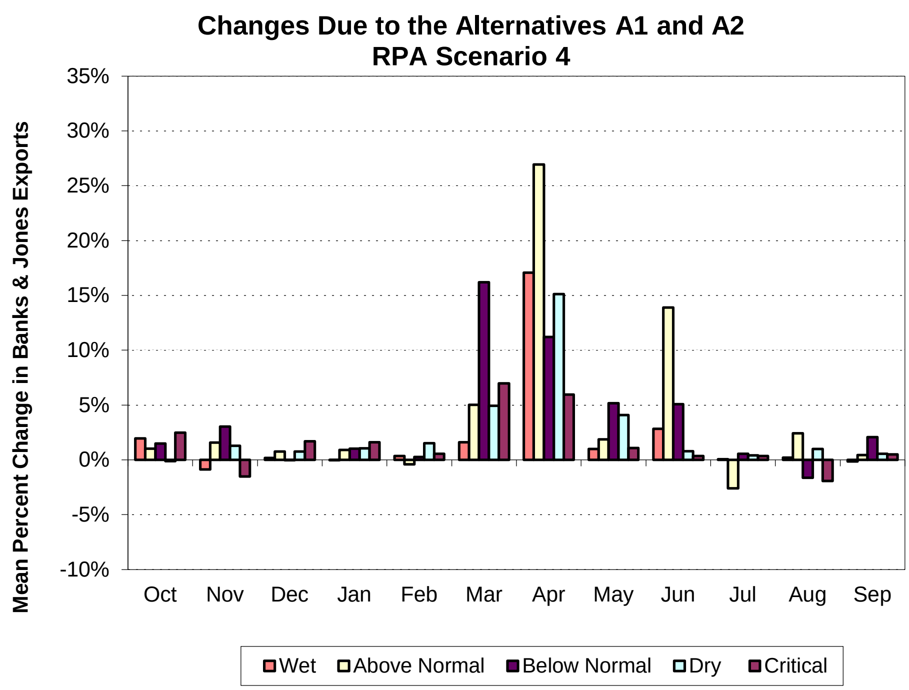


Key:
RPA = reasonable and prudent alternative

Figure 5-4.
Mean Percent Changes in Diversions at the Jones and Banks Facilities

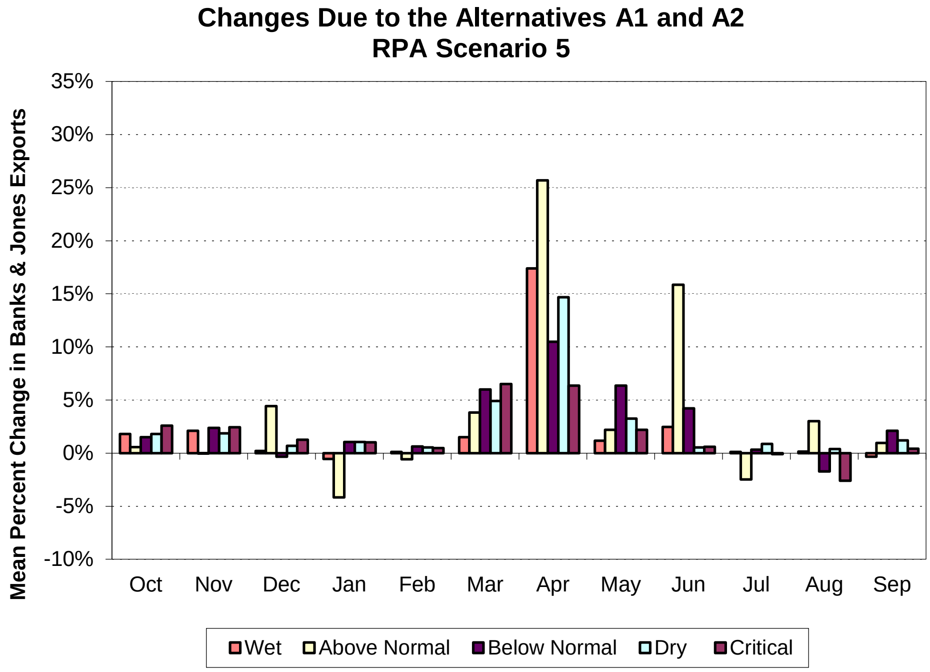


Key:
RPA = reasonable and prudent alternative

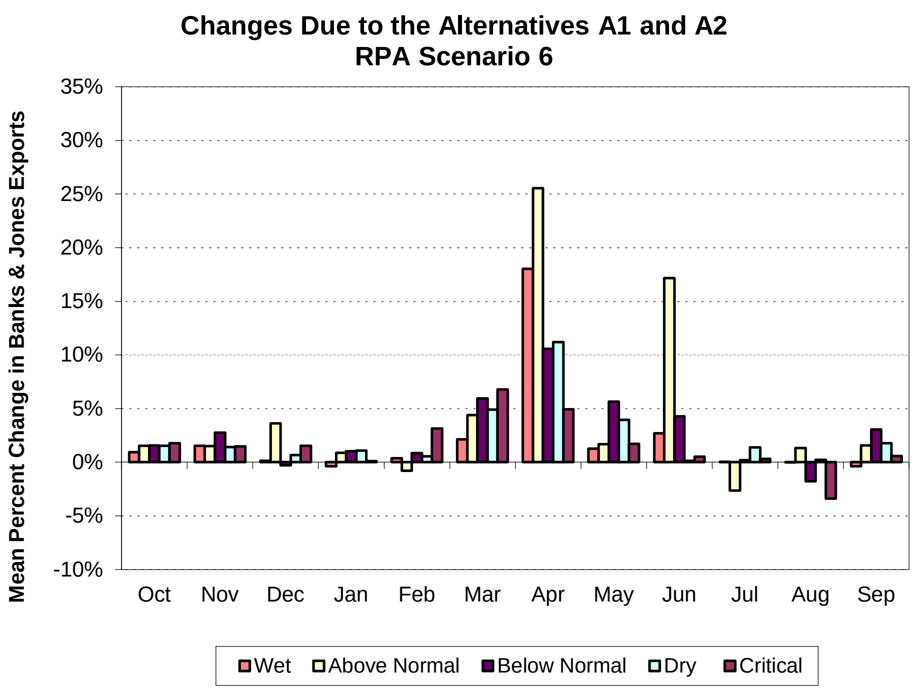


Key:
RPA = reasonable and prudent alternative

Figure 5-4.
Mean Percent Changes in Diversions at the Jones and Banks Facilities (contd.)



Key:
RPA = reasonable and prudent alternative



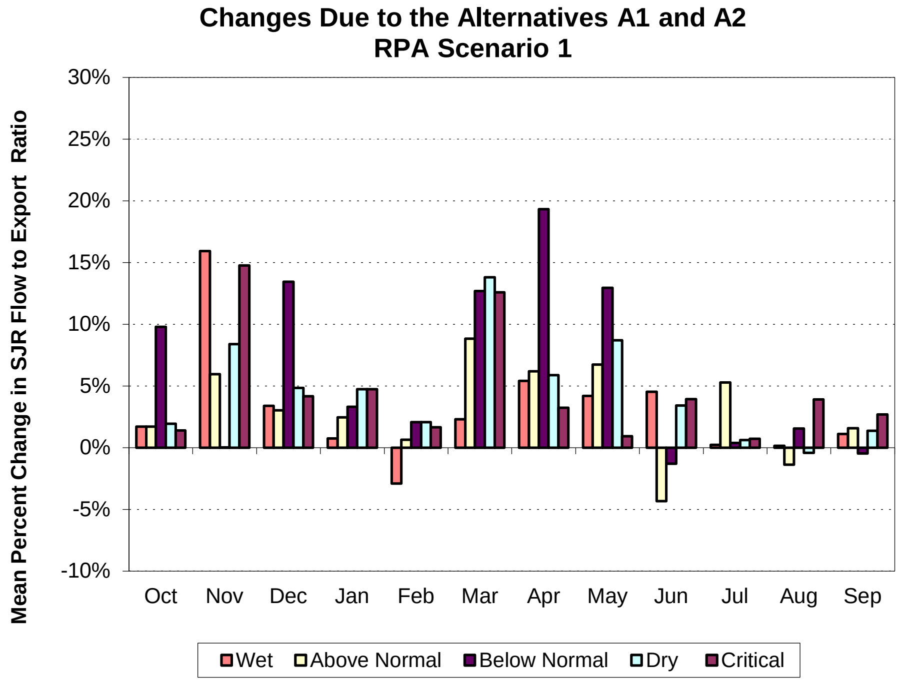
Key:
RPA = reasonable and prudent alternative

Figure 5-4.
Mean Percent Changes in Diversions at the Jones and Banks Facilities (contd.)

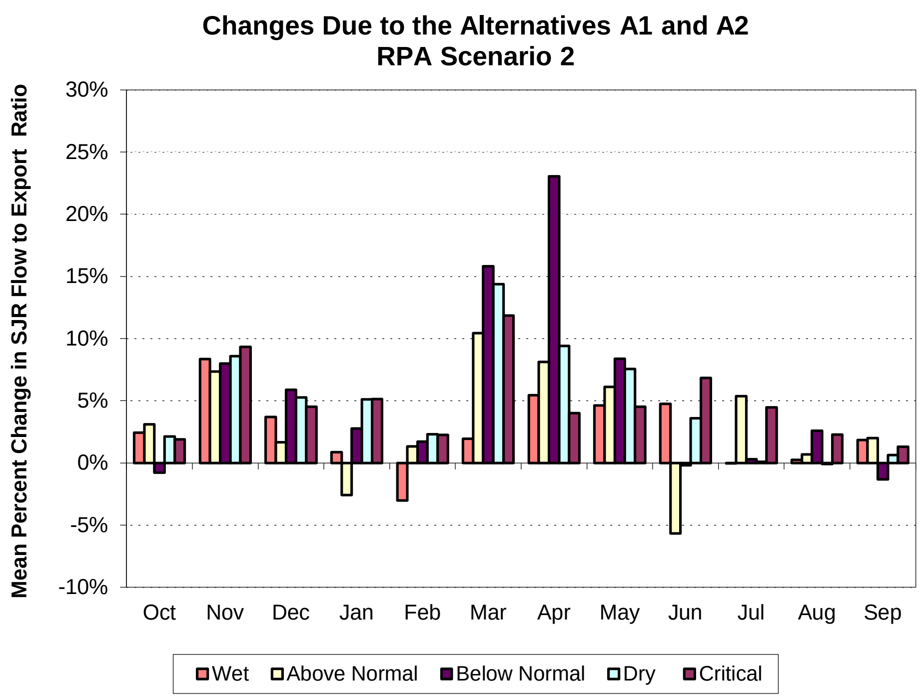
Table 5-4.
Percentage of Years for Which Diversions Increased by More Than 10 Percent

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Draft PEIS/R	6	4	5	7	9	23	40	5	4	6	4	4
RPA 1	4	9	1	1	0	10	63	5	7	1	4	6
RPA 2	4	9	2	2	2	9	63	6	7	1	4	6
RPA 3	6	6	2	1	0	7	62	11	9	1	2	7
RPA 4	5	4	1	1	1	10	54	11	9	1	4	5
RPA 5	5	5	2	0	1	6	57	12	9	2	2	5
RPA 6	1	4	2	0	1	10	52	12	10	1	1	6

Key:
PEIS/R = Programmatic Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

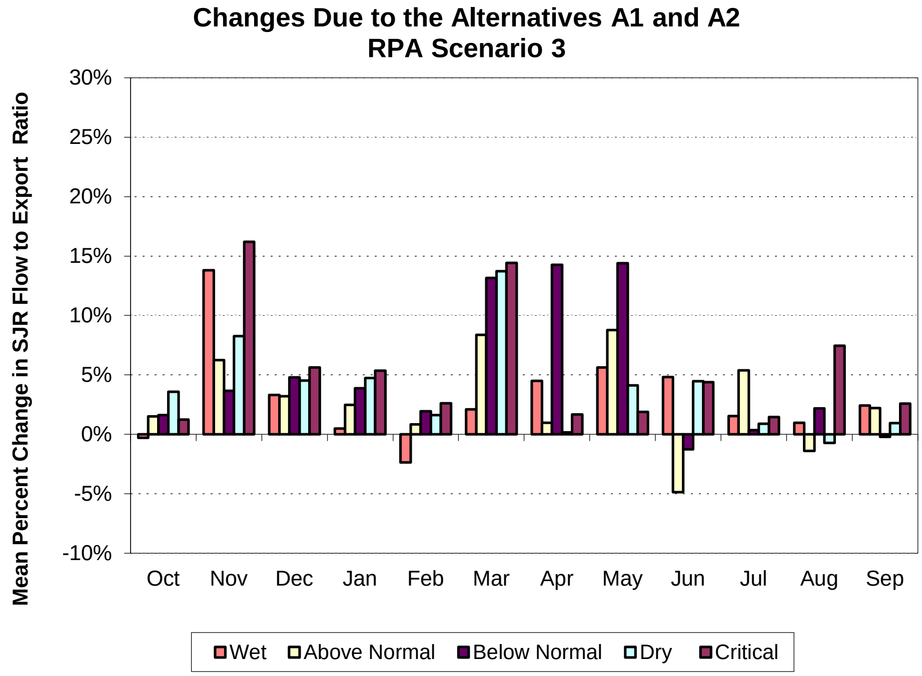


Key:
RPA = reasonable and prudent alternative

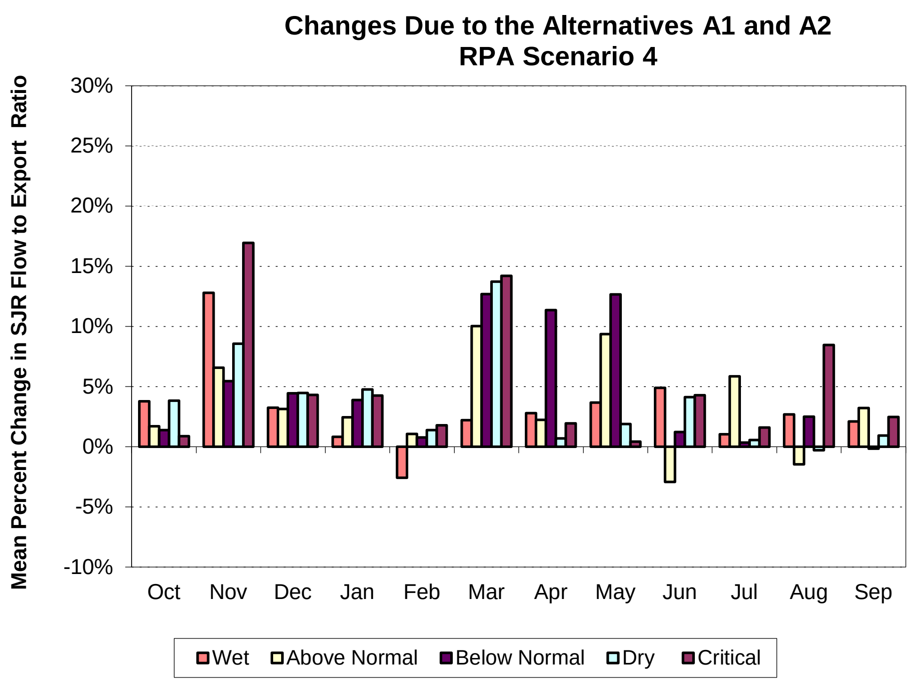


Key:
RPA = reasonable and prudent alternative

Figure 5-5.
Mean Percent Changes in Ratio of San Joaquin River at Vernalis Flow to Diversions at Jones and Banks Facilities

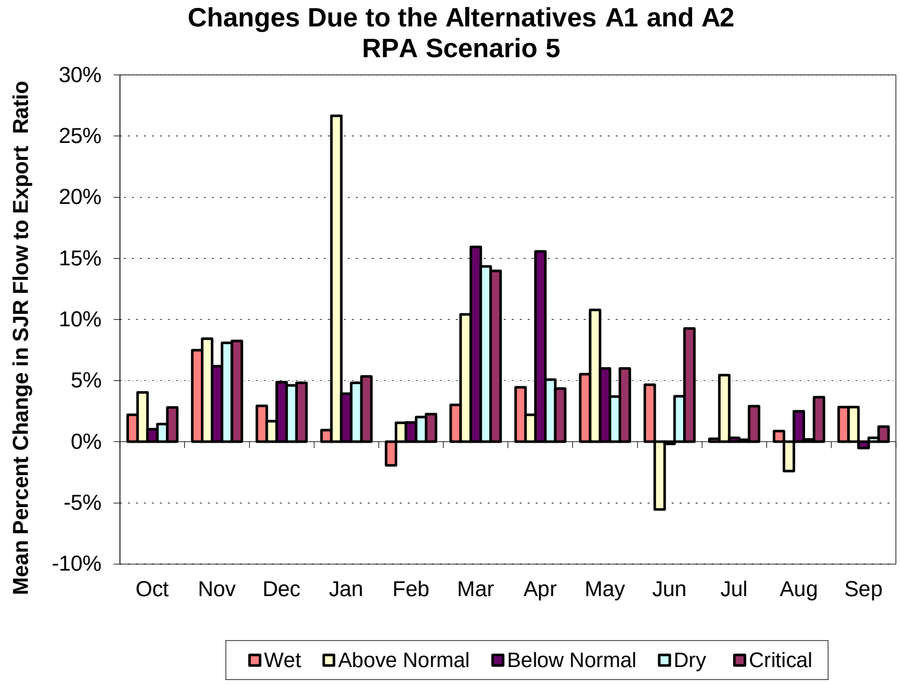


Key:
RPA = reasonable and prudent alternative

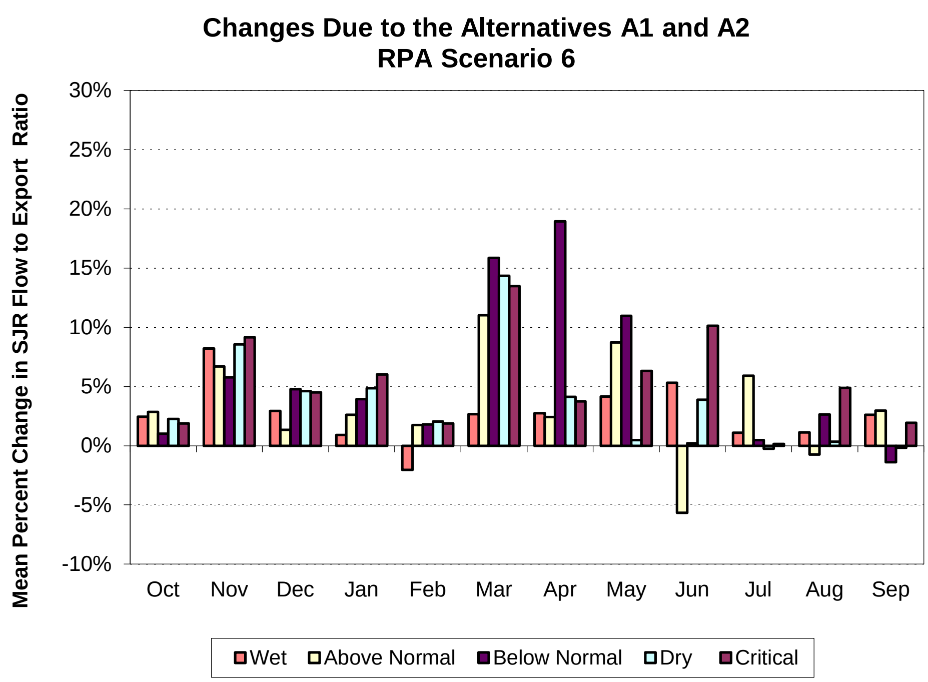


Key:
RPA = reasonable and prudent alternative

Figure 5-5.
Mean Percent Changes in Ratio of San Joaquin River at Vernalis Flow to Diversions at Jones and Banks Facilities (contd.)



Key:
RPA = reasonable and prudent alternative



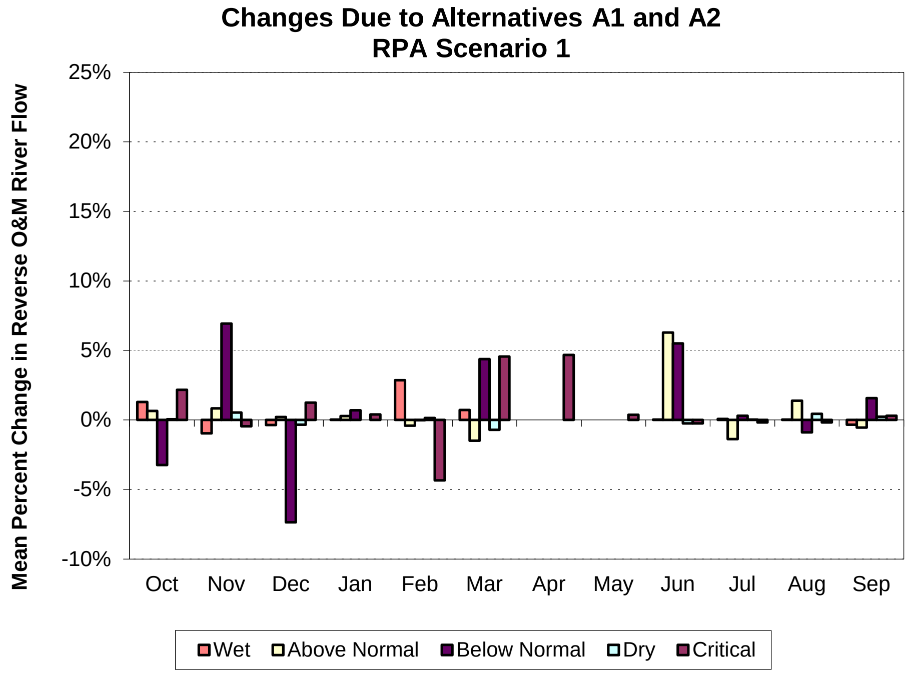
Key:
RPA = reasonable and prudent alternative

Figure 5-5.
Mean Percent Changes in Ratio of San Joaquin River at Vernalis Flow to Diversions at Jones and Banks Facilities (contd.)

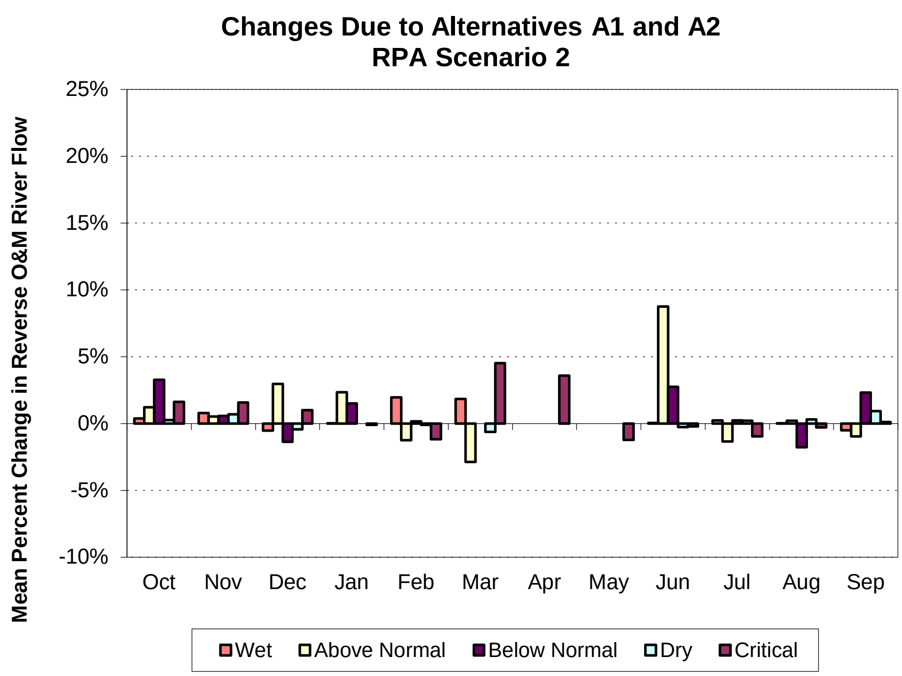
**Table 5-5.
Percentage of Years for Which the Ratio of San Joaquin River Flow to Jones and Banks Diversions Increased by More Than 10 Percent**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Draft PEIS/R	4	4	2	6	16	2	4	2	4	6	2	0
RPA 1	2	2	0	0	5	2	0	0	6	1	4	6
RPA 2	2	2	1	2	5	2	0	0	6	0	2	6
RPA 3	4	1	0	0	4	1	2	0	6	0	2	6
RPA 4	2	0	0	0	2	1	2	0	5	0	2	5
RPA 5	1	1	1	0	2	0	0	0	6	0	1	4
RPA 6	0	0	1	0	2	0	0	0	6	1	1	5

Key:
PEIS/R = Programmatic Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

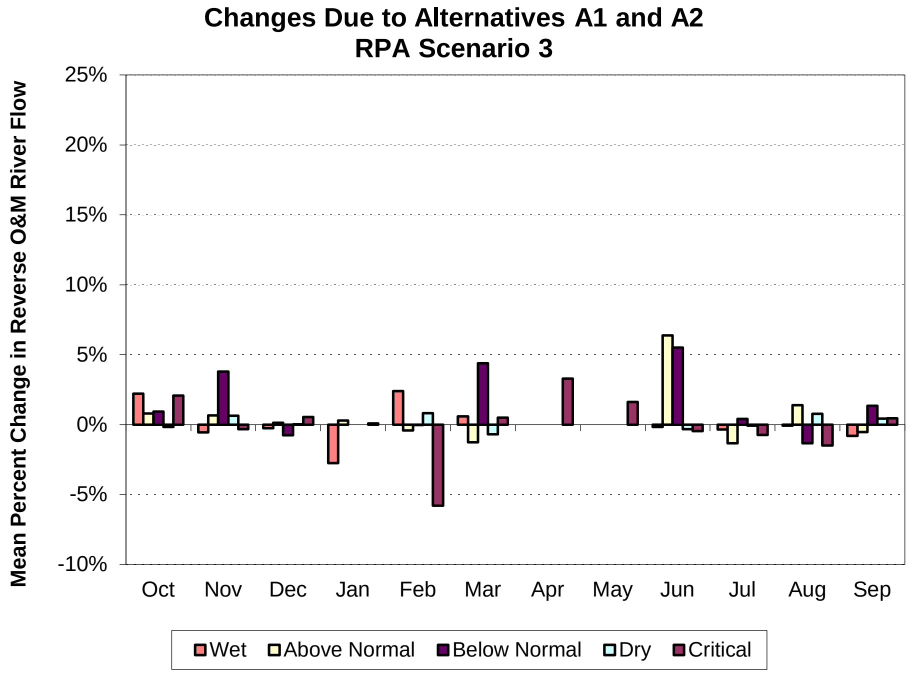


Key:
RPA = reasonable and prudent alternative

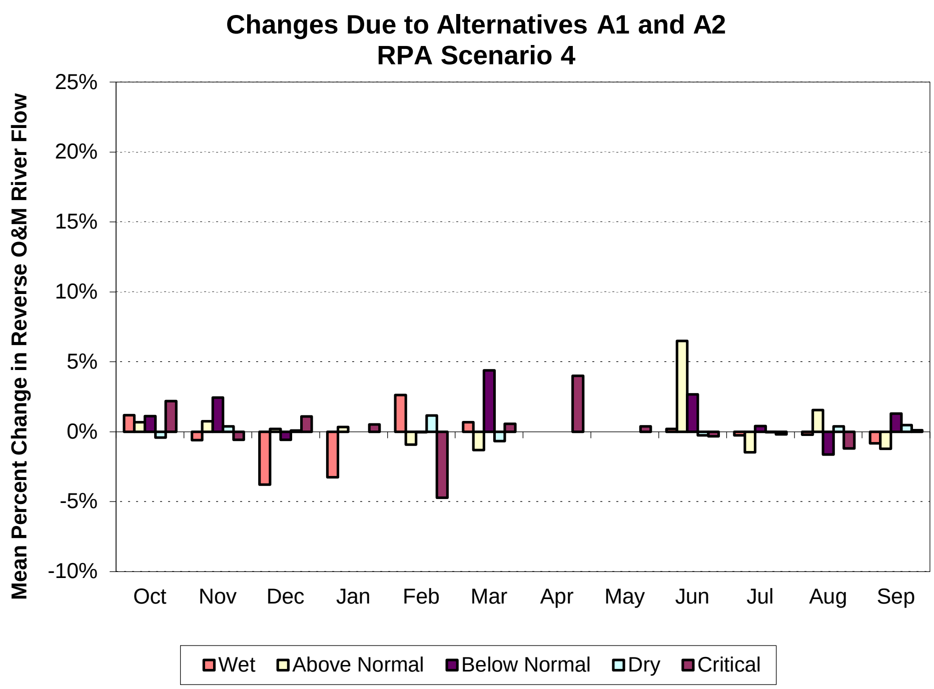


Key:
RPA = reasonable and prudent alternative

Figure 5-6.
Mean Percent Changes in Old and Middle River Reverse Flow

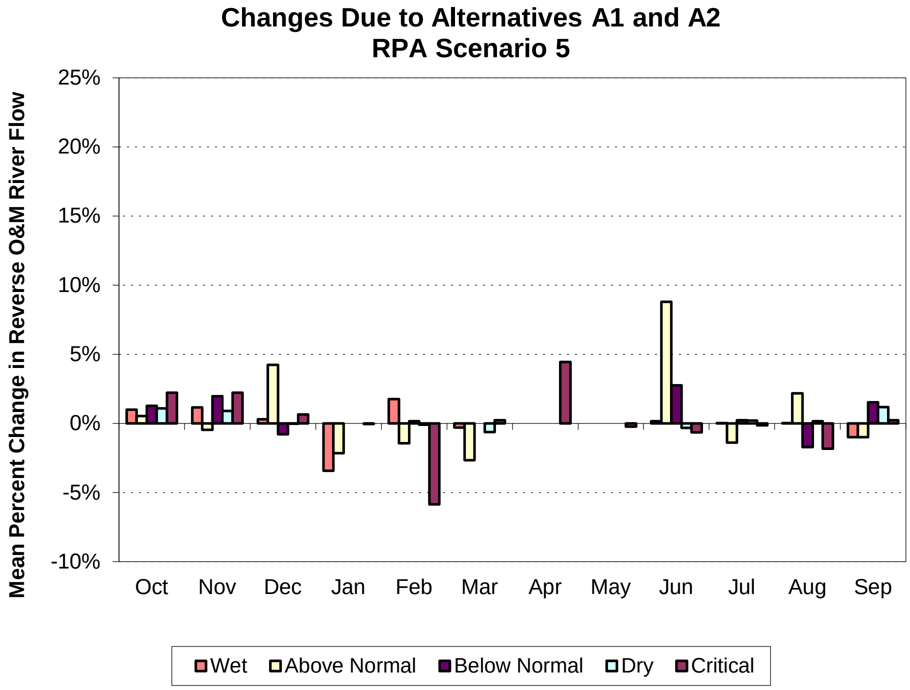


Key:
RPA = reasonable and prudent alternative

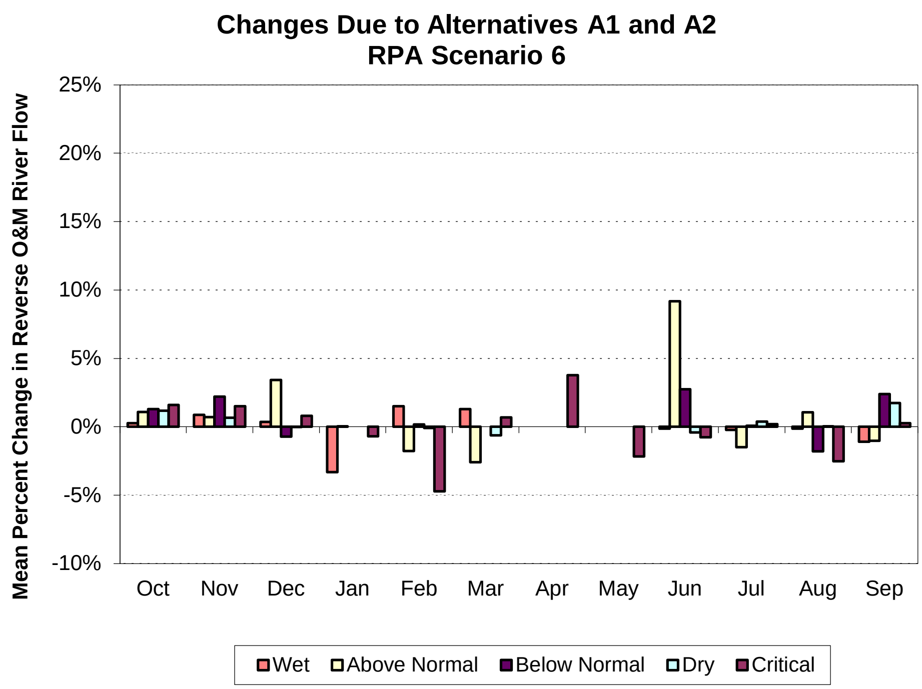


Key:
RPA = reasonable and prudent alternative

Figure 5-6.
Mean Percent Changes in Old and Middle River Reverse Flow (contd.)



Key:
RPA = reasonable and prudent alternative



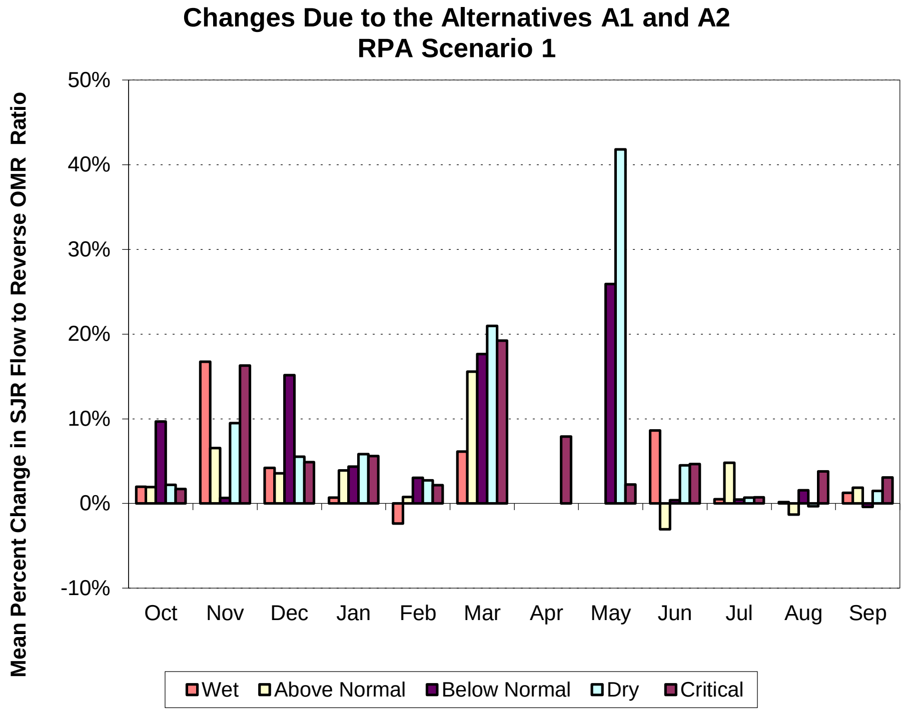
Key:
RPA = reasonable and prudent alternative

Figure 5-6.
Mean Percent Changes in Old and Middle River Reverse Flow (contd.)

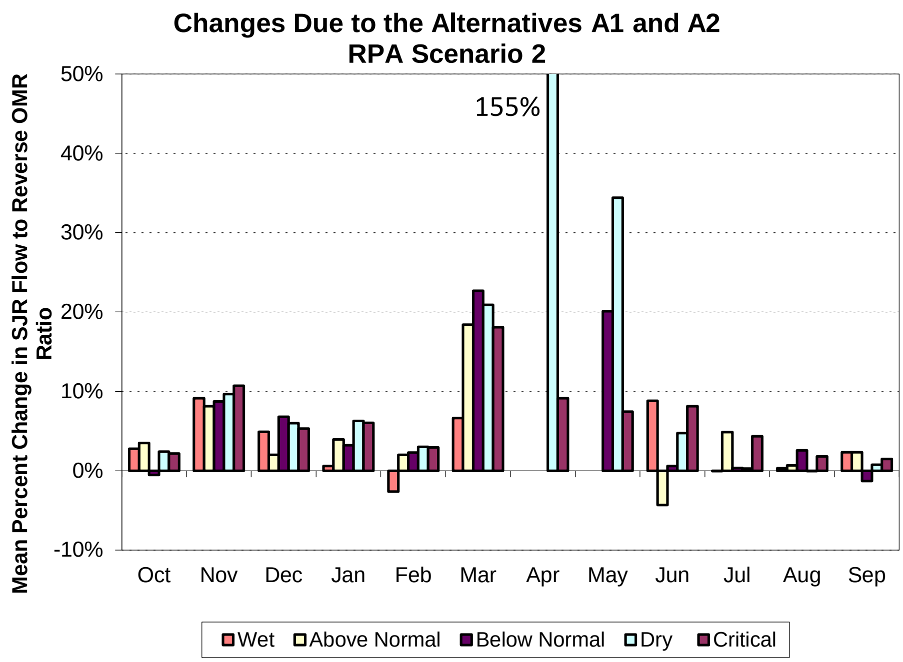
Table 5-6.
Percentage of Years for Which Reverse Old and Middle Rivers Flows Increased by More Than 10 Percent

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Draft PEIS/R	5	4	9	13	15	17	40	2	9	6	4	2
RPA 1	2	9	1	1	5	6	33	0	6	1	4	6
RPA 2	4	7	4	1	5	4	27	0	8	0	4	6
RPA 3	6	6	3	1	5	4	11	0	6	0	2	7
RPA 4	5	4	1	1	7	4	11	0	6	1	2	5
RPA 5	6	5	4	0	4	1	20	0	8	0	2	6
RPA 6	1	4	4	0	5	3	20	0	8	1	1	6

Key:
PEIS/R = Programmatic Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

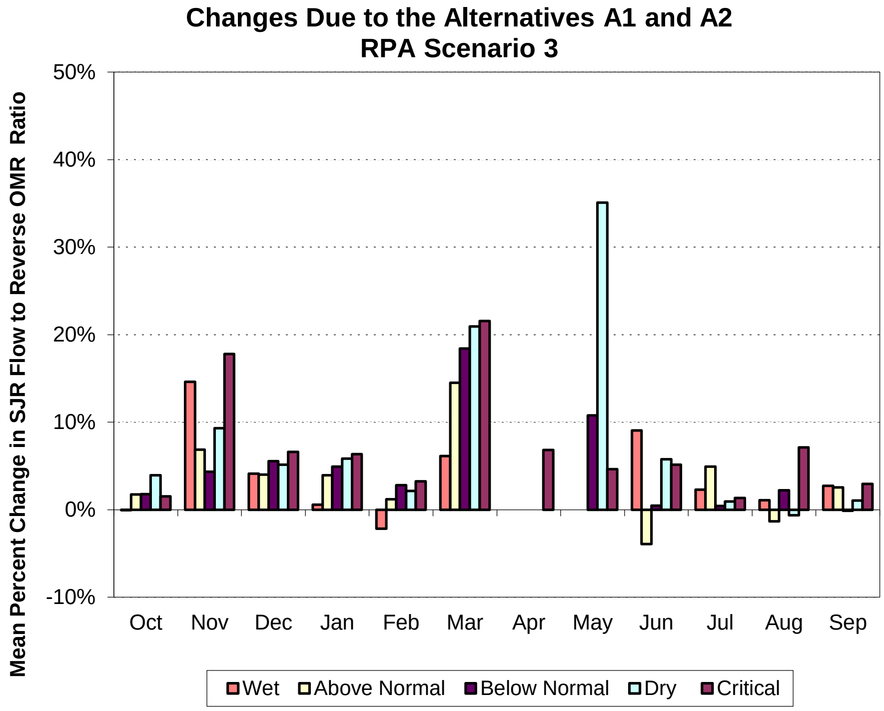


Key:
RPA = reasonable and prudent alternative

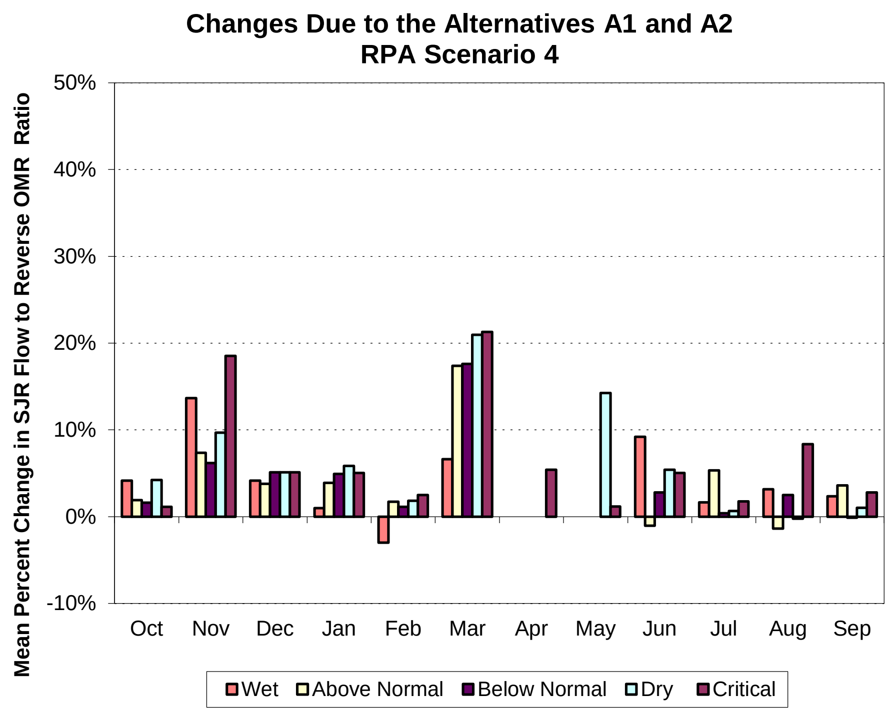


Key:
RPA = reasonable and prudent alternative

Figure 5-7.
Mean Percent Changes in Ratio of San Joaquin River at Vernalis Flow to Reverse Flow of Old and Middle Rivers Combined

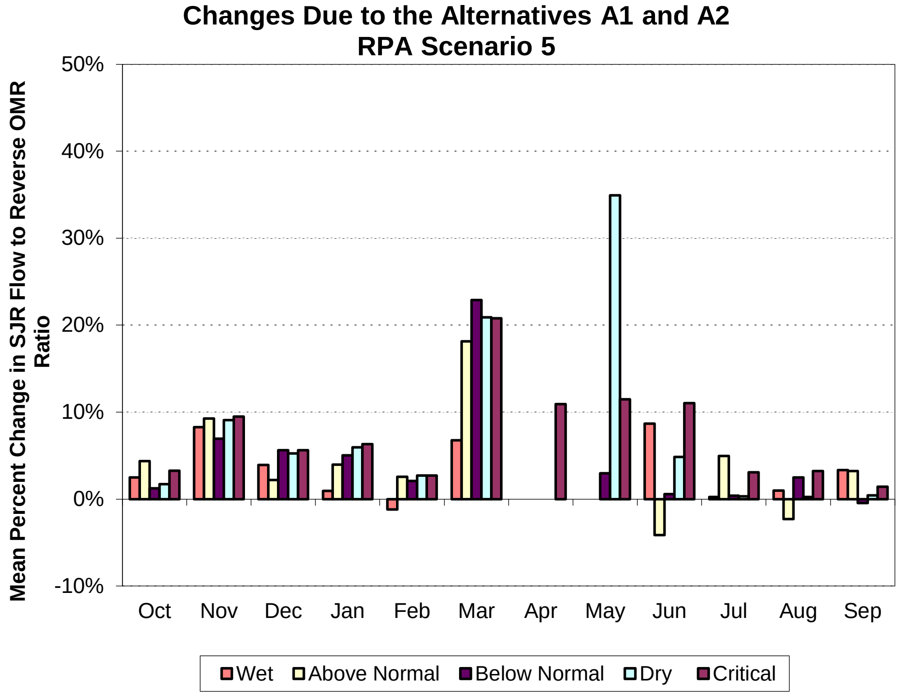


Key:
RPA = reasonable and prudent alternative

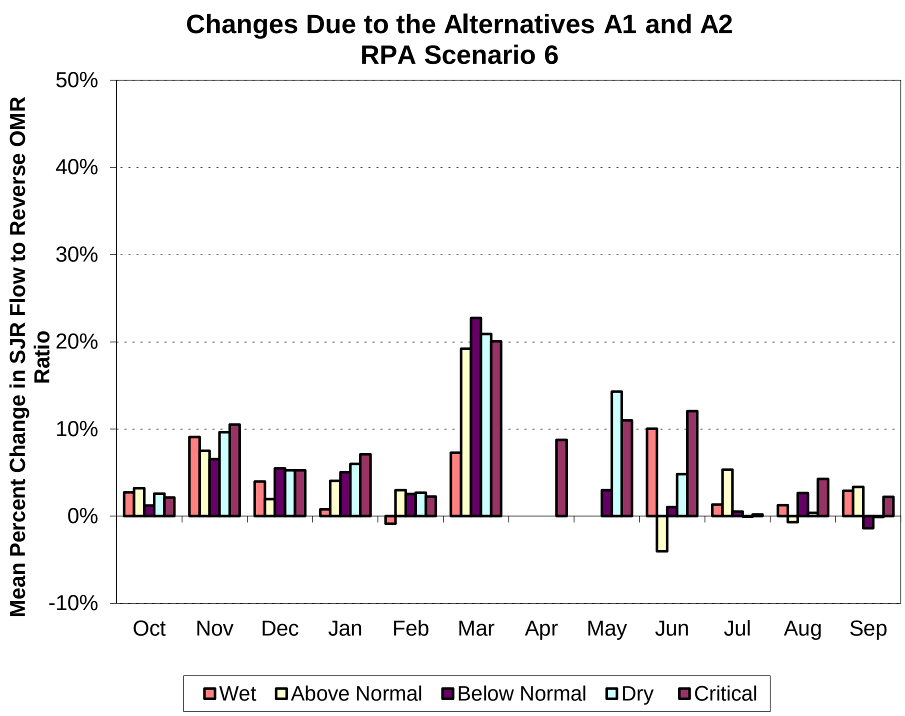


Key:
RPA = reasonable and prudent alternative

Figure 5-7.
Mean Percent Changes in Ratio of San Joaquin River at Vernalis Flow to Reverse Flow of Old and Middle Rivers Combined (contd.)



Key:
RPA = reasonable and prudent alternative



Key:
RPA = reasonable and prudent alternative

Figure 5-7.
Mean Percent Changes in Ratio of San Joaquin River at Vernalis Flow to Reverse Flow of Old and Middle Rivers Combined (contd.)

**Table 5-7.
Percentage of Years for Which the Ratio of San Joaquin River Flow to Reverse Flow of Old and Middle Rivers Combined Decreased by More Than 10 Percent**

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Draft PEIS/R	4	5	3	7	12	4	1	2	4	6	2	0
RPA 1	2	2	0	1	6	4	0	0	5	1	4	5
RPA 2	2	2	3	3	7	3	0	0	6	0	2	6
RPA 3	4	1	0	3	10	1	7	0	6	0	2	6
RPA 4	2	0	0	1	8	1	7	0	6	0	2	5
RPA 5	1	1	3	1	8	0	0	0	6	0	1	4
RPA 6	0	0	3	1	10	0	0	0	6	1	0	5

Key:
PEIS/R = Programmatic Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

Impact FSH-36 (Alternatives A1 and A2): ***Changes in Predation Levels in the Delta – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the implementation of the RPAs, Alternatives A1 and A2 would result in lower average fish predation rates on many Delta fish species because the flow patterns would help to keep fish from the south Delta where predation rates are high. The reduced predation is beneficial for early life stages and small-bodied fish species, including delta smelt and longfin smelt. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

As described in the Draft PEIS/R, predation rates are higher for most fishes in the south Delta than in other parts of the Delta for a variety of reasons. Alternatives A1 through C2 are predicted to increase the ratio of San Joaquin River inflow to reverse flows in Old and Middle rivers, which could lead to fish population distributions that have fewer fish in the south Delta. The increases would be greatest for March and April, as shown in Figure 5-8 (Figure 5-11 of the Draft PEIS/R), a period during which early life stages of many fish species, which are particularly vulnerable to predation, are present in the Delta. This impact was found to be less than significant and beneficial in the Draft PEIS/R.

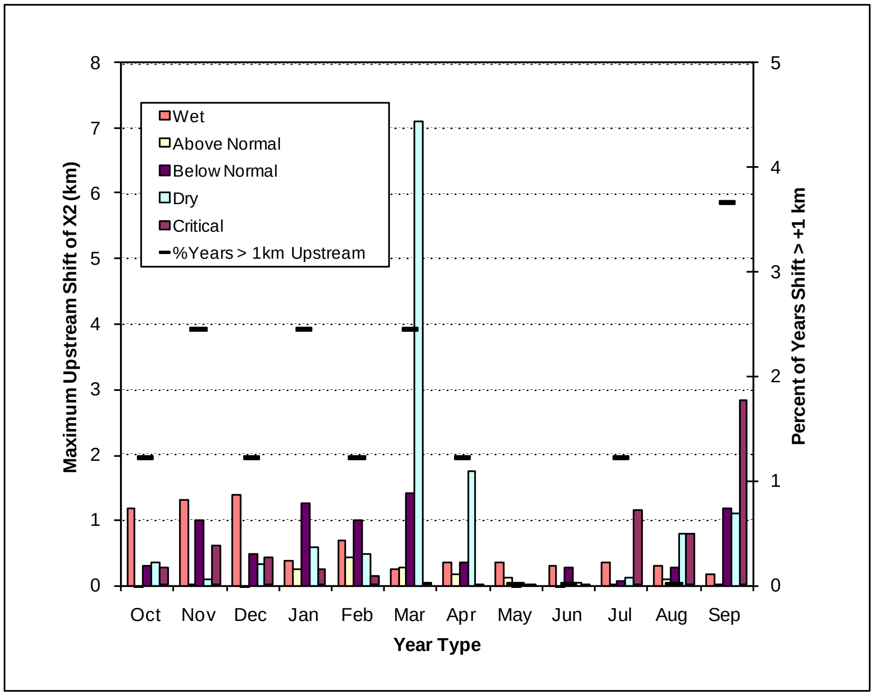


Figure 5-8.
Figure 5-11 of the Draft PEIS/R: Maximum Mean Monthly Upstream Shifts in X2 and Percent of Years with Greater Than 1 Kilometer Mean Monthly Upstream Shift Under 2005 Level of Development

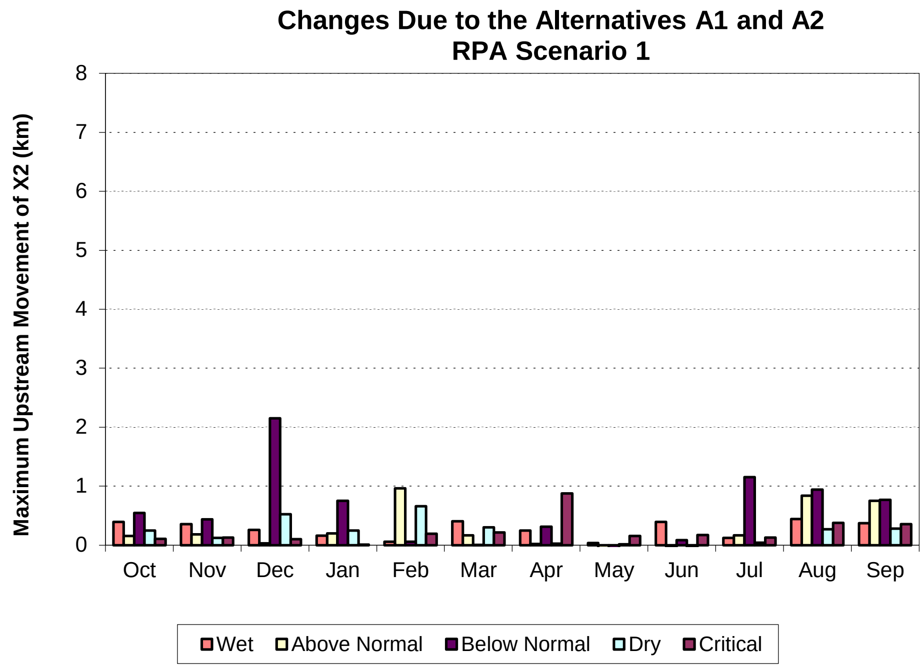
With the implementation of the RPAs, Alternatives A1 and A2 would increase the ratio of San Joaquin River inflow to reverse flows in Old and Middle rivers (as shown in Figure 5-7 and Table 5-7), which could lead to fish population distributions that have fewer fish in the south Delta. These changes are expected to reduce movement of fish into the south Delta and reduce vulnerability to predation in the South Delta. Therefore, the impact conclusion would not change from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact FSH-37 (Alternatives A1 and A2): ***Changes in Food Web Support in the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the implementation of the RPAs, Alternatives A1 and A2 are expected to reduce time spent by planktivorous Delta fishes in the poor feeding conditions of the south Delta, thus improving their average food resource and food web support conditions. However, a decrease in small fish in the south Delta would adversely affect piscivorous fish species. Fish species most likely to benefit from this effect include delta smelt and longfin smelt, both of which are at least partially planktivorous in all life stages. Fish species most likely to be adversely affected include striped bass, whose juveniles and adults rely heavily on fish prey. Alternatives A1 and A2 are predicted to have very little effect on X2 and thus would have no effect on food resources and other conditions in the low salinity zone (LSZ). The net impact on food resources and food web support of Alternatives A1 and A2 would be less than significant. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

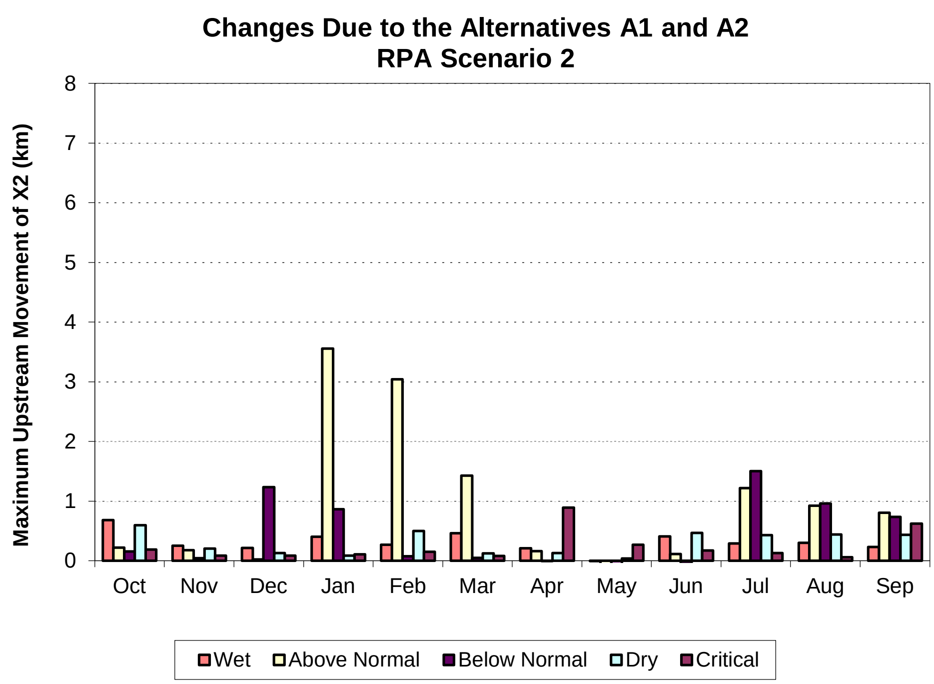
As described in the Draft PEIS/R, Alternatives A1 through C2 are predicted to increase the ratio of San Joaquin River inflow to reverse flow in Old and Middle rivers, so the number of fish present in the south Delta is expected to decrease. As a result, the feeding conditions for planktivorous fish would, on average, improve. However, because numbers of small fish in the south Delta would be reduced, food resources for piscivorous species such as striped bass, which benefit from the increased water clarity, would decline. An additional potential effect of Alternatives A1 through C2 on food web support results from changes in Delta outflow and X2. Delta outflow largely determines X2, which is used to reference the location of the LSZ. The LSZ is an area that historically has had high prey densities and other favorable habitat conditions for rearing juvenile delta smelt, striped bass, and other fish species (Kimmerer 2004). The LSZ is believed to provide the best combination of habitat conditions when X2 is located downstream from the confluence of the Sacramento and San Joaquin rivers, which is the basis for the “X2 standards” in the SWRCB’s *1995 Bay-Delta Plan* (U.S. Department of the Interior 2005). When Delta outflow is low, X2 is located in the relatively narrow channel of these rivers, whereas at higher outflows, X2 moves downstream into more open waters (Kimmerer 2004). X2 is referenced as the distance from the Golden Gate Bridge; therefore, higher X2 values correspond to greater distances upstream. The confluence of the two rivers is about 81 km from the Golden Gate Bridge; thus, increases in X2 above 81 km are considered to adversely affect habitat and food web support, while decreases below 81 km are considered to have beneficial effects.

As shown in Figure 5-8 (Figure 5-11 of the Draft PEIS/R), Alternatives A1 through C2 would rarely appreciably affect X2. The relatively minor effect of Alternatives A1 through C2 on X2 is expected because the San Joaquin River has much less effect on Delta outflow than the Sacramento River, and increases in San Joaquin River inflow would be largely offset by increased exports from the south Delta. This impact was found to be less than significant in the Draft PEIS/R.

With the RPAs in place, Alternatives A1 and A2 would rarely appreciably affect X2. The maximum upstream shift in X2 would, on average, not exceed 1 kilometer, as shown in Figure 5-9, which is unlikely to have a significant effect on fish. Exceptions include shifts of several kilometers in January and February of Above Normal years in RPA scenarios 2, 5 and 6. The movements were very small for all months and year types for RPA scenario 3, and even more so in the RPA scenario 4. Under Alternatives A1 and A2, the percentage of years with upstream shifts of more than 1 kilometer was less than 4 percent for all months with the RPAs in place, as shown in Table 5-8. This is similar to the range of shift in X2 described in the Draft PEIS/R. The impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

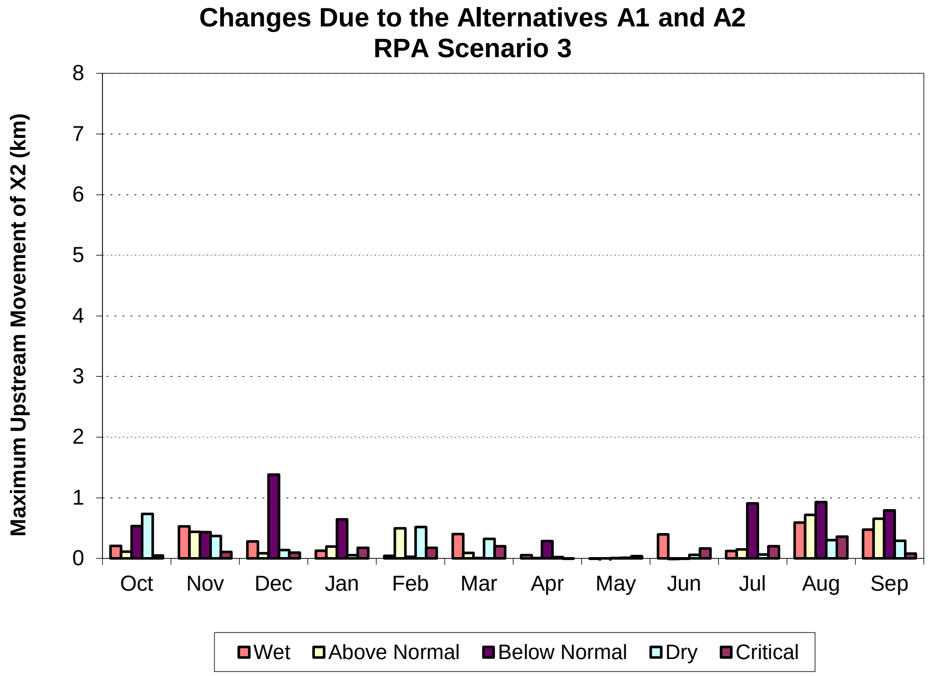


Key:
RPA = reasonable and prudent alternative

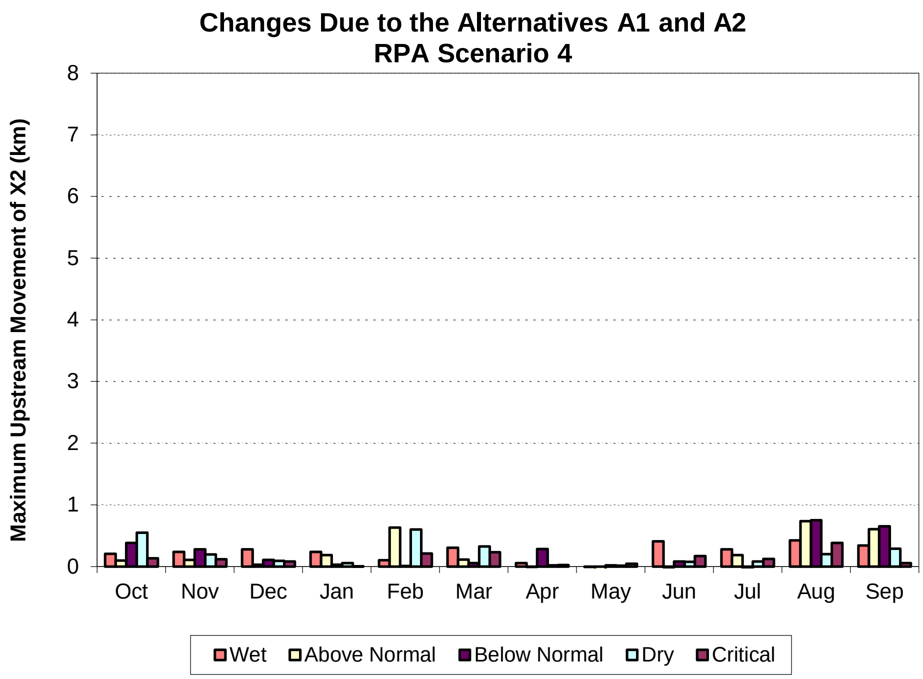


Key:
RPA = reasonable and prudent alternative

Figure 5-9.
Maximum Mean Monthly Upstream Shifts in X2



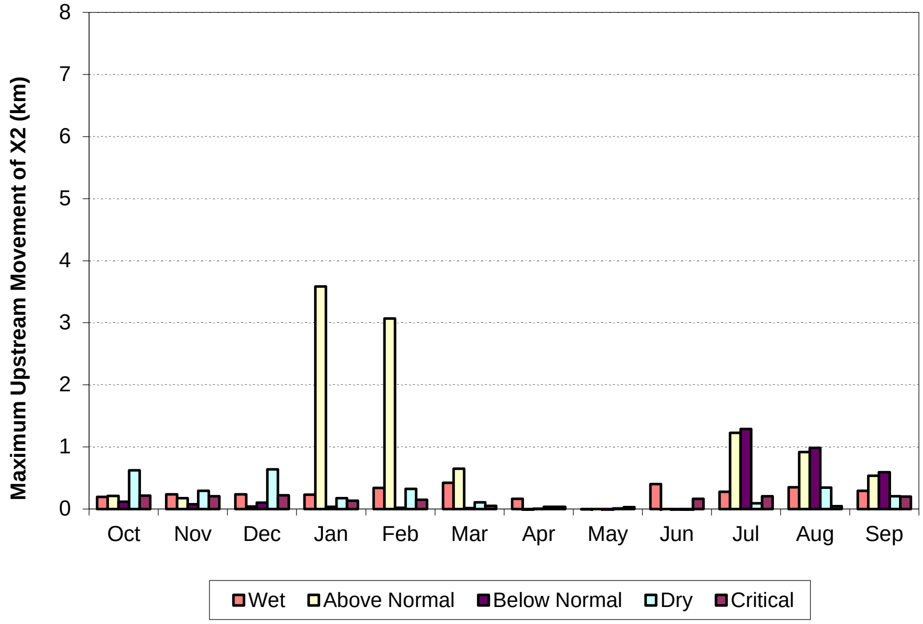
Key:
RPA = reasonable and prudent alternative



Key:
RPA = reasonable and prudent alternative

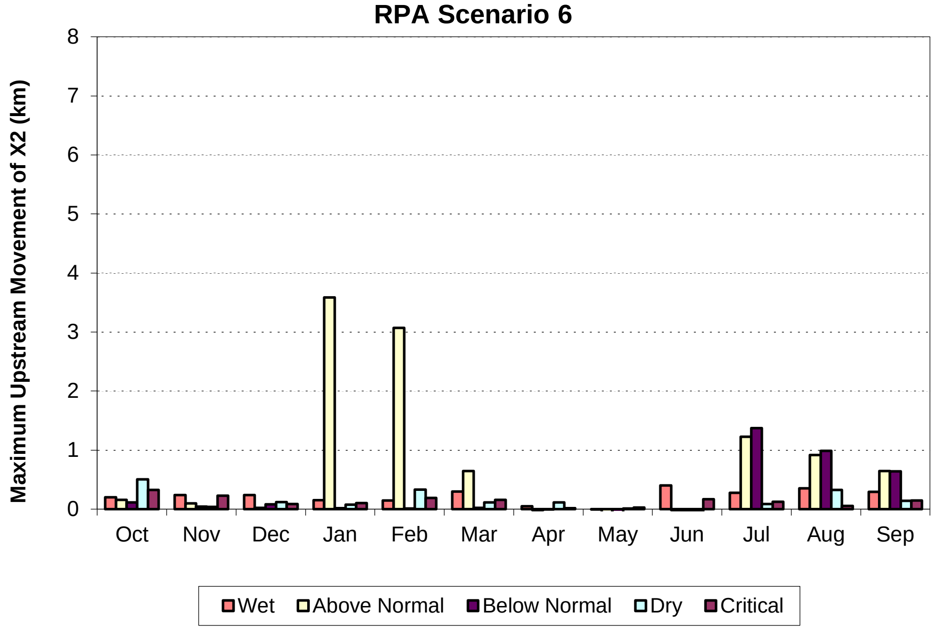
Figure 5-9.
Maximum Mean Monthly Upstream Shifts in X2 (contd.)

Changes Due to the Alternatives A1 and A2
RPA Scenario 5



Key:
RPA = reasonable and prudent alternative

Changes Due to the Alternatives A1 and A2
RPA Scenario 6



Key:
RPA = reasonable and prudent alternative

Figure 5-9.
Maximum Mean Monthly Upstream Shifts in X2 (contd.)

Table 5-8.
Percentage of Years with Upstream Shifts of More Than One Kilometer

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Draft PEIS/R	1	3	0	3	1	3	1	0	0	1	0	4
RPA 1	0	0	4	0	0	0	0	0	0	1	0	0
RPA 2	4	9	2	2	2	9	63	6	7	1	4	6
RPA 3	0	0	3	0	0	0	0	0	0	0	0	0
RPA 4	0	0	0	0	0	0	0	0	0	0	0	0
RPA 5	0	0	0	1	1	0	0	0	0	3	0	0
RPA 6	0	0	0	1	1	0	0	0	0	3	0	0

Key:
PEIS/R = Programmatic Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

Impact FSH-38 (Alternatives A1 and A2): ***Salinity Changes in the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. As previously described for Impact FSH-37, modeling results show that with the RPAs in place, Alternatives A1 and A2 were predicted to move X2 from downstream to upstream from the confluence for only three simulated months (0.3 percent of all months simulated), and in all three cases, the shift was about 1 kilometer (Figure 5-9 and Table 5-8). The impact conclusion **would not** change from the Draft PEIS/R, and would remain less than significant.

Impact FSH-39 (Alternatives A1 and A2): Changes to Delta Inflow and Flow Patterns in the Delta – Project-Level. This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would increase San Joaquin River inflows and reverse Old and Middle river flows, and ratios of the inflows to reverse flows, as previously described for Impact FSH-35. These outcomes would likely result in lower occurrences of most Delta fish species in the south Delta, which would provide a beneficial effect to many Delta fish species, including Central Valley fall-run Chinook salmon, Central Valley steelhead, Sacramento splittail, longfin smelt, and delta smelt. Additional protection would be provided to the fish because the action alternatives would be operated consistent with applicable laws, regulations, BOs, and court orders in place at the time the water was recaptured. The impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Chapter 6.0 Biological Resources – Vegetation and Wildlife

This chapter describes the potential for impacts of Alternatives A1 and A2 on vegetation and wildlife under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 6.0 of the Draft PEIS/R, "Biological Resources – Vegetation and Wildlife." The discussion of potential impacts on vegetation and wildlife presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 6.1, "Environmental Setting"** – Describes existing vegetation and wildlife along the San Joaquin River upstream from Friant Dam, within the Restoration Area, along the San Joaquin River from the Merced River to the Delta, within the Delta, and within the Friant Division.

- **Section 6.2, "Regulatory Setting"** – Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to vegetation and wildlife.

- **Section 6.3, "Environmental Consequences and Mitigation Measures"** – Includes a discussion of the methodology used to determine the potential for impacts to vegetation and wildlife to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 6-1. As shown in Table 6-1, none of the impact conclusions of Alternatives A1 and A2 on vegetation and wildlife would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 6.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 6-1.

Table 6-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Vegetation and Wildlife: Program-Level						
VEG-1: Substantially Alter Riparian Habitat and Other Sensitive Communities in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[1,2]	No[1,2]
VEG-2: Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-3: Facilitate Increase in Distribution and Abundance of Invasive Plants in the Restoration Area	No-Action	SU	--	SU	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-4: Substantially Affect Special-Status Plant Species in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-5: Substantially Reduce Habitat or Populations of Special-Status Animals in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]

Table 6-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Program-Level (contd.)						
VEG-6: Substantially Alter Designated Critical Habitat in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VEG-7: Conflict with Adopted Conservation Plans in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[1,2]	No[1,2]
VEG-8: Substantially Alter Riparian Habitat and Other Sensitive Communities Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-9: Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-10: Facilitate Increase in Distribution and Abundance of Invasive Plants Between the Merced River and the Delta	No-Action	SU	--	SU	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]

Table 6-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Biological Resources – Vegetation and Wildlife: Program-Level (contd.)						
VEG-11: Substantially Alter Special-Status Plant Species Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-12: Substantially Reduce Habitat or Populations of Special-Status Animals Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-13: Substantially Alter Designated Critical Habitat Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
VEG-14: Conflict with Adopted Conservation Plans Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
Biological Resources – Vegetation and Wildlife: Project-Level						
VEG-15: Effects of Surface Water Fluctuation on Biological Resources Upstream from Friant Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 6-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Biological Resources – Vegetation and Wildlife: Project-Level (contd.)						
VEG-16: Substantially Alter Riparian Habitat and Other Sensitive Communities in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
VEG-17: Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-18: Facilitate Increase in Distribution and Abundance of Invasive Plants in Sensitive Natural Communities in the Restoration Area	No-Action	SU	--	SU	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-19: Substantially Affect Delta Button-Celery and Other Special-Status Plant Species in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-20: Substantially Reduce Habitat or Populations of Special-Status Animal Species in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 6-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Project-Level (contd.)						
VEG-21: Substantially Alter Designated Critical Habitat in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
VEG-22: Conflict with Provisions of Adopted Habitat Conservation Plans, Natural Community Conservation Plans, and Other Approved Local, Regional, or State Conservation Plans in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
VEG-23: Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans Between the Merced River and the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 6-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Biological Resources – Vegetation and Wildlife: Project-Level (contd.)						
VEG-24: Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans in the Delta	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
VEG-25: Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans in the CVP/SWP Water Service Areas	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
RPA = reasonable and prudent alternative
SU = significant and unavoidable

6.1 Program-Level Impacts

The potential program-level impacts to vegetation and wildlife under Alternatives A1 and A2, as described in the Draft PEIS/R, would be associated with construction activities. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO; therefore, the significance conclusions identified for these impacts would not change from those presented in the Draft PEIS/R.

Impacts VEG-8 through VEG-14 are related to construction activities that would not occur under Alternatives A1 and A2 and therefore are not discussed further in this chapter.

Impact VEG-1 (Alternatives A1 and A2): *Substantially Alter Riparian Habitat and Other Sensitive Communities in the Restoration Area – Program-Level.* This impact was found to be less than significant and beneficial in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact VEG-2 (Alternatives A1 and A2): *Fill, Fragment, Isolate, Divert, or Substantially Alter Jurisdictional Waters of the United States in the Restoration Area – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VEG-3 (Alternatives A1 and A2): *Facilitate Increase in Distribution and Abundance of Invasive Plants in the Restoration Area – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VEG-4 (Alternatives A1 and A2): *Substantially Affect Special-Status Plant Species in the Restoration Area – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VEG-5 (Alternatives A1 and A2): *Substantially Reduce Habitat or Populations of Special-Status Animals in the Restoration Area – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VEG-6 (Alternatives A1 and A2): ***Substantially Alter Designated Critical Habitat in the Restoration Area – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VEG-7 (Alternatives A1 and A2): ***Conflict With Adopted Conservation Plans in the Restoration Area – Program-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

6.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to vegetation and wildlife would be considered potentially significant if the program alternatives would do any of the following:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by USFWS or DFG.
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations, or by USFWS or DFG.
- Have a substantial adverse effect on federally protected wetlands, as defined by Section 404 of the Clean Water Act (CWA) (including but not limited to marsh, vernal pool, coastal), through direct removal, filling, hydrological interruption, or other means.
- Introduce or substantially spread a nonnative invasive plant species.
- Interfere substantially with the movement of any native resident or migratory wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Substantially reduce the habitat of a wildlife species; cause a wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; or substantially reduce the number or restrict the range of an endangered, rare, or threatened species.
- Conflict with local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or State habitat conservation plan.

Impacts VEG-15 through VEG-22 would occur upstream from Friant Dam or within the Restoration Area. These impacts would not change with the RPAs in place, as described in Chapter 1.0, "Introduction." Therefore, these impacts are not discussed further in this chapter.

Impact VEG-23 (Alternatives A1 and A2): ***Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the United States, and Adopted Conservation Plans Along the San Joaquin River from the Merced River to the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would increase mean monthly flows in the San Joaquin River between the Merced River and the Delta during some months of most years. However, these changes in flows would be generally seasonal with timing similar to historical flows, much smaller than existing flood flows, not adding to future flood flows, and confined to existing channels. For these reasons, these increased flows would not be sufficient to affect special-status species, sensitive natural communities, waters of the United States, or implementation of adopted conservation plans. The significance conclusion of this impact **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, because increased flows between the Merced River and the Delta under Alternatives A1 and A2 would largely be confined within existing channel capacities, they would not increase flood flows, would be within the range of historical flows, and would have a similar timing to historical flows, they would not result in substantial adverse changes in conditions affecting vegetation and wildlife.

Under all RPA scenarios, Alternatives A1 and A2 would continue to result in an increase in flows entering the San Joaquin River from the Restoration Area, and these additional inflows would not substantially change water surface elevations, water quality, or other conditions that could substantially affect vegetation or wildlife. Also, flood frequency and duration would remain well within the historic range of seasonal and annual fluctuations, and would be insufficient to alter habitats and vegetation or to affect special-status species, either directly or indirectly. The significance conclusion of this impact would not change and would remain less than significant.

Impact VEG-24 (Alternatives A1 through C2): ***Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the U.S., and Adopted Conservation Plans in the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not result in substantial changes in water levels, flood frequency or magnitude, or other conditions or events that could affect vegetation or wildlife in the Delta. Thus, any changes in the Delta would not be sufficient to affect special-status species, sensitive natural communities, waters of the United States, or implementation of adopted conservation plans. The significance conclusion of this impact **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, reoperating Friant Dam would not result in a decrease in flows reaching the Delta; rather, water flow from the San Joaquin River into the Delta would be increased. However, additional inflows would not substantially change water surface elevations, water quality, or other conditions that could substantially affect vegetation or wildlife. In addition, flood frequency and duration would remain well within the historic range of seasonal and annual fluctuations and would be insufficient to alter habitats and vegetation or to affect special-status species, either directly or indirectly.

Under all RPA scenarios, Alternatives A1 and A2 would continue to result in an increase in flows reaching the Delta, and these additional inflows would not substantially change water surface elevations, water quality, or other conditions that could substantially affect vegetation or wildlife. Also, flood frequency and duration would remain well within the historic range of seasonal and annual fluctuations, and would be insufficient to alter habitats and vegetation or to affect special-status species, either directly or indirectly. The significance conclusion of this impact would not change and would be less than significant.

Impact VEG-25 (Alternatives A1 through C2): ***Substantially Affect Special-Status Species, Sensitive Communities, Jurisdictional Waters of the U.S., and Adopted Conservation Plans in the CVP/SWP Water Service Areas – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not result in increased water availability in the CVP/SWP water service areas that would remove an impediment to growth, and thus indirectly affect vegetation and wildlife. Therefore, effects on special-status species, sensitive natural communities, waters of the United States, and implementation of adopted conservation plans would not be substantial. The significance conclusion of this impact **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, the project-level actions would not increase the supply of surface water to the CVP/SWP water service areas, but could result in a small increase in surface water deliveries from the Delta to water users south of the Delta outside of the Friant Division of the CVP. This small increase in surface water deliveries would not induce growth because the CVP is unable to fulfill existing contractual obligations; the small increase in surface water deliveries would be distributed over a large area; and in part, these deliveries would substitute for groundwater pumping. Therefore, reoperating Friant Dam would not result in growth that could cause substantial effects on special-status species, sensitive natural communities, or waters of the United States, or interfere with the implementation of an adopted conservation plan.

With the RPAs in place, the project-level actions would not increase the supply of surface water to the CVP/SWP water service areas. While the project-level actions could result in a small increase in surface water deliveries from the Delta to water users south of the Delta outside of the Friant Division of the CVP with the RPAs in place, this increase would be smaller than described in the Draft PEIS/R. Therefore, reoperating Friant Dam would not result in growth that could cause substantial effects on special-status species, sensitive natural communities, or waters of the United States, or interfere with the implementation of an adopted conservation plan. The significance conclusion of this impact would not change and would be less than significant.

Chapter 7.0 Climate Change and Greenhouse Gas Emissions

This chapter describes the potential for impacts of Alternatives A1 and A2 on climate change and greenhouse gas emissions under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 7.0 of the Draft PEIS/R, "Climate Change and Greenhouse Gas Emissions." The discussion of potential impacts on socioeconomics presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 7.1, "Environmental Setting" –** Describes climate change and greenhouse gas emissions in the San Joaquin Valley Air Basin within a global, regional and local climate change.

- **Section 7.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to climate change.

- **Section 7.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to climate change and greenhouse gas emissions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the action alternatives.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 7-1. This chapter focuses on the contribution of the action alternatives to the buildup of greenhouse gases (GHG) in the atmosphere, which has been shown to contribute to climate change (IPCC 2007). It is unlikely that any single project by itself could have a significant impact on the environment with respect to GHGs. However, the cumulative effect of human activities has been clearly linked to quantifiable changes in the composition of the atmosphere, which has in turn been shown to be the main cause of global climate change (IPCC 2007). Therefore, analysis of the environmental effects of GHG emissions from implementing the Settlement is addressed as a cumulative impact analysis. Because analysis of the environmental effects of GHG emissions from the program alternatives is addressed as a cumulative impact analysis, and the No-Action Alternative by definition cannot contribute to a cumulative impact, no significance determination is made for the No-Action Alternative.

As shown in Table 7-1, none of the impact conclusions of Alternatives A1 and A2 on climate change and greenhouse gas emissions would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 7.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 7-1.

Table 7-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Climate Change and Greenhouse Gas Emissions: Program-Level						
CLM-1: Construction-Related Emissions of GHGs	A1 & A2	PS	CLM-1: Implement All Feasible Measures to Reduce Emissions	PSU	No[1]	No[1]
CLM-2: Operational Emissions of GHGs	A1 & A2	LTS	--	LTS	No[2,3]	No[2,3]
Climate Change and Greenhouse Gas Emissions: Project-Level						
CLM-3: Construction-Related Emissions of GHGs	A1 & A2	No Impact	--	No Impact	No[1]	No[1]
CLM-4: Operational Emissions of GHGs	A1 & A2	PS	CLM-1: Implement All Feasible Measures to Reduce Emissions	PSU	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative

7.1 Program-Level Impacts

The potential program-level impact to climate change and greenhouse gas emissions as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Long-term operations of equipment would occur primarily in the Restoration Area for levee and channel maintenance and remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

7.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to climate change and greenhouse gas emissions would be affected by altering surface water deliveries to the Friant Division, and by altering operations at Friant Dam and at existing pumping facilities to recapture Interim Flows in the Restoration Area and in the Delta. The project-level actions also could affect GHG emissions indirectly through an increase in traffic volumes associated with expanded recreation opportunities in the Restoration Area.

Impact CLM-3 (Alternatives A1 and A2): ***Construction-Related Emissions of GHGs – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. No short-term construction activity or related GHG emissions would occur as a result of the release of Interim and Restoration flows under Alternatives A1 and A2. This would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would have no impact.

Impact CLM-4 (Alternatives A1 and A2): ***Operational Emissions of GHGs – Project Level.*** This impact was found to be potentially a considerable contribution to a significant cumulative impact; therefore, the impact was found to be potentially significant in the Draft PEIS/R. Under the RPAs, the potential GHG emissions that could occur as a result of Alternatives A1 and A2 would not change, and could be increased through traffic from increased recreational visitors, and increased by increased groundwater pumping and changes in CVP/SWP energy generation and consumption, or offset or decreased by some project-level actions. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

As described in the Draft PEIS/R, recreational activities related to additional water flows may increase; therefore, the number of visitors to the Restoration Area also would be expected to increase from current levels. Approximately 628 additional vehicles per day are expected to travel to the Restoration Area for recreation, contributing an additional 2,627 metric tons (mt) of carbon dioxide equivalent (CO_2e) per year. Implementing Interim or Restoration flows under Alternatives A1 and A2 would not result in any new stationary or area sources of GHGs. Hydroelectric power generation at the Millerton

Hydroelectric Power Plant would remain similar to existing conditions. Although carbon sequestration due to an increase in riparian vegetation is anticipated, the amount is uncertain; thus, none was assumed in this analysis. If no water released as Interim and Restoration flows was recaptured under the action alternatives, and these supplies were entirely replaced through increased pumping of groundwater in the Friant Division, increased energy consumption could result in GHG emissions of up to 77,302 $mtCO_2e$/year above existing conditions under all action alternatives (77,187 $mtCO_2e$/year above the No-Action Alternative), as shown in Tables 7-4 and 7-5 of the Draft PEIS/R. The maximum increase in net CVP/SWP operational GHG emissions anticipated under Alternatives A1 and A2 at the current level of demand of up to 26,974 $mtCO_2e$/year above existing conditions.

With the RPAs in place, the maximum potential GHG emissions under Alternatives A1 and A2 would be less than or equal to that described in the Draft PEIS/R. GHG emissions associated with recreational activities in the Restoration Area, new stationary or area sources of GHGs, and power generation at the Millerton Hydroelectric Power Plant would not be affected by the RPAs. The maximum potential increase in groundwater pumping, and therefore in GHG emissions in the Friant Division, would occur if none of the water released as Interim and Restoration flows was recaptured downstream and recirculated to the Friant Division. This is the same maximum potential impact described in the Draft PEIS/R. Because maximum potential emissions and offsets in the Restoration Area and within the Friant Division would not change from that described in the Draft PEIS/R, this impact conclusion would not change and would remain potentially significant.

Mitigation Measure CLM-1 (Alternatives A1 and A2): ***Implement All Feasible Measures to Reduce Emissions – Project-Level.*** This mitigation measure is identical to Mitigation Measure CLM-1 (Alternatives A1 through C2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

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Chapter 8.0 Cultural Resources

This chapter describes the potential for impacts of Alternatives A1 and A2 on cultural resources under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 8.0 of the Draft PEIS/R, "Cultural Resources." The discussion of potential impacts on surface cultural resources presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 8.1, "Historic Context" –** Describes the historic context of the San Joaquin River upstream from Friant Dam, the Restoration Area, and along the San Joaquin River downstream from the Restoration Area. Implementation of the Settlement is not anticipated to cause impacts to cultural resources in the Delta or in CVP/SWP service areas.

- **Section 8.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal and State agencies pertaining to cultural resources.

- **Section 8.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to cultural resources conditions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 8-1. As shown in Table 8-1, none of the impact conclusions of Alternatives A1 and A2 on cultural resources would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 8.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 8-1.

Table 8-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Cultural Resources: Program-Level						
CUL-1: Disturbance or Destruction of Cultural Resources Within the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	CUL-1: Comply with Section 106 of the NHPA or Equivalent	LTS	No[2]	No[2]
Cultural Resources: Project-Level						
CUL-2: Disturbance or Destruction of Cultural Resources Around Millerton Lake	No-Action	LTS	--	LTS	NA	NA
	A1 & A2	PS	CUL-2: Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement	LTS	No[2]	No[2]
CUL-3: Disturbance or Destruction of Cultural Resources in the Restoration Area	No-Action	LTS	--	LTS	NA	NA
	A1 & A2	PS	CUL-2: Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement	LTS	No[2]	No[2]
CUL-4: Disturbance or Destruction of Cultural Resources Along the San Joaquin River Downstream from the Merced River	No-Action	LTS	--	LTS	NA	NA
	A1 & A2	PS	CUL-2: Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
NHPA = National Historic Preservation Act
PEIS/R = Program Environmental Impact Statement/Report
RPA = reasonable and prudent alternative
PS = potentially significant

8.1 Program-Level Impacts

The potential program-level impact to cultural resources as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact CUL-1 (Alternatives A1 and A2): ***Disturbance or Destruction of Cultural Resources Within Restoration Area – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction activities that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure CUL-1 (Alternatives A1 and A2): ***Comply with Section 106 of the NHPA or Equivalent – Program-Level.*** This mitigation measure is identical to Mitigation Measure CUL-1 (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

8.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to cultural resources would be associated with the effects of Interim and Restoration flows, and could occur in the vicinity of Millerton Lake, in the Restoration Area, and along the San Joaquin River downstream from the Merced River.

Impacts CUL-2 and CUL-3 could occur upstream from Friant Dam or in the Restoration Area, respectively. These impacts would not change with the RPAs in place, as described in Chapter 1.0, “Introduction.” Therefore, these impacts are not discussed further in this chapter.

Impact CUL-4 (Alternatives A1 and A2): ***Disturbance or Destruction of Cultural Resources Along the San Joaquin River Downstream from the Merced River – Project-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Interim and Restoration flows would increase flows in the San Joaquin River downstream from the Merced River. Though flows in the San Joaquin River between the Merced River and the Delta could change with the RPAs in place, the difference in this impact from the Draft PEIS/R will be minimal. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure CUL-2 (Alternatives A1 and A2): ***Comply with Section 106 of the NHPA and Develop and Implement a Programmatic Agreement – Project-Level.*** This mitigation measure is identical to Mitigation Measure CUL-2 (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Chapter 9.0 Environmental Justice

This chapter describes the potential for impacts of Alternatives A1 and A2 on environmental justice under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 9.0 of the Draft PEIS/R, "Environmental Justice." The discussion of potential impacts on environmental justice presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 9.1, "Environmental Setting" –** Describes affected environment related to environmental justice, as defined by Federal Executive Order (EO) 12898 (59 CFR 7629) and CEQ Guidance (1997). Under EO 12898, demographic information is used to determine whether minority populations or low-income populations are present in the areas potentially affected by the range of program alternatives. If so, a determination must be made whether implementation of the program alternatives may cause disproportionately high and adverse human health or environmental impacts on those populations.

- **Section 9.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to environmental justice conditions.

- **Section 9.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the relative effects that the program alternatives would have on minority and low-income populations within the study area, with most of the analysis occurring within the Restoration Area counties because of the proximity of construction-related impacts to residents. Impacts to other resource areas that could cause disproportionately high and adverse effects are identified. The criteria used to analyze program- and project-level impacts, and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative, are discussed in this section.

Impacts to other resource areas that would be significant and unavoidable or potentially significant and unavoidable after mitigation could cause disproportionately high and adverse effects human health or environmental impacts on minority and low-income populations. The potential for these impacts to cause disproportionately high and adverse effects on minority and low-income populations was evaluated in the Draft PEIS/R as summarized in Table 9-1. As shown in Table 9-1, this potential for these impacts to cause disproportionately high and adverse effects would not change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 9.3 of the Draft PEIS/R, the following sections describe the potential for these impacts to cause disproportionately high and adverse effects and provide the basis for the analysis of potential changes in the level of significance as presented in Table 9-1.

Table 9-1.
Impacts Potentially Causing Adverse Environmental Justice Effects

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Alternative	**Impact**	**Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**	**Change in Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**
Environmental Justice: Program-Level			
No-Action	AIR-1: Construction-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-2: Long-Term Operations-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-3: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	Yes	--
	AIR-4: Exposure of Sensitive Receptors to Odor Emissions	No	--
	FSH-1: Changes in Water Temperatures in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	VEG-3: Facilitate Increase in Distribution and Abundance of Invasive Plants in the Restoration Area	No	--
	VEG-10: Facilitate Increase in Distribution and Abundance of Invasive Plants Between the Merced River and the Delta	No	--
	LUP-1: Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	Yes	--
	UTL-1: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	Yes	--
	UTL-3: Potential for Insufficient Water Supply and Resources in the Restoration Area	Yes	--
	UTL-6: Potential for Insufficient Existing Water Supply and Resources Between the Merced River and the Delta	Yes	--

Table 9-1.
Impacts Potentially Causing Adverse Environmental Justice Effects (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Alternative	**Impact**	**Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**	**Change in Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**
Environmental Justice: Program-Level (contd.)			
A1 & A2	AIR-1: Construction-Related Emissions of Criteria Air Pollutants and Precursors	Yes	No[1]
	CLM-1: Construction-Related Emissions of GHGs in the Restoration Area	No	No[1]
	LUP-1: Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	Yes	No[1,2]
	LUP-3: Conflict with Adopted Land Use Plans, Goals, Policies, and Ordinances of Affected Jurisdictions	Yes	No[1,2]
	NOI-1: Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise	Yes	No[1]
	NOI-2: Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels	Yes	No[1]
	TRN-1: Reduced Traffic Circulation and Roadway Capacity	Yes	No[1,2]
	VIS-2: Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No	No[1,2]
Environmental Justice: Project-Level			
No-Action	AIR-5: Construction-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-6: Operations-Related Emissions of Criteria Air Pollutants and Precursors	Yes	--
	AIR-7: Exposure of Sensitive Receptors to Substantial Concentrations of Toxic Air Contaminants	Yes	--
	AIR-8: Exposure of Sensitive Receptors to Odor Emissions	No	--
	FSH-15: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Upstream from Friant Dam	Yes	--

Table 9-1.
Impacts Potentially Causing Adverse Environmental Justice Effects (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Alternative	**Impact**	**Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**	**Change in Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**
Environmental Justice: Project-Level (contd.)			
No-Action	FSH-22: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-23: Changes in Pollutant Discharge and Mobilization in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-24: Changes in Sediment Discharge and Turbidity in the San Joaquin River Between Friant Dam and the Merced River	Yes	--
	FSH-31: Changes in Water Temperatures and Dissolved Oxygen Concentrations in the Delta	Yes	--
	FSH-38: Salinity Changes in the Delta	No	--
	FSH-39: Changes to Delta Inflow and Flow Patterns in the Delta	Yes	--
	VEG-18: Facilitate Increase in Distribution and Abundance of Invasive Plants in Sensitive Natural Communities in the Restoration Area	No	--
	GRW-4: Changes in Groundwater Levels in CVP/SWP Water Service Areas	Yes	--
	GRW-5: Changes in Groundwater Quality in CVP/SWP Water Service Areas	Yes	--
	SWS-5: Change in Recurrence of Delta Excess Conditions	No	--
	UTL-9: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	Yes	--
	UTL-11: Potential for Insufficient Water Supply and Resources	Yes	--

Table 9-1.
Impacts Potentially Causing Adverse Environmental Justice Effects (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]			Sensitivity Analyses of Program Alternatives with RPAs
Alternative	**Impact**	**Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**	**Change in Potential for Disproportionately High and Adverse Effects on Minority and Low-Income Populations**
Environmental Justice: Project-Level (contd.)			
A1 & A2	CLM-4: Operational Emissions of GHGs in the Delta	No	No[3]
	GRW-4: Changes in Groundwater Levels in CVP/SWP Water Service Areas	Yes	No[3]
	GRW-5: Changes in Groundwater Quality in CVP/SWP Water Service Areas	Yes	No[3]
	LUP-5: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation	Yes	No[3]
	LUP-8: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries	Yes	No[3]
	UTL-11: Potential for Insufficient Existing Water Supply and Resources	Yes	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.
[4] Impacts and mitigation measures are presented as modified in Appendix B of this Final PEIS/R, “Errata.”

Key:
-- = not applicable
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
GHG = greenhouse gas
PEIS/R = Program Environmental Impact Statement/Report
RPA = reasonable and prudent alternative
SWP = State Water Project

9.1 Program-Level Impacts

The potential for program-level impacts described in the Draft PEIS/R to cause disproportionately high and adverse effects to human health or environmental impacts on minority and low-income populations was assessed for program-level impacts that were determined to be significant and unavoidable or potentially significant and unavoidable, after mitigation. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the potential for these impacts to disproportionately accrue to minority or low-income residents would not change from those presented in the Draft PEIS/R.

Impact AIR-1 (Alternatives A1 and A2): *Construction-Related Emissions of Criteria Air Pollutants and Precursors – Program-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Impact CLM-1 (Alternatives A1 and A2): *Construction-Related Emissions of GHGs – Program-Level.* This impact was found not to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations would not occur.

Impact LUP-1 (Alternatives A1 and A2): *Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts – Program-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Impact LUP-3 (Alternatives A1 and A2): *Conflict with Adopted Land Use Plans, Goals, Policies, and Ordinances of Affected Jurisdictions – Program-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Impact NOI-1 (Alternatives A1 and A2): *Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise – Program-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Impact NOI-2 (Alternatives A1 and A2): *Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels – Program-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Impact TRN-1 (Alternatives A1 and A2): *Reduced Traffic Circulation and Roadway Capacity – Program-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities within the Restoration Area that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Impact VIS-2 (Alternatives A1 and A2): *Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character – Program-Level.* This impact was found not to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. Because this impact is related to construction activities and changes within the Restoration Area that would not be affected by the RPAs, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations would not occur.

9.2 Project-Level Impacts

The potential for project-level impacts described in the Draft PEIS/R to cause disproportionately high and adverse effects human health or environmental impacts on minority and low-income populations was assessed for program-level impacts that were determined to be significant and unavoidable or potentially significant and unavoidable, after mitigation. The potential for these impacts to disproportionately accrue to minority or low-income residents would not change from those presented in the Draft PEIS/R, as described below.

Impact CLM-4 (Alternatives A1 and A2): *Operational Emissions of GHGs – Project Level.* This impact was found not to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. As described in the Draft PEIS/R, the global nature of this impact has little relevance in environmental justice analysis. Therefore, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations would not occur.

GRW-4 (Alternatives A1 through C2): *Change in Groundwater Levels in CVP/SWP Water Service Areas – Project-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. With the RPAs in place, the proposed Interim and Restoration flows associated with Alternatives A1 and A2 could result in changes in groundwater levels throughout CVP/SWP water service areas, which include the counties of Fresno, Kern, Kings, Madera, Merced, and Tulare. The six counties have proportions of minority residents in excess of 50 percent, and communities having high proportions of low-income residents in this area include Orange Cove, Madera, and Lindsay. It is likely that disproportionately high and adverse impacts related to groundwater could occur to residential areas within the counties with high proportions of minority and low-income residents. Therefore, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

GRW-5 (Alternatives A1 and A2): *Change in Groundwater Quality in CVP/SWP Water Service Areas – Project-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. With the RPAs in place, the proposed Interim and Restoration flows associated with Alternatives A1 and A2 could result in changes in groundwater quality throughout CVP/SWP water service areas, which include the counties of Fresno, Kern, Kings, Madera, Merced, and Tulare. The six counties have proportions of minority residents in excess of 50 percent, and communities having high proportions of low-income residents in this area include Orange Cove, Madera, and Lindsay. It is likely that disproportionately high and adverse impacts related to groundwater could occur to residential areas within the counties with high proportions of minority and low-income residents. Therefore, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

LUP-5 (Alternatives A1 and A2): *Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation – Project-Level.* This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. With the RPAs in place, proposed Interim and Restoration flows associated with Alternatives A1 through C2 could cause substantial diminishment of agricultural land quality and importance along the San Joaquin River. Mitigation measures put in place to preserve agricultural activity would not lower the level of the impact to less than significant, and the impact is considered to be significant and unavoidable. This significant and unavoidable impact is not expected to disproportionately affect specific geographic distributions of minority and low-income populations because the effects would be distributed across broad geographical areas of the State. However, the agricultural workers affected by diminished quality of farmland are disproportionately racial and/or ethnic minorities relative to California's demographics. The proportion of low-income agricultural workers who work in this area is also substantial. Therefore, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

LUP-8 (Alternatives A1 and A2): ***Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries – Project-Level.*** This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. With the RPAs in place, potential reductions in water deliveries associated with Alternatives A1 through C2 could cause substantial diminishment of agricultural land quality and importance. Mitigation measures put in place to preserve agricultural activity would not lower the level of the impact to less than significant, and the impact is considered to be significant and unavoidable. This significant and unavoidable impact is not expected to disproportionately affect specific geographic distributions of low-income populations or minority groups because the effects would be distributed across broad geographical areas of the State. However, the agricultural workers affected by diminished quality of farmland are disproportionately racial and/or ethnic minorities relative to California's demographics. The proportion of low-income agricultural workers who work in this area is also substantial. Therefore, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

UTL-11 (Alternatives A1 and A2): ***Potential for Insufficient Existing Water Supply and Resources – Project-Level.*** This impact was found to have the potential to cause disproportionately high and adverse effects on minority and low-income populations in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would result in an overall reduction in water deliveries to Friant Division long-term contractors in residential areas within the counties with high proportions of minority and low-income residents. Therefore, this impact **would not change** from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

As described in the Draft PEIS/R, the six-county region where Friant Division water is delivered has a total minority proportion exceeding 50 percent, including some areas such as Delano, Wasco, and Madera that have percentages exceeding 75 percent (91.6, 84.5, and 78.8 percent, respectively). The six-county region of the Friant Division also has a proportion of low-income residents higher than that for the State (13.0 percent). Data presented in Table 9-9 of the Draft PEIS/R suggest that median incomes in the farming industry are lower than the median income for all industries, with less skilled workers (graders and sorters, farmworkers) earning close to 50 percent of the median wage of all county industries combined, in some cases. These minority and income data suggest that impacts to the agricultural industry could be considered to disproportionately accrue to environmental justice populations. A reduction in water deliveries to Friant Division long-term contractors, which would occur if all Interim and Restoration flows are not recirculated to the Friant Division long-term contractors, could therefore disproportionately accrue to minority or low-income residents. Thus, disproportionately high and adverse effects on minority and low-income populations could occur.

With the RPAs in place, the potential range of recirculation of recaptured Interim and Restoration flows to the Friant Division remains the same as that evaluated in the Draft PEIS/R, and ranges from recirculation of no water to recirculation of all Interim and

Restoration flows. However as described in Chapter 12.0, "Hydrology – Groundwater," of this appendix, the RPAs would reduce the anticipated maximum amount of water that would be recaptured at existing facilities in the Delta. The minimum amount that would be recaptured would remain recapture of no water. As described in the Draft PEIS/R, a reduction in surface water deliveries to the Friant Division would result in increased use of groundwater supplies, thereby increasing groundwater overdraft. A reduction in water deliveries to Friant Division long-term contractors, which would occur if all Interim and Restoration flows are not recirculated to the Friant Division long-term contractors, could therefore disproportionately accrue to minority or low-income residents. This impact would not change from the Draft PEIS/R, and disproportionately high and adverse effects on minority and low-income populations could occur.

Chapter 10.0 Geology and Soils

This chapter describes the potential for impacts of Alternatives A1 and A2 on geology and soils under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 10.0 of the Draft PEIS/R, "Geology and Soils." The discussion of potential impacts on surface geology and soils presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 10.1, "Environmental Setting" –** Describes existing geology, soils and mineral resources in the northern California region and specifically along the San Joaquin River Restoration Area. Implementation of the Settlement is not anticipated to cause impacts to geology and soils in the CVP/SWP service areas.

- **Section 10.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to geology and soils conditions.

- **Section 10.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to geology and soils conditions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 10-1. As shown in Table 10-1, none of the impact conclusions of Alternatives A1 and A2 on geology and soils would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 10.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 10-1.

Table 10-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Geology and Soils: Program-Level						
GEO-1: Potential Localized Soil Erosion, Sedimentation, and Inadvertent Permanent Soil Loss	No-Action	LTS	--	No Impact	--	--
	A1 & A2	PS	GEO-1: Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities	LTS	No[1]	No[1]
GEO-2: Potential Loss of Availability of a Known Mineral Resource of Value	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Geology and Soils: Project-Level						
GEO-3: Potential Localized Soil Erosion, Sedimentation, and Inadvertent Permanent Soil Loss	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
GEO-4: Potential Increase in Channel Erosion, Sediment Transport, and Meander Migration from San Joaquin River Flows	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
GEO-5: Potential Loss of Availability of a Known Mineral Resource of Value	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key: -- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

10.1 Program-Level Impacts

The potential program-level impact to geology and soils as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact GEO-1 (Alternatives A1 and A2): *Potential Localized Soil Erosion, Sedimentation, and Inadvertent Permanent Soil Loss – Program-Level.* This impact was found to be potentially significant in the Draft PEIS/R. Program-level construction and maintenance activities could result in localized soil erosion, sedimentation, and inadvertent permanent soil loss. This impact is related to construction activities that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure GEO-1 (Alternatives A1 and A2): *Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities – Program-Level.* This mitigation measure is identical to Mitigation Measure SWQ-1A, as described in Chapter 14.0, “Hydrology – Surface Water Quality presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact GEO-2 (Alternatives A1 and A2): *Potential Loss of Availability of a Known Mineral Resource of Value – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Mining activities include those discussed in Chapter 10.3.3 of the Draft PEIS/R, within the Restoration Area. Because this impact is related to mining activities within the Restoration Area, it would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

10.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to geology and soils would be associated with the effects of Interim and Restoration flows, and would occur in the vicinity of Millerton Lake, in the Restoration Area, and along the San Joaquin River downstream from the Merced River.

Impact GEO-3 (Alternatives A1 and A2): *Potential Localized Soil Erosion, Sedimentation, and Inadvertent Permanent Soil Loss – Project-Level.* This impact was found to be less than significant in the Draft PEIS/R. Variation in reservoir levels of

Millerton Lake due to reoperating Friant Dam could result in erosion of soils and loss of soil horizons down to bedrock along the reservoir shore in the zone of water elevation variation. Impact GEO-3 would not occur downstream from Friant Dam. This impact conclusion **would not change** with the RPAs in place, as described in Chapter 1.0, "Introduction." Therefore, this impact is not discussed further in this chapter.

Impact GEO-4 (Alternatives A1 and A2): ***Potential Increase in Channel Erosion, Sediment Transport, and Meander Migration from San Joaquin River Flows – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would result in no change in the historical rates of stream channel erosion and meander migration. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, reoperating Friant Dam to release Interim and Restoration flows would change the timing, frequency, duration, and volume of flows in the San Joaquin River from the Merced River to the Delta, including a reduction in the number of flood releases under the Action Alternatives, as described in Chapter 11.0, "Hydrology – Flood Management," and could change rates of stream channel erosion and meander migration. However, release of Interim and Restoration flows falls within the historical range of reservoir releases, and would result in no change in the historical rates of stream channel erosion and meander migration.

The RPAs would not affect the timing, frequency, duration, or volume of flows released from Friant Dam. With the RPAs in place, flows entering the San Joaquin River from the Restoration Area would not change from those described in the Draft PEIS/R. However, flows entering the San Joaquin River from the Merced, Tuolumne, and Stanislaus; thus, flows in the San Joaquin River between the Merced River and the Delta, would change with the RPAs in place. These changes in flows would be generally seasonal with timing similar to historical flows. The change in flows would not add to future flood flows, and nonflood flows would remain much smaller than existing flood flows and confined to existing channels. This change in flows would result in no change in the historical rates of stream channel erosion and meander migration. The significance conclusion of this impact would not change and would remain less than significant.

Impact GEO-5 (Alternatives A1 and A2): ***Potential Loss of Availability of a Known Mineral Resource of Value – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Variation in San Joaquin River levels due to reoperating Friant Dam could result in inundation of existing gravel and sand mining locations. However, release of Interim and Restoration flows falls within the historical range of reservoir releases, and attendant river-level fluctuations would be within the historical range of fluctuations. Because variation in San Joaquin River levels would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, reoperating Friant Dam to release Interim and Restoration flows could result in inundation of existing gravel and sand mining locations. The RPAs would not affect the timing, frequency, duration or volume of flows released from Friant Dam. Existing gravel and sand mining locations are within the Restoration Area, and would be subject to the variation in San Joaquin River levels as described in the Draft PEIS/R. With the RPAs in place, flows in the San Joaquin River Restoration Area would not change from those described in the Draft PEIS/R; therefore, this impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

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Chapter 11.0 Hydrology – Flood Management

This chapter describes the potential for impacts of Alternatives A1 and A2 on flood management under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 11.0 of the Draft PEIS/R, "Hydrology – Flood Management." The discussion of potential impacts on flood management presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 11.1, "Environmental Setting" –** Describes the history, infrastructure and management of floods on the San Joaquin River upstream from Friant Dam, from Friant Dam to the Merced River, and from the Merced River to the Delta. Implementation of the Settlement is not anticipated to cause impacts to flood management in CVP/SWP service areas.

- **Section 11.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to flood management.

- **Section 11.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to flood management conditions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 11-1. As shown in Table 11-1, none of the impact conclusions of Alternatives A1 and A2 on flood management would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 11.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 11-1.

Table 11-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Hydrology – Flood Management: Program-Level						
FLD-1: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding, Including Flooding as a Result of the Failure of a Levee or Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	FLD-1: Implement Design Standards to Minimize Risk of Loss, Injury, or Death Involving Flooding	LTS	No[3]	No[3]
FLD-2: Substantially Reduce Opportunities for Levee and Flood System Facilities Inspection and Maintenance	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
FLD-3: Substantially Alter the existing Drainage Pattern of the Site or Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-Site	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]

Table 11-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Hydrology – Flood Management: Program-Level (contd.)						
FLD-4: Placement of Structures Within a 100-Year Flood Hazard Area Structures That Would Impede or Redirect Flood Flows	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
FLD-5: Placement of Housing Within a 100-Year Flood Hazard Area, as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
Hydrology – Flood Management: Project-Level						
FLD-6: Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding, Including Flooding as a Result of the Failure of a Levee or Dam	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 11-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Flood Management: Project-Level (contd.)						
FLD-7: Substantially Reduce Opportunities for Levee and Flood System Facilities Inspection and Maintenance	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
FLD-8: Substantially Alter the Existing Drainage Pattern of the Site or Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-Site	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]
FLD-9: Placement of Structures Within a 100-Year Flood Hazard Area Structures That Would Impede or Redirect Flood Flows	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]

Table 11-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Hydrology – Flood Management: Project-Level (contd.)						
FLD-10: Placement of Housing Within a 100-Year Flood Hazard Area, as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Notes
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

11.1 Program-Level Impacts

The potential program-level impacts to flood management as described in the Draft PEIS/R would be associated with construction activities and long-term operations and maintenance. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact FLD-1 (Alternatives A1 and A2): ***Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding, Including Flooding as a Result of the Failure of a Levee or Dam – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Program-level construction for Alternatives A1 and A2, including new levees, has the potential to cause little to no change in water level frequencies within the Restoration Area or downstream, and this would not change with the RPAs in place. This impact was found to be potentially significant due to lack of current information regarding levee conditions within the Restoration Area. This impact conclusion **would not change** from the Draft PEIS/R and would remain potentially significant.

As described in the Draft PEIS/R, program-level construction, such as new levees, has the potential to transfer flood risk to downstream areas and expose people or structures to increased risk. Program-level activities include development of floodplain and riparian habitat in Reaches 2B and 4B1, which would increase vegetation or change sediment deposition patterns within these river reaches. Levee improvements in Reaches 2B and 4B1 would expand the existing local channel capacity. These improvements could redirect flood flows to downstream reaches of the Restoration Area and to the San Joaquin River downstream from the Merced River confluence. Hydraulic modeling of these actions conducted to support the Draft PEIS/R demonstrates little to no change in water level frequencies in the Restoration Area, with minor changes attributed to hydraulic data variability and perturbation effects of the Monte Carlo simulation. These changes are considered less than significant; however, due to lack of current information regarding levee conditions within the Restoration Area, this impact is considered potentially significant in the Restoration Area. Downstream from the Restoration Area, the changes in water level frequencies are smaller than within the Restoration Area and separated by distance from the potential effects of redirected flows; therefore, impacts outside of the Restoration Area are considered less than significant. This impact was found to be potentially significant in the Draft PEIS/R.

With the RPAs in place, the potential for flooding in the Restoration Area would not change because the RPAs would not affect flows or structures in this area. The RPAs could change flows in the San Joaquin River downstream from the Merced confluence, however, the contribution of Interim and Restoration flows would remain smaller than within the Restoration Area and separated by distance from the potential effects of redirected flows. Therefore, this impact conclusion would not change from the Draft PEIS/R, and would remain potentially significant within the Restoration Area and less than significant downstream from the Merced River confluence.

Mitigation Measure FLD-1 (Alternatives A1 and A2): ***Implement Design Standards to Minimize Risk of Loss, Injury, or Death Involving Flooding – Program-Level.*** This mitigation measure is identical to Mitigation Measure FLD-1 (Alternatives A1 through C2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact FLD-2 (Alternatives A1 and A2): ***Substantially Reduce Opportunities for Levee and Flood System Facilities Inspection and Maintenance – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Program-level construction activities may temporarily limit access for maintenance and inspection staff. The duration of this impact, however, would not completely impede these inspection and maintenance activities, but rather require minor coordination of such activities. This impact is related to construction activities that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

Impact FLD-3 (Alternatives A1 and A2): ***Substantially Alter the Existing Drainage Pattern of the Site or Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result in Flooding On- or Off-Site – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Program-level construction activities would alter local drainage patterns, and could create interior drainage, ponding, or other site-specific flooding issues. Project-specific actions would be taken to avoid interior drainage issues of proposed levees or other hydraulic structures. This impact is related to construction activities and considerations within the Restoration Area that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

Impact FLD-4 (Alternatives A1 and A2): ***Placement of Structures Within a 100-Year Flood Hazard Area That Would Impede or Redirect Flood Flows – Program Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to program-level construction of structures within the floodplain, including a fish screen and other modifications at Sack Dam and Arroyo Canal, as well as other minor modifications to various small diversions and structures within the Restoration Area to allow fish passage. Project-specific actions would be taken to avoid impacts to flood flow passage. This impact is related to construction activities and considerations within the Restoration Area that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

Impact FLD-5 (Alternatives A1 and A2): ***Placement of Housing Within a 100-Year Flood Hazard Area, as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not alter the 100-year flood hazard area and would not place additional housing within a 100-year flood hazard area. This impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

11.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to flood management would be associated with Friant Dam reoperation and release of Interim and Restoration flows. The effects of these project-level actions on the flood management system would occur within the Restoration Area, as described below.

Impact FLD-6 (Alternatives A1 and A2): ***Expose People or Structures to a Significant Risk of Loss, Injury, or Death Involving Flooding, Including Flooding as a Result of the Failure or a Levee or Dam – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, the potential for flooding in the Restoration Area would not change because the RPAs would not affect flows or structures in this area. The RPAs could change flows in the San Joaquin River downstream from the Merced confluence, however, the contribution of Interim and Restoration flows would remain smaller than within the Restoration Area and separated by distance from the potential effects of redirected flows. Therefore, this impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

As described in Daft PEIS/R, under Alternatives A1 and A2, Reclamation would implement three integrated measures to collectively avoid a potentially significant increase in the risk of flood damage or levee failure due to underseepage, through-seepage, erosion or landslide slope stability issues (as described in Chapter 2.0 of the Draft PEIS/R, “Description of Alternatives”). These three measures include: (1) establishing a Channel Capacity Advisory Group and determining and updating estimates of then-existing channel capacities as needed, (2) maintaining Interim and Restoration flows below estimates of then-existing channel capacities, and (3) closely monitoring erosion and performing maintenance and/or reducing Interim and Restoration flows as necessary to avoid erosion-related impacts.

With the RPAs in place, the potential for flooding in the Restoration Area would not change because the RPAs would not affect flows or structures in this area. The RPAs could change flows in the San Joaquin River downstream from the Merced confluence, however, the contribution of Interim and Restoration flows would remain smaller than within the Restoration Area and separated by distance from the potential effects of redirected flows. Therefore, the impact this impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Impact FLD-7 (Alternatives A1 and A2): ***Substantially Reduce Opportunities for Levee and Flood System Facilities Inspection and Maintenance – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Increased durations of elevated instream flows would subject the channels and, at times, the levees in the Restoration Area to increased periods of saturation. Maintenance activities such as placing rock on levee crowns to enable access by large vehicles are anticipated at such locations. These activities are anticipated to be completed as part of normal flood system maintenance prior to the implementation of the action alternatives and are therefore not included in the action alternatives. With the RPAs in place these activities would still be completed prior to the implementation of the action alternatives. Thus, this impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

Impact FLD-8 (Alternatives A1 and A2): *Substantially Alter the Existing Drainage Pattern of the Site or Area, Including Through the Alteration of the Course of a Stream or River, or Substantially Increase the Rate or Amount of Surface Runoff in a Manner Which Would Result In Flooding On- or Off-Site – Project Level.* This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, no project-level actions under Alternatives A1 and A2 would physically alter the drainage pattern of the site or area. This impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact FLD-9 (Alternatives A1 and A2): *Placement of Structures Within a 100-Year Flood Hazard Area That Would Impede or Redirect Flood Flows – Project Level.* This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, no project-level actions under Alternatives A1 and A2 would place structures within a 100-year flood hazard area. This impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact FLD-10 (Alternatives A1 and A2): *Placement of Housing Within a 100-Year Flood Hazard Area, as Mapped on a Federal Flood Hazard Boundary or Flood Insurance Rate Map or Other Flood Hazard Delineation Map – Project-Level.* This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, no project-level actions under Alternatives A1 and A2 would place additional housing within a 100-year flood hazard area. This impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

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Chapter 12.0 Hydrology – Groundwater

This chapter describes the potential for impacts of Alternatives A1 and A2 on groundwater under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 12.0 of the Draft PEIS/R, "Hydrology – Groundwater." The discussion of potential impacts on groundwater presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 12.1, "Environmental Setting" –** Describes the hydrogeology and groundwater resources in the San Joaquin Valley Groundwater Basin, which includes the San Joaquin River Hydrologic Region and the Tulare River Hydrologic Region, and encompasses the San Joaquin River upstream from Friant Dam, the Restoration Area, and along the San Joaquin River downstream from the Restoration Area. Implementation of the Settlement is not anticipated to cause impacts to groundwater resources in the Delta.

- **Section 12.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining groundwater.

- **Section 12.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to groundwater to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 12-1. As shown in Table 12-1, none of the impact conclusions of Alternatives A1 and A2 on groundwater would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 12.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 12-1.

Table 12-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs: Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Groundwater: Program-Level						
GRW-1: Temporary Construction-Related Effects on Groundwater Quality	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	PS	GRW-1a: Prepare and Implement a Stormwater Pollution Prevention Plan That Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities GRW-1b: Conduct Phase I Environmental Site Assessments	LTS	No[1,2]	No[1,2]
Hydrology – Groundwater: Project-Level						
GRW-2: Changes in Groundwater Levels Along the San Joaquin River from Friant Dam to the Merced River Confluence	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
GRW-3: Changes in Groundwater Quality Along the San Joaquin River from Friant Dam to the Merced River Confluence	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Table 12-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Hydrology – Groundwater: Project-Level (contd.)						
GRW-4: Changes in Groundwater Levels in CVP/SWP Water Service Areas	No-Action	PSU	--	PSU	--	--
	A1 & A2	PSU	--	PSU	No[3]	No[3]
GRW-5: Changes in Groundwater Quality in CVP/SWP Water Service Areas	No-Action	PSU	--	PSU	--	--
	A1 & A2	PSU	--	PSU	No[3]	No[3]

Notes:
1 Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
2 Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
3 Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

12.1 Program-Level Impacts

The potential program-level impact to groundwater as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact GRW-1 (Alternatives A1 and A2): ***Temporary Construction-Related Effects on Groundwater Quality – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact GRW-1 (Alternatives A1 and A2): ***Temporary Construction-Related Effects on Groundwater Quality – Program Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure GRW-1A (Alternatives A1 and A2): ***Prepare and Implement a Stormwater Pollution Prevention Plan That Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities – Program-Level.*** This mitigation measure is identical to Mitigation Measure GRW-1A (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Mitigation Measure GRW-1B (Alternatives A1 and A2): ***Conduct Phase I Environmental Site Assessments – Program-Level.*** This mitigation measure is identical to Mitigation Measure GRW-1B (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

12.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to groundwater levels and groundwater quality would be associated with Interim and Restoration flows in the Restoration Area along the San Joaquin River and changes in deliveries to the CVP/SWP service areas. For the purposes of this PEIS/R, the alternatives were determined to result in significant impacts related to groundwater resources if they would cause any of the following:

- A change in groundwater level resulting in long-term overdraft conditions for the groundwater basins.
- A change in groundwater level adjacent to the San Joaquin River resulting in increased groundwater levels in localized areas already experiencing high groundwater levels.
- A change in groundwater quality resulting in substantially adverse effects to designated beneficial uses of groundwater.

Potential project-level impacts in the CVP/SWP service areas would vary based on the quantity of recaptured Interim and Restoration flows that would be recirculated to Friant Division long-term contractors. Changes in recaptured and recirculated water would result in changes to groundwater pumping in the Friant Division long-term contractor areas. The impact analysis was completed using the Schmidt Tool and mass balance method to identify potential impacts of the program alternatives to Friant Division long-term contractors.

As described in the Draft PEIS/R, if recaptured Interim and Restoration flows are successfully recirculated to Friant Division long-term contractors, the increase in groundwater pumping due to reduced surface water supplies resulting from reoperating Friant Dam would be relatively low. However, if no water released as Interim and Restoration flows is recirculated to Friant Division long-term contractors, the increase in groundwater pumping due to reoperating Friant Dam would be relatively high.

With the RPAs in place, Interim and Restoration flows would be recaptured and recirculated to Friant Division long-term contractors, resulting in a relatively small increase in groundwater pumping from existing conditions, due to reduced surface water supplies. This increase in groundwater pumping would be less than the increase in groundwater pumping that would be experienced under other project alternatives when no water is recaptured and recirculated back to the Friant Division long-term contractors (referred to in the Draft PEIS/R as “high” impact conditions).

The results of the analyses provided in the Draft PEIS/R, and summarized in this chapter, indicate that if Interim and Restoration flows are not successfully recirculated to Friant Division long-term contractors, changes in groundwater levels in the CVP/SWP water service areas would result in potentially significant and unavoidable impacts. This conclusion also would be the case if Interim and Restoration flows are successfully recirculated to Friant Division long-term contractors.

With the RPAs in place, the changes in surface water deliveries to the Friant Division long-term contractors, modeled with CalSim-II, indicate minor changes resulting from changes in simulated Delta conditions. However, the changes in surface water deliveries would not result in differences in groundwater pumping and groundwater levels significant enough to result in changes in the level of significance of the impact statements from the Draft PEIS/R.

Impact GRW-2 (Alternatives A1 and A2): ***Changes in Groundwater Levels Along the San Joaquin River from Friant Dam to Merced River – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Because this impact would occur upstream from the Merced River confluence in an area that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact GRW-3 (Alternatives A1 and A2): ***Changes in Groundwater Quality Along the San Joaquin River from Friant Dam to Merced River – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. Because this impact would occur upstream from the Merced River confluence in an area that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact GRW-4 (Alternatives A1 and A2): ***Changes in Groundwater Levels in CVP/SWP Water Service Areas – Project-Level.*** This impact was found to be potentially significant and unavoidable in the Draft PEIS/R. With the RPAs in place, surface water deliveries to the Friant Division long-term contractors would be reduced from the existing conditions, increasing the need to pump groundwater, and thereby increasing groundwater overdraft. The results from completing the Schmidt Tool and mass balance analyses indicate that this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

As described in the Draft PEIS/R and shown in Tables 12-2 through 12-5 (Tables 12-16 through 12-19 in the Draft PEIS/R), the greatest changes in simulated groundwater pumping and groundwater levels using the Schmidt Method were 39 percent and 217 percent change from existing conditions, respectively. As shown in Tables 12-6 through 12-9 (Tables 12-20 through 12-23 in the Draft PEIS/R), the greatest changes in simulated groundwater pumping and groundwater levels using the mass balance method were 36 percent and 2 percent change from existing conditions, respectively. These changes would occur under Alternative A1 or A2 if no water is recirculated to the Friant Division. As described in the Draft PEIS/R, the analysis using the mass balance method accounts for the change in groundwater pumping compared to existing conditions. Therefore, the results presented below do not include a percent difference from the existing conditions, because an existing level of pumping was not assumed for the districts evaluated using the mass balance method.

With the RPAs in place, if no recaptured Interim or Restoration flows are recirculated to the Friant Division, the greatest changes in simulated groundwater pumping and groundwater levels would not change from those shown in Tables 12-4, 12-5, 12-8, and 12-9 (Tables 12-18, 12-19, 12-22, and 12-23 in the Draft PEIS/R). However, with the RPAs in place, if recaptured Interim and Restoration flows are successfully recirculated to Friant Division long-term contractors, the greatest changes in groundwater pumping and groundwater levels from existing conditions using the Schmidt Method would be 23 percent and 76 percent, as shown in Table 12-10 and 12-11. The greatest changes in groundwater levels from existing conditions using the mass balance method would be less than one percent, as shown in Table 12-12 and 12-13. These percent changes from existing conditions would fall within the range of impacts evaluated in the Draft PEIS/R, and would not change the maximum potential effect of implementing the program. Therefore, this impact conclusion would not change from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Table 12-2.
Table 12-16 of the Draft PEIS/R: Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Schmidt Tool Calculations – Low[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (TAF)	Alt A[4,6] (TAF)	Alt B[4,7] (TAF)	Alt C[4,8] (TAF)	No-Action Alt[4] (TAF)	Alt A[5,6] (TAF)	Alt B[5,7] (TAF)	Alt C[5,8] (TAF)
Arvin-Edison WSD	186	211 (14%)	211 (14%)	211 (13%)	186 (0%)	211 (14%)	211 (14%)	210 (13%)
Chowchilla WD	93	105 (13%)	105 (13%)	104 (12%)	93 (0%)	105 (13%)	105 (13%)	103 (11%)
Delano-Earlimart ID	26	28 (8%)	28 (9%)	27 (2%)	26 (0%)	28 (9%)	29 (10%)	26 (-1%)
Exeter ID	20	21 (6%)	21 (6%)	21 (5%)	20 (0%)	21 (6%)	21 (6%)	21 (5%)
Ivanhoe ID	16	16 (2%)	16 (2%)	16 (2%)	16 (0%)	16 (2%)	16 (3%)	16 (1%)
Lindmore ID	34	35 (2%)	35 (2%)	34 (0%)	34 (0%)	35 (2%)	35 (2%)	34 (0%)
Lindsay-Strathmore ID	7	6 (-15%)	6 (-15%)	6 (-20%)	7 (0%)	6 (-15%)	6 (-14%)	6 (-20%)
Lower Tule River ID	134	152 (14%)	152 (14%)	151 (13%)	134 (0%)	152 (14%)	152 (14%)	151 (13%)
Madera ID	153	166 (8%)	166 (8%)	164 (7%)	153 (0%)	166 (8%)	166 (8%)	164 (7%)
Orange Cove ID	41	39 (-4%)	40 (-4%)	39 (-5%)	41 (0%)	40 (-4%)	40 (-3%)	39 (-5%)
Porterville ID	23	25 (9%)	25 (9%)	25 (7%)	23 (0%)	25 (9%)	25 (9%)	25 (7%)
Saucelito ID	15	17 (13%)	17 (13%)	17 (11%)	15 (0%)	17 (13%)	17 (14%)	17 (10%)
Shafter-Wasco ID	55	56 (3%)	57 (3%)	56 (1%)	55 (0%)	56 (3%)	57 (3%)	55 (1%)
Southern San Joaquin MUD	49	50 (1%)	50 (1%)	48 (-2%)	49 (0%)	50 (1%)	50 (2%)	47 (-3%)
Tulare ID	137	148 (8%)	148 (8%)	148 (8%)	137 (0%)	148 (8%)	148 (8%)	147 (8%)

Input to Schmidt Tool Calculations

Table 12-2.
Table 12-16 of the Draft PEIS/R: Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Schmidt Tool Calculations – Low[1, 2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – Low = full return of Interim and Restoration flows by Delta pumping.
[7] Alt B – Low = full return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – Low = full return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
MUD = Municipal Utilities District
TAF = thousand acre-feet
WD = Water District
WSD = Water Storage District

Table 12-3.
Table 12-17 of the Draft PEIS/R: Average Annual Groundwater Depth of All Restoration Year Types Using Schmidt Tool – Low[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (feet)	Alt A[4,6] (feet)	Alt B[4,7] (feet)	Alt C[4,8] (feet)	No-Action Alt[4] (feet)	Alt A[5,6] (feet)	Alt B[5,7] (feet)	Alt C[5,8] (feet)
Arvin-Edison WSD	410	583 (42%)	583 (42%)	579 (41%)	410 (0%)	583 (42%)	584 (42%)	577 (41%)
Chowchilla WD	245	288 (17%)	288 (18%)	285 (16%)	245 (0%)	288 (17%)	289 (18%)	283 (16%)
Delano-Earlimart ID	193	208 (8%)	208 (8%)	196 (2%)	193 (0%)	208 (8%)	211 (9%)	192 (-1%)
Exeter ID	90	114 (27%)	115 (27%)	111 (23%)	90 (0%)	115 (27%)	115 (28%)	109 (21%)
Ivanhoe ID	108	114 (6%)	114 (6%)	112 (4%)	108 (0%)	114 (6%)	115 (7%)	111 (3%)
Lindmore ID	95	105 (10%)	105 (11%)	97 (2%)	95 (0%)	105 (11%)	107 (12%)	93 (-2%)
Lindsay-Strathmore ID	53	42 (-20%)	42 (-19%)	39 (-26%)	52 (0%)	42 (-19%)	43 (-18%)	39 (-26%)
Lower Tule River ID	238	286 (20%)	286 (20%)	283 (19%)	238 (0%)	286 (20%)	286 (20%)	282 (19%)
Madera ID	246	255 (4%)	255 (4%)	254 (3%)	246 (0%)	255 (4%)	255 (4%)	254 (3%)
Orange Cove ID	33	-46 (-242%)	-45 (-237%)	-71 (-319%)	32 (0%)	-45 (-238%)	-39 (-219%)	-71 (-319%)
Porterville ID	73	115 (59%)	116 (60%)	110 (52%)	73 (0%)	116 (59%)	117 (61%)	108 (49%)
Saucelito ID	208	242 (17%)	242 (17%)	236 (14%)	208 (0%)	242 (17%)	243 (17%)	234 (13%)
Shafter-Wasco ID	403	416 (3%)	417 (4%)	409 (2%)	403 (0%)	417 (4%)	418 (4%)	406 (1%)
Southern San Joaquin MUD	243	243 (0%)	243 (0%)	242 (0%)	243 (0%)	243 (0%)	243 (0%)	241 (0%)
Tulare ID	223	284 (27%)	284 (28%)	281 (26%)	223 (0%)	284 (27%)	284 (28%)	280 (26%)

Source: Schmidt Tool Calculations

Table 12-3.
Table 12-17 of the Draft PEIS/R: Average Annual Groundwater Depth of All Restoration Year Types Using Schmidt Tool – Low[1, 2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low, and corresponding change in groundwater depth would be small.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – Low = full return of Interim and Restoration flows by Delta pumping.
[7] Alt B – Low = full return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – Low = full return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
MUD = Municipal Utilities District
TAF = thousand acre-feet
WD = Water District
WSD = Water Storage District

Table 12-4.
Table 12-18 of the PEIS/R: Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Schmidt Tool Calculations – High[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (TAF)	Alt A[4,6] (TAF)	Alt B[4,7] (TAF)	Alt C[4,8] (TAF)	No-Action Alt[4] (TAF)	Alt A[5,6] (TAF)	Alt B[5,7] (TAF)	Alt C[5,8] (TAF)
Arvin-Edison WSD	186	214 (15%)	214 (15%)	213 (15%)	186 (0%)	214 (15%)	214 (15%)	213 (14%)
Chowchilla WD	93	109 (17%)	108 (16%)	107 (15%)	93 (0%)	109 (17%)	108 (16%)	107 (15%)
Delano-Earlimart ID	26	36 (39%)	35 (36%)	33 (29%)	26 (0%)	36 (39%)	35 (35%)	32 (24%)
Exeter ID	20	22 (10%)	22 (10%)	22 (9%)	20 (0%)	22 (10%)	22 (10%)	22 (8%)
Ivanhoe ID	16	17 (6%)	17 (6%)	17 (5%)	16 (0%)	17 (6%)	17 (5%)	17 (4%)
Lindmore ID	34	37 (9%)	37 (8%)	36 (6%)	34 (0%)	37 (9%)	37 (8%)	36 (5%)
Lindsay-Strathmore ID	7	8 (14%)	8 (11%)	7 (4%)	7 (0%)	8 (14%)	8 (10%)	7 (-1%)
Lower Tule River ID	134	157 (17%)	156 (17%)	155 (16%)	134 (0%)	157 (17%)	156 (16%)	154 (15%)
Madera ID	153	172 (12%)	171 (12%)	170 (11%)	153 (0%)	172 (12%)	171 (12%)	169 (10%)
Orange Cove ID	41	42 (3%)	42 (3%)	41 (1%)	41 (0%)	42 (3%)	42 (2%)	41 (0%)
Porterville ID	23	26 (14%)	26 (13%)	26 (12%)	23 (0%)	26 (14%)	26 (13%)	26 (11%)
Saucelito ID	15	19 (24%)	18 (23%)	18 (20%)	15 (0%)	19 (24%)	18 (22%)	18 (19%)
Shafter-Wasco ID	55	60 (9%)	60 (9%)	59 (7%)	55 (0%)	60 (9%)	60 (8%)	58 (6%)
Southern San Joaquin MUD	49	57 (16%)	56 (14%)	54 (11%)	49 (0%)	57 (16%)	56 (14%)	53 (8%)
Tulare ID	137	150 (10%)	150 (9%)	149 (9%)	137 (0%)	150 (10%)	150 (9%)	149 (9%)

Source: Input to Schmidt Tool Calculations

Table 12-4.
Table 12-18 of the PEIS/R: Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Schmidt Tool Calculations – High[1, 2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] High = no water released as Interim and Restoration flows is recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively high.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – High = no return of Interim and Restoration flows by Delta pumping.
[7] Alt B – High = no return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – High = no return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
MUD = Municipal Utilities District
TAF = thousand acre-feet
WD = Water District
WSD = Water Storage District

Table 12-5.
Table 12-19 of the PEIS/R: Average Annual Groundwater Depth of All Restoration Year Types Using Schmidt Tool – High[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (feet)	Alt A[4,6] (feet)	Alt B[4,7] (feet)	Alt C[4,8] (feet)	No-Action Alt[4] (feet)	Alt A[5,6] (feet)	Alt B[5,7] (feet)	Alt C[5,8] (feet)
Arvin-Edison WSD	410	603 (47%)	601 (47%)	596 (45%)	410 (0%)	603 (47%)	600 (46%)	593 (45%)
Chowchilla WD	245	303 (24%)	301 (23%)	297 (21%)	245 (0%)	303 (24%)	301 (23%)	295 (20%)
Delano-Earlimart ID	193	264 (37%)	258 (34%)	244 (27%)	193 (0%)	264 (37%)	256 (33%)	236 (22%)
Exeter ID	90	132 (46%)	130 (44%)	126 (40%)	90 (0%)	132 (46%)	129 (44%)	123 (37%)
Ivanhoe ID	108	124 (15%)	123 (15%)	121 (12%)	108 (0%)	124 (15%)	123 (14%)	119 (11%)
Lindmore ID	95	144 (51%)	140 (47%)	130 (37%)	95 (0%)	144 (51%)	139 (46%)	124 (31%)
Lindsay-Strathmore ID	53	62 (18%)	60 (14%)	55 (5%)	52 (0%)	62 (18%)	59 (13%)	52 (-1%)
Lower Tule River ID	238	298 (25%)	296 (25%)	293 (24%)	238 (0%)	298 (25%)	296 (25%)	292 (23%)
Madera ID	246	259 (6%)	259 (5%)	258 (5%)	246 (0%)	259 (6%)	259 (5%)	257 (5%)
Orange Cove ID	33	103 (217%)	88 (172%)	51 (57%)	32 (0%)	103 (217%)	83 (156%)	29 (-12%)
Porterville ID	73	141 (95%)	139 (91%)	132 (82%)	73 (0%)	141 (94%)	138 (90%)	128 (77%)
Saucelito ID	208	269 (30%)	266 (28%)	259 (25%)	208 (0%)	269 (30%)	265 (28%)	255 (23%)
Shafter-Wasco ID	403	451 (12%)	448 (11%)	439 (9%)	403 (0%)	451 (12%)	447 (11%)	434 (8%)
Southern San Joaquin MUD	243	248 (2%)	248 (2%)	246 (2%)	243 (0%)	248 (2%)	248 (2%)	246 (1%)
Tulare ID	223	296 (33%)	295 (32%)	292 (31%)	223 (0%)	296 (33%)	294 (32%)	290 (30%)

Source: Schmidt Tool Calculations

Table 12-5.
Table 12-19 of the PEIS/R: Average Annual Groundwater Depth of All Restoration Year Types Using Schmidt Tool – High[1, 2] (contd.)

Notes:

All results are rounded to the nearest whole number.

[1] Year type as defined by the Restoration Year Type.

[2] High = no water released as Interim and Restoration flows is recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively high, and corresponding change in groundwater depth would be large.

[3] Simulation period: October 1921 – September 2003.

[4] (%) indicates percent change from existing conditions.

[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.

[6] Alt A – High = no return of Interim and Restoration flows by Delta pumping.

[7] Alt B – High = no return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.

[8] Alt C – High = no return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:

Alt = Alternative

ID = Irrigation District

MUD = Municipal Utilities District

TAF = thousand acre-feet

WD = Water District

WSD = Water Storage District

Table 12-6.
Table 12-20 of the PEIS/R: Change in Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used In Mass Balance Calculations – Low[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (TAF)	Alt A[4,6] (TAF)	Alt B[4,7] (TAF)	Alt C[4,8] (TAF)	No-Action Alt[4] (TAF)	Alt A[5,6] (TAF)	Alt B[5,7] (TAF)	Alt C[5,8] (TAF)
City of Fresno	NA	-2 (-4%)	-2 (-4%)	-3 (-5%)	0 (0%)	-2 (-4%)	-2 (-4%)	-3 (-5%)
City of Lindsay	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
City of Orange Cove	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
Fresno County Waterworks District No. 18	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
Fresno ID	NA	6 (36%)	6 (36%)	6 (36%)	0 (0%)	6 (36%)	6 (36%)	6 (36%)
Garfield WD	NA	0 (36%)	0 (36%)	0 (36%)	0 (0%)	0 (36%)	0 (36%)	0 (36%)
Gravelly Ford WD	NA	1 (36%)	1 (36%)	1 (36%)	0 (0%)	1 (36%)	1 (36%)	1 (36%)
International WD	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
Lewis Creek WD	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
Madera County (Hidden Lake Estates)	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
Stone Corral ID	NA	0 (-4%)	0 (-4%)	-1 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	-1 (-5%)
Tea Pot Dome WD	NA	0 (-4%)	0 (-4%)	0 (-5%)	0 (0%)	0 (-4%)	0 (-4%)	0 (-5%)
Terra Bella ID	NA	-1 (-4%)	-1 (-4%)	-1 (-5%)	0 (0%)	-1 (-4%)	-1 (-4%)	-1 (-5%)

Inputs to Mass Balance Method Calculations

Table 12-6.
Table 12-20 of the PEIS/R: Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used In Mass Balance Calculations – Low[1, 2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low, and corresponding change in groundwater depth would be small.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – High = no return of Interim and Restoration flows by Delta pumping.
[7] Alt B – High = no return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – High = no return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
TAF = thousand acre-feet
WD = Water District

Table 12-7.
Table 12-21 of the PEIS/R: Average Annual Simulated Groundwater Depth of All Restoration Year Types Using Mass Balance Method – Low[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (feet)	Alt A[4,6] (feet)	Alt B[4,7] (feet)	Alt C[4,8] (feet)	No-Action Alt[4] (feet)	Alt A[5,6] (feet)	Alt B[5,7] (feet)	Alt C[5,8] (feet)
City of Fresno	115	114 (0%)	114 (0%)	114 (0%)	115 (0%)	114 (0%)	114 (0%)	114 (0%)
City of Lindsay	53	53 (-1%)	53 (-1%)	52 (-1%)	53 (0%)	53 (-1%)	53 (-1%)	52 (-1%)
City of Orange Cove	27	26 (-2%)	26 (-2%)	26 (-2%)	27 (0%)	26 (-2%)	26 (-2%)	26 (-2%)
Fresno County Waterworks District No. 18	69	69 (0%)	69 (0%)	69 (0%)	69 (0%)	69 (0%)	69 (0%)	69 (0%)
Fresno ID	85	85 (0%)	85 (0%)	85 (0%)	85 (0%)	85 (0%)	85 (0%)	85 (0%)
Garfield WD	160	159 (0%)	159 (0%)	159 (-1%)	160 (0%)	159 (0%)	159 (0%)	159 (-1%)
Gravelly Ford WD	140	141 (1%)	141 (1%)	141 (1%)	140 (0%)	141 (1%)	141 (1%)	141 (1%)
International WD	55	54 (-1%)	54 (-1%)	54 (-1%)	55 (0%)	54 (-1%)	54 (-1%)	54 (-1%)
Lewis Creek WD	55	55 (-1%)	55 (-1%)	54 (-1%)	55 (0%)	55 (-1%)	55 (-1%)	54 (-1%)
Madera County (Hidden Lake Estates)	112	112 (0%)	112 (0%)	112 (-1%)	112 (0%)	112 (0%)	112 (0%)	112 (-1%)
Stone Corral ID	40	39 (-1%)	39 (-1%)	39 (-2%)	40 (0%)	39 (-1%)	40 (-1%)	39 (-2%)
Tea Pot Dome WD	155	154 (-1%)	154 (-1%)	154 (-1%)	155 (0%)	154 (-1%)	154 (-1%)	154 (-1%)
Terra Bella ID	140	139 (-1%)	139 (-1%)	139 (-1%)	140 (0%)	139 (-1%)	139 (-1%)	139 (-1%)

Mass Balance Method Calculations

Table 12-7.
Table 12-21 of the PEIS/R: Average Annual Simulated Groundwater Depth of All Restoration Year Types Using Mass Balance Method – Low[1, 2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low, and corresponding change in groundwater depth would be small.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – High = no return of Interim and Restoration flows by Delta pumping.
[7] Alt B – High = no return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – High = no return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
TAF = thousand acre-feet
WD = Water District

Table 12-8.
Table 12-22 of the PEIS/R: Change in Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Mass Balance Calculations – High[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (TAF)	Alt A[4,6] (TAF)	Alt B[4,7] (TAF)	Alt C[4,8] (TAF)	No-Action Alt[4] (TAF)	Alt A[5,6] (TAF)	Alt B[5,7] (TAF)	Alt C[5,8] (TAF)
City of Fresno	NA	2 (4%)	2 (3%)	1 (1%)	0 (0%)	2 (4%)	2 (3%)	0 (0%)
City of Lindsay	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
City of Orange Cove	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Fresno County Waterworks District No. 18	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Fresno ID	NA	6 (36%)	6 (36%)	6 (36%)	0 (0%)	6 (36%)	6 (36%)	6 (36%)
Garfield WD	NA	0 (36%)	0 (36%)	0 (36%)	0 (0%)	0 (36%)	0 (36%)	0 (36%)
Gravelly Ford WD	NA	1 (36%)	1 (36%)	1 (36%)	0 (0%)	1 (36%)	1 (36%)	1 (36%)
International WD	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Lewis Creek WD	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Madera County (Hidden Lake Estates)	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Stone Corral ID	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Tea Pot Dome WD	NA	0 (4%)	0 (3%)	0 (1%)	0 (0%)	0 (4%)	0 (3%)	0 (0%)
Terra Bella ID	NA	1 (4%)	1 (3%)	0 (1%)	0 (0%)	1 (4%)	1 (3%)	0 (0%)

Inputs to Mass Balance Method Calculations

Table 12-8.
Table 12-22 of the PEIS/R: Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Mass Balance Calculations – High[1, 2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] High = no water released as Interim and Restoration flows is recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively high, and corresponding change in groundwater depth would be large.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – High = no return of Interim and Restoration flows by Delta pumping.
[7] Alt B – High = no return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – High = no return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
TAF = thousand acre-feet
WD = Water District

Table 12-9.
Table 12-23 of the PEIS/R: Average Annual Simulated Groundwater Depth of All Restoration Year Types Using Mass Balance Method – High[1, 2]

District	Existing Level (2005)[3]				Future Level (2030)[3]			
	Existing Conditions (feet)	Alt A[4,6] (feet)	Alt B[4,7] (feet)	Alt C[4,8] (feet)	No-Action Alt[4] (feet)	Alt A[5,6] (feet)	Alt B[5,7] (feet)	Alt C[5,8] (feet)
City of Fresno	115	115 (0%)	115 (0%)	115 (0%)	115 (0%)	115 (0%)	115 (0%)	115 (0%)
City of Lindsay	53	54 (1%)	54 (1%)	53 (0%)	53 (0%)	54 (1%)	53 (1%)	53 (0%)
City of Orange Cove	27	27 (2%)	27 (1%)	27 (0%)	27 (0%)	27 (2%)	27 (1%)	27 (0%)
Fresno County Waterworks District No. 18	69	69 (0%)	69 (0%)	69 (0%)	69 (0%)	69 (0%)	69 (0%)	69 (0%)
Fresno ID	85	85 (0%)	85 (0%)	85 (0%)	85 (0%)	85 (0%)	85 (0%)	85 (0%)
Garfield WD	160	161 (0%)	160 (0%)	160 (0%)	160 (0%)	161 (0%)	160 (0%)	160 (0%)
Gravelly Ford WD	140	141 (1%)	141 (1%)	141 (1%)	140 (0%)	141 (1%)	141 (1%)	141 (1%)
International WD	55	56 (1%)	55 (1%)	55 (0%)	55 (0%)	56 (1%)	55 (1%)	55 (0%)
Lewis Creek WD	55	55 (1%)	55 (1%)	55 (0%)	55 (0%)	55 (1%)	55 (0%)	55 (0%)
Madera County (Hidden Lake Estates)	112	113 (0%)	113 (0%)	113 (0%)	112 (0%)	113 (0%)	113 (0%)	112 (0%)
Stone Corral ID	40	40 (1%)	40 (1%)	40 (0%)	40 (0%)	40 (1%)	40 (1%)	40 (0%)
Tea Pot Dome WD	155	156 (0%)	156 (0%)	155 (0%)	155 (0%)	156 (0%)	156 (0%)	155 (0%)
Terra Bella ID	140	141 (1%)	141 (0%)	140 (0%)	140 (0%)	141 (1%)	141 (0%)	140 (0%)

Mass Balance Method Calculations

Table 12-9.
Table 12-23 of the PEIS/R: Average Annual Simulated Groundwater Depth of All Restoration Year Types Using Mass Balance Method – High[1,2] (contd.)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] High = no water released as Interim and Restoration flows is recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively high, and corresponding change in groundwater depth would be large.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] (%) indicates percent change from No-Action Alternative. CalSim II simulation period: October 1921 – September 2003.
[6] Alt A – High = no return of Interim and Restoration flows by Delta pumping.
[7] Alt B – High = no return of Interim and Restoration flows by Delta pumping and full return of San Joaquin River exchange flows.
[8] Alt C – High = no return of Interim and Restoration flows by Delta pumping, full return of San Joaquin River exchange flows, and full return of San Joaquin River pumping.

Key:
Alt = Alternative
ID = Irrigation District
TAF = thousand acre-feet
WD = Water District

Table 12-10.
Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used in Schmidt Tool Calculations – Low[1, 2]

District	Alternative A RPA5[3,4,5] (TAF)
Arvin-Edison WSD	213 (14%)
Chowchilla WD	106 (15%)
Delano-Earlimart ID	32 (23%)
Exeter ID	22 (8%)
Ivanhoe ID	17 (4%)
Lindmore ID	36 (5%)
Lindsay-Strathmore ID	7 (-2%)
Lower Tule River ID	154 (15%)
Madera ID	169 (10%)
Orange Cove ID	41 (0%)
Porterville ID	26 (11%)
Saucelito ID	18 (18%)
Shafter-Wasco ID	58 (6%)
Southern San Joaquin MUD	53 (8%)
Tulare ID	149 (9%)

Notes:
All results are rounded to the nearest whole number.
1 Year type as defined by the Restoration Year Type.
2 Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low.
3 Simulation period: October 1921 – September 2003.
4 (%) indicates percent change from existing conditions.
5 Alt A – Low = full return of Interim and Restoration flows by Delta pumping.

Key:
ID = Irrigation District
MUD = Municipal Utilities District
RPA = reasonable and prudent alternative
TAF = thousand acre-feet
WD = Water District
WSD = Water Storage District

**Table 12-11.
Average Annual Groundwater Depth
of All Restoration Year Types Using Schmidt Tool – Low[1, 2]**

District	Alternative A RPA5[3,4,5] (feet)
Arvin-Edison WSD	592 (44%)
Chowchilla WD	295 (20%)
Delano-Earlimart ID	233 (21%)
Exeter ID	122 (36%)
Ivanhoe ID	119 (10%)
Lindmore ID	123 (29%)
Lindsay-Strathmore ID	51 (-2%)
Lower Tule River ID	291 (23%)
Madera ID	257 (5%)
Orange Cove ID	23 (-31%)
Porterville ID	127 (76%)
Saucelito ID	254 (23%)
Shafter-Wasco ID	433 (7%)
Southern San Joaquin MUD	245 (1%)
Tulare ID	289 (30%)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low, and corresponding change in groundwater depth would be small.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] Alt A – Low = full return of Interim and Restoration flows by Delta pumping.

Key:
ID = Irrigation District
MUD = Municipal Utilities District
RPA = reasonable and prudent alternative
TAF = thousand acre-feet
WD = Water District
WSD = Water Storage District

Table 12-12.
Change in Average Annual Simulated Groundwater Pumping of All Restoration Year Types Used In Mass Balance Calculations – Low[1, 2]

District	Alternative A RPA 5[3,4,5] (TAF)
City of Fresno	0
City of Lindsay	0
City of Orange Cove	0
Fresno County Waterworks District No. 18	0
Fresno ID	6
Garfield WD	0
Gravelly Ford WD	1
International WD	0
Lewis Creek WD	0
Madera County (Hidden Lake Estates)	0
Stone Corral ID	0
Tea Pot Dome WD	0
Terra Bella ID	0

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low, and corresponding change in groundwater depth would be small.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] Alt A – High = no return of Interim and Restoration flows by Delta pumping.

Key:
ID = Irrigation District
RPA = reasonable and prudent alternative
TAF = thousand acre-feet
WD = Water District

Table 12-13.
Average Annual Simulated Groundwater Depth
of All Restoration Year Types Using Mass Balance Method – Low[1, 2]

District	Alt A RPA 5[3,4,5] (feet)
City of Fresno	115 (0%)
City of Lindsay	53 (0%)
City of Orange Cove	27 (0%)
Fresno County Waterworks District No. 18	69 (0%)
Fresno ID	85 (0%)
Garfield WD	160 (0%)
Gravelly Ford WD	141 (0%)
International WD	55 (0%)
Lewis Creek WD	55 (0%)
Madera County (Hidden Lake Estates)	112 (0%)
Stone Corral ID	40 (0%)
Tea Pot Dome WD	155 (0%)
Terra Bella ID	140 (0%)

Notes:
All results are rounded to the nearest whole number.
[1] Year type as defined by the Restoration Year Type.
[2] Low = full quantity of recaptured Interim and Restoration flows is successfully recirculated to Friant Division long-term contractors. The increase in groundwater pumping due to reoperating Friant Dam would be relatively low, and corresponding change in groundwater depth would be small.
[3] Simulation period: October 1921 – September 2003.
[4] (%) indicates percent change from existing conditions.
[5] Alt A – High = no return of Interim and Restoration flows by Delta pumping.

Key:
Alt = Alternative
ID = Irrigation District
RPA = reasonable and prudent alternative
TAF = thousand acre-feet
WD = Water District

Impact GRW-5 (Alternatives A1 Through C2): ***Change in Groundwater Quality in CVP/SWP Water Service Areas – Project-Level.*** This impact was found to be potentially significant and unavoidable in the Draft PEIS/R. With the RPAs in place, surface water deliveries to Friant Division long-term contractors would be reduced under all alternatives, increasing the need to pump groundwater, and thereby increasing groundwater overdraft, as discussed in Impact GRW-4. This could lead to upwelling of poorer quality groundwater; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

As described in the Draft PEIS/R, an increase in groundwater pumping for a prolonged period would not only decrease groundwater levels, but could potentially lead to upwelling of poorer quality groundwater under the action alternatives. The San Joaquin Valley Groundwater Basin is in a state of overdraft, and groundwater levels are expected to continue in a downward trend under the No-Action Alternative. Implementing the action alternatives would increase overdraft and accelerate the downward groundwater level trend. This impact would be potentially significant and unavoidable.

With the RPAs in place, as described in Impact GRW-4 the action alternatives would reduce surface water deliveries to the Friant Division long-term contractors, increasing the need to pump groundwater, and thereby increasing groundwater overdraft. This overdraft, and the associated impacts to groundwater quality, would be within the range of impacts evaluated in the Draft PEIS/R, and would not change the maximum potential effect of implementing the program. Therefore, this impact conclusion would not change from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Chapter 13.0 Hydrology – Surface Water Supplies and Facilities Operations

This chapter describes the potential for impacts of Alternatives A1 and A2 on surface water supplies and facilities operations under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 13.0, "Hydrology – Surface Water Supplies and Facilities Operations," of the Draft PEIS/R. The discussion of potential impacts on surface water supplies and facilities operations presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 13.1, "Environmental Setting" –** Describes existing surface water supplies and facilities operations conditions along the San Joaquin River upstream from Friant Dam, within the Restoration Area, along the San Joaquin River from the Merced River to the Delta, within the Delta, and within the Friant Division.

- **Section 13.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to surface water supplies and facilities operations conditions.

- **Section 13.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to surface water supplies and facilities operations conditions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 13-1. As shown in Table 13-1, none of the impact conclusions of Alternatives A1 and A2 on surface water supplies and facilities operations would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 13.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 13-1.

Table 13-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Hydrology – Surface Water Supplies and Facilities Operations: Program-Level						
SWS-1: Changes in Diversion Capacities	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	SWS-1: Provide Alternate Temporary or Permanent River Access to Avoid Diversion Losses	LTS	No[1,2]	No[1,2]
Hydrology – Surface Water Supplies and Facilities Operations: Project-Level						
SWS-2: Change in Water Levels in the Old River near the Tracy Road Bridge	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWS-3: Change in Water Levels in the Grant Line Canal near the Grant Line Canal Barrier	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWS-4: Change in Water Levels in the Middle River near the Howard Road Bridge	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWS-5: Change in Recurrence of Delta Excess Conditions	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

13.1 Program-Level Impacts

The potential program-level impacts to surface water supplies and facilities under Alternatives A1 and A2, as described in the Draft PEIS/R, would be associated with construction activities. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO; therefore, the significance conclusion and mitigation requirements identified for this impact would not change from those presented in the Draft PEIS/R.

Impact SWS-1 (Alternatives A1 and A2): ***Changes in Diversion Capacities – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure SWS-1 (Alternatives A1 and A2): ***Provide Alternative Temporary or Permanent River Access to Avoid Diversion Losses – Program-Level.*** This mitigation measure is identical to Mitigation Measure SWS-1 (Alternatives A1 through C2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would be less than significant.

13.2 Project-Level Impacts

As described in the Draft PEIS/R, potential impacts to surface water supplies and facilities operations are evaluated using criteria identified in the *Response Plan for Water Level Concerns in the South Delta Under Water Rights Decision 1641* (Water Level Response Plan) (Reclamation and DWR 2004). Consistent with the requirements of State Water Resource Control Board (SWRCB) Decision 1641 (D-1641), Reclamation and DWR developed the Water Level Response Plan to ensure that water levels in the southern Delta will not be lowered to the injury of water users in the southern Delta (Reclamation and DWR 2004). Under the Water Level Response Plan, DWR utilizes DSM2 to simulate water levels at three barriers in the south Delta, located on the Middle River, Grant Line Canal, and Old River. These barriers are installed in spring and removed in fall to facilitate adequate water levels and water quality for agricultural diversions. Water levels in the south Delta are considered adequate if they are simulated to be 0.0 feet mean sea level (msl) or greater at Old River near Tracy Road Bridge, or at Doughty Cut above Grant Line Canal Barrier, and 0.3 feet msl or greater at Middle River near Howard Road Bridge. The Water Level Response Plan includes provisions to adjust operations at Jones and Banks pumping plants if simulations or real-time observations indicate water levels of concern.

To determine the potential for changes in Delta CVP/SWP operations to occur as an indirect effect of Interim and Restoration flows from the San Joaquin River reaching the Delta, analyses in the Draft PEIS/R compared water surface elevations simulated using

DSM2 to the criteria identified in the Water Level Response Plan. The criteria identified in the plan are also applied in the Final PEIS/R, such that a change in water level is considered potentially significant if the following conditions are both true:

1. The simulated water level is below 0.0 feet at msl at the Old River near Tracy Boulevard Bridge and at locations above the Grant Line Canal Barrier, or 0.3 foot above msl at the Middle River near the Howard Road Bridge. A simulated water level below these thresholds would indicate a time period when Reclamation and DWR would adjust real-time operations at Jones and Banks pumping plants to maintain consistency with the provisions of the Water Level Response Plan. Typically this would include reducing diversions at Jones and Banks pumping plants.

2. The simulated water level change between the alternative and baseline is greater than a 0.1-foot decrease during the irrigation season of April through October. A threshold of change of 0.1-foot was selected because it is consistent with the level of precision provided in the water level response plan standards, and it provides a conservative threshold to identify the likelihood that real-time adjustments to CVP/SWP operations would result in water recapture from the Delta that would differ from simulated operations.

The results of the analyses provided in the Draft PEIS/R, and summarized in this chapter, indicate water levels would not meet the above conditions and would not result in real-time adjustments to Jones and Banks pumping plant operations based on the Water Level Response Plan criteria. The CalSim-II water operations modeling conducted in support of the impact analyses presented in the Draft PEIS/R indicated that annual average exports at Jones and Banks pumping plants could increase by up to about 94 thousand acre-feet (TAF), as compared to the No-Action Alternative. Impact assessments in the Draft PEIS/R evaluated the full range of potential change in annual average exports, from 0 TAF to about 94 TAF. DSM2 modeling of surface water levels indicated that surface water levels in the South Delta would not trigger real-time export reductions based on the Water Level Response Plan criteria.

With the RPAs in place, CalSim-II water operations modeling indicates that annual average exports at Jones and Banks pumping plants could increase by up to about 60 TAF over the No-Action Alternative. The annual average exports would remain within the range of annual average exports evaluated in the Draft PEIS/R (0 TAF to about 94 TAF). Because the average annual exports at Jones and Banks pumping plants would remain within the range of exports analyzed in the Draft PEIS/R, and the provisions of the Water Level Response Plan would continue to be met, surface water supply impact significance determinations would not change from those presented in the Draft PEIS/R.

In addition to the changes in Delta exports described above, changes in simulated Delta conditions are also considered to be potentially significant if the program alternatives would cause the Delta to be in balanced conditions when it would otherwise have been under excess conditions at any time from November 1 to June 30, as this would reduce Contra Costa Water District's (CCWD) potential to fill Los Vaqueros Reservoir.

Impact SWS-2 (Alternatives A1 and A2): ***Change in Water Levels in the Old River near the Tracy Road Bridge – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, simulated water levels under Alternatives A1 and A2 would decrease more than 0.1 feet, resulting in a simulated water level below 0.0 foot elevation, during April in some of the 82 years of simulated record. During these periods real-time adjustments to diversions at Jones and Banks pumping plants would be made, such that water levels in the Old River near the Tracy Road Bridge would remain at or above 0.0 feet msl, and would not adversely affect agricultural users' ability to divert irrigation water. The significance conclusion of this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Alternatives A1 and A2 would not directly change Delta operations, but instead would change Delta conditions through indirect effects of Interim and Restoration flows from the San Joaquin River entering the Delta. These changed conditions could alter the quantity and timing of Jones and Banks pumping in the south Delta, which could impact south Delta water levels. This impact mechanism is affected by some of the RPAs.

As described in the Draft PEIS/R, water level decreases greater than 0.1 feet in the Old River near the Tracy Road Bridge that also result in water levels below the identified threshold of 0.0 foot elevation rarely occurred in the April through October irrigation months. As shown in Table 13-2 (Table 13-54 of the Draft PEIS/R), the greatest decreases shown in the DSM2 modeling were 0.53 feet and 0.89 feet compared to the existing conditions and No-Action Alternative, respectively, however these decreases only rarely result in a water level below the 0.0 foot elevation threshold. Under the Water Level Response Plan, during these periods real-time adjustments to diversions at Jones and Banks pumping plants would be made, such that water levels in the Old River near the Tracy Road Bridge would remain at or above 0.0 feet msl, and would not adversely affect agricultural users' ability to divert irrigation water. This impact was found to be less than significant in the Draft PEIS/R.

Table 13-2.
Table 13-54 of the Draft PEIS/R: Simulated Monthly Maximum 15-Minute Change in Water Levels at Old River near Tracy Road Bridge at Low-Low Tide

Month	Existing Level (2005)			Future Level (2030)			
	Alt A1 and A2 (ft msl)	Alt B1 and B2 (ft msl)	Alt C1 and C2 (ft msl)	No-Action Alt (ft msl)	Alt A1 and A2 (ft msl)	Alt B1 and B2 (ft msl)	Alt C1 and C2 (ft msl)
April	-0.09 (0%)	-0.09 (0%)	-0.09 (0%)	-0.38 (0%)	-0.08 (0%)	-0.08 (0%)	-0.08 (0%)
May	-0.37 (0%)	-0.37 (0%)	-0.37 (0%)	-1.67 (0%)	-0.31 (0%)	-0.31 (0%)	-0.31 (0%)
June	-0.53 (0%)	-0.53 (0%)	-0.53 (0%)	-3.06 (0%)	-0.58 (0%)	-0.58 (0%)	-0.58 (0%)
July	-0.20 (0%)	-0.20 (0%)	-0.20 (0%)	-3.08 (0%)	-0.19 (0%)	-0.19 (0%)	-0.19 (0%)
August	-0.07 (0%)	-0.07 (0%)	-0.07 (0%)	-2.58 (0%)	-0.05 (0%)	-0.05 (0%)	-0.06 (0%)
September	-0.02 (0%)	-0.02 (0%)	-0.02 (0%)	-1.95 (0%)	-0.89 (0%)	-0.89 (0%)	-0.89 (0%)
October	-0.03 (0%)	-0.03 (0%)	-0.03 (0%)	-1.47 (0%)	-0.15 (0%)	-0.15 (0%)	-0.15 (0%)

Source: DSM2 simulations (Node 071_3116)
Notes:
Simulation period: October 1921 – September 2003.
(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.
Key:
Alt = Alternative
ft msl = feet mean sea level
PEIS/R = Program Environmental Impact Statement/Report

Under all RPA scenarios, DSM2 simulations indicate that Alternatives A1 and A2 would cause a maximum decrease in water level exceeding 0.1 feet, and resulting in a water level below the 0.0 foot elevation threshold, during April in some years. This condition would occur between 2.4 percent (Scenarios 4, 5, 6) and 6.1 percent (Scenario 1) of the simulated months, as shown in Table 13-3. This corresponds to a decrease in water level exceeding 0.1 feet (and a resulting water level below the 0.0 foot elevation threshold) in two months to five months in a year, respectively, throughout the 82 years of simulated record. No decreases that would cause a maximum decrease in water level exceeding 0.1 feet, and resulting in a water level below the 0.0 foot elevation threshold, occurred in the months from May through October. These data are provided in the Delta Simulation Modeling Output – DSM2 Attachment. During these periods real-time adjustments to diversions at Jones and Banks pumping plants would be made, such that water levels in the Old River near the Tracy Road Bridge would remain at or above 0.0 feet msl and would not adversely affect agricultural users' ability to divert irrigation water. The significance conclusion of this impact would not change from the Draft PEIS/R, and would be less than significant.

Table 13-3.
Simulated Monthly Maximum 15-Minute Change in Water Levels at Old River near Tracy Road Bridge at Low-Low Tide, Alternatives A1 and A2 Under All RPA Scenarios

Month	Scenario 1 (ft msl)	Scenario 2 (ft msl)	Scenario 3 (ft msl)	Scenario 4 (ft msl)	Scenario 5 (ft msl)	Scenario 6 (ft msl)
April	-0.22 (6.1%)	-0.22 (4.9%)	-0.17 (3.7%)	-0.12 (2.4%)	-0.16 (2.4%)	-0.12 (2.4%)
May	-0.27 (0.0%)	-0.34 (0.0%)	-0.25 (0.0%)	-0.25 (0.0%)	-0.25 (0.0%)	-0.27 (0.0%)
June	-0.10 (0.0%)	-2.74 (0.0%)	-0.10 (0.0%)	-0.22 (0.0%)	-2.74 (0.0%)	-2.74 (0.0%)
July	-0.03 (0.0%)	-0.06 (0.0%)	-0.02 (0.0%)	-0.03 (0.0%)	-0.06 (0.0%)	-0.06 (0.0%)
August	-0.03 (0.0%)	-0.05 (0.0%)	-0.03 (0.0%)	-0.03 (0.0%)	-0.03 (0.0%)	-0.01 (0.0%)
September	-0.06 (0.0%)	-0.06 (0.0%)	-0.06 (0.0%)	-0.04 (0.0%)	-0.07 (0.0%)	-0.07 (0.0%)
October	-0.03 (0.0%)	-0.04 (0.0%)	-0.11 (0.0%)	-0.03 (0.0%)	-0.04 (0.0%)	-0.01 (0.0%)

Source: DSM2 simulations (Node 071_3116)

Notes:

Simulation period: October 1921 – September 2003.

(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.

Key:

Alt = Alternative

ft msl = feet mean sea level

RPA = reasonable and prudent alternative

Impact SWS-3 (Alternatives A1 and A2): ***Change in Water Levels in the Grant Line Canal near the Grant Line Canal – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place Alternatives A1 and A2 would not cause a maximum decrease in water level exceeding 0.1 feet, and resulting in a water level below 0.3 foot elevation (the water level thresholds identified in the Draft PEIS/R), and would not adversely affect agricultural users' ability to divert irrigation. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Alternatives Al and A2 would not directly change Delta operations, but instead would change Delta conditions because of indirect effects of Interim and Restoration flows from the San Joaquin River reaching the Delta. These changed conditions could alter the quantity and timing of Jones and Banks pumping in the south Delta, which could impact south Delta water levels. This impact mechanism is affected by some of the RPAs. As described in the Draft PEIS/R, water level decreases greater than 0.1 feet in the Grant Line Canal near the Grant Line Canal Barrier that also result in water levels below the identified limit rarely occurred in the simulated irrigation months during the late spring. As shown in Table 13-4 (Table 13-55 of the Draft PEIS/R), the greatest decreases were 0.58 feet and 0.57 feet compared to the existing conditions and No-Action Alternative, respectively, yet these maximum decreases do not cause a maximum decrease in water level exceeding 0.1 feet, and a resulting water level below the 0.3 foot elevation threshold, and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

Table 13-4.
Table 13-55 of the Draft PEIS/R: Simulated Monthly Maximum 15-Minute Change in Water Levels at Grant Line Canal near Grant Line Canal Barrier at Low-Low Tide

Month	Existing Level (2005)			Future Level (2030)			
	Alt A1 and A2 (ft msl)	Alt B1 and Bsure2 (ft msl)	Alt C1 and C2 (ft msl)	No-Action Alt (ft msl)	Alt A1 and A2 (ft msl)	Alt B1 and B2 (ft msl)	Alt C1 and C2 (ft msl)
April	-0.08 (0%)	-0.08 (0%)	-0.08 (0%)	0.00 (0%)	-0.08 (0%)	-0.08 (0%)	-0.08 (0%)
May	-0.36 (0%)	-0.36 (0%)	-0.36 (0%)	-1.12 (0%)	-0.32 (0%)	-0.32 (0%)	-0.32 (0%)
June	-0.58 (0%)	-0.58 (0%)	-0.58 (0%)	-2.84 (0%)	-0.57 (0%)	-0.57 (0%)	-0.57 (0%)
July	-0.21 (0%)	-0.21 (0%)	-0.21 (0%)	-2.79 (0%)	-0.20 (0%)	-0.20 (0%)	-0.20 (0%)
August	-0.07 (0%)	-0.07 (0%)	-0.07 (0%)	-2.31 (0%)	-0.05 (0%)	-0.05 (0%)	-0.05 (0%)
September	-0.02 (0%)	-0.02 (0%)	-0.02 (0%)	-1.39 (0%)	-0.27 (0%)	-0.27 (0%)	-0.27 (0%)
October	-0.03 (0%)	-0.03 (0%)	-0.03 (0%)	-1.52 (0%)	-0.14 (0%)	-0.14 (0%)	-0.14 (0%)

Source: DSM2 simulations (Node 206_5533)

Notes:

Simulation period: October 1921 – September 2003.

(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.

Key:

Alt = Alternative

ft msl = feet mean sea level

PEIS/R = Program Environmental Impact Statement/Report

Under the RPA Scenarios, DSM2 simulations indicate that Alternatives A1 and A2 would not cause a maximum decrease in water level exceeding 0.1 feet, with a water level below the 0.3 foot elevation threshold, as shown in Table 13-3. These results indicate a that project-level actions would not result in real-time adjustments to Jones and Banks pumping plant operations based on the Water Level Response Plan criteria, and Alternatives A1 and A2 would not substantially affect agricultural users' ability to divert irrigation water. The significance conclusion of this impact would not change from the Draft PEIS/R, and would be less than significant.

Table 13-5.
Simulated Monthly Maximum 15-Minute Change in Water Levels at Grant Line Canal near Grant Line Canal Barrier at Low-Low Tide, Alternatives A1 and A2 Under All RPA Scenarios

Month	Scenario 1 (ft msl)	Scenario 2 (ft msl)	Scenario 3 (ft msl)	Scenario 4 (ft msl)	Scenario 5 (ft msl)	Scenario 6 (ft msl)
April	0.00 (0.0%)	0.00 (0.0%)	-0.02 (0.0%)	0.00 (0.0%)	0.00 (0.0%)	0.00 (0.0%)
May	-0.25 (0.0%)	-0.25 (0.0%)	-0.25 (0.0%)	-0.25 (0.0%)	-0.25 (0.0%)	-0.25 (0.0%)
June	-0.10 (0.0%)	-2.52 (0.0%)	-0.10 (0.0%)	-0.22 (0.0%)	-2.52 (0.0%)	-2.50 (0.0%)
July	-0.03 (0.0%)	-0.05 (0.0%)	-0.02 (0.0%)	-0.03 (0.0%)	-0.05 (0.0%)	-0.05 (0.0%)
August	-0.03 (0.0%)	-0.05 (0.0%)	-0.03 (0.0%)	-0.03 (0.0%)	-0.03 (0.0%)	-0.01 (0.0%)
September	-0.06 (0.0%)	-0.06 (0.0%)	-0.07 (0.0%)	-0.04 (0.0%)	-0.07 (0.0%)	-0.07 (0.0%)
October	-0.04 (0.0%)	-0.04 (0.0%)	-0.12 (0.0%)	-0.04 (0.0%)	-0.04 (0.0%)	-0.01 (0.0%)

Source: DSM2 simulations (Node 206_5533)

Notes:

Simulation period: October 1921 – September 2003.

(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.

Key:

Alt = Alternative

ft msl = feet mean sea level

RPA = reasonable and prudent alternative

Impact SWS-4 (Alternatives A1 and A2): ***Change in Water Levels in the Middle River near the Howard Road Bridge – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, simulated water levels under Alternatives A1 and A2 would decrease more than 0.1 feet, resulting in a water level below 0.3 foot elevation in April and May in some of the 82 years of simulated record. These conditions reflect an increased likelihood that project-level actions could result in real-time adjustments to diversions at Jones and Banks pumping plants, such that water levels in the Middle River near the Howard Road Bridge would remain at or above 0.3 feet msl. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Alternatives A1 and A2 would not directly change Delta operations, but instead would change Delta conditions because of indirect effects of Interim and Restoration flows from the San Joaquin River reaching the Delta. These changed conditions could alter the quantity and timing of Jones and Banks pumping in the south Delta, which could impact south Delta water levels. As described in the Draft PEIS/R, water level decreases greater than 0.1 feet in the Middle River near the Howard Road Bridge that also result in water levels below the identified limit rarely occurred in the simulated irrigation months during the late spring. As shown in Table 13-6 (Table 13-56 of the Draft PEIS/R), the greatest decreases were 0.45 feet and 0.55 feet compared to the existing conditions and No-Action Alternative, respectively, yet these maximum decreases would not cause a maximum decrease in water level exceeding 0.1 feet, and a resulting water level below the 0.0 foot elevation threshold, and would not adversely affect agricultural users' ability to divert irrigation water. This impact would be less than significant.

Table 13-6.
Table 13-56 of the Draft PEIS/R: Simulated Monthly Maximum 15-Minute Change in Water Levels at Middle River near Howard Road Bridge at Low-Low Tide

Month	Existing Level (2005)			Future Level (2030)			
	Alt A1 and A2 (ft msl)	Alt B1 and B2 (ft msl)	Alt C1 and C2 (ft msl)	No-Action Alt (ft msl)	Alt A1 and A2 (ft msl)	Alt B1 and B2 (ft msl)	Alt C1 and C2 (ft msl)
April	-0.06 (0%)	-0.06 (0%)	-0.06 (0%)	-0.26 (0%)	-0.08 (0%)	-0.08 (0%)	-0.08 (0%)
May	-0.28 (0%)	-0.28 (0%)	-0.28 (0%)	-0.68 (0%)	-0.37 (0%)	-0.37 (0%)	-0.37 (0%)
June	-0.45 (0%)	-0.45 (0%)	-0.45 (0%)	-1.35 (0%)	-0.53 (0%)	-0.53 (0%)	-0.53 (0%)
July	-0.16 (0%)	-0.16 (0%)	-0.16 (0%)	-0.96 (0%)	-0.54 (0%)	-0.55 (0%)	-0.55 (0%)
August	-0.03 (0%)	-0.04 (0%)	-0.04 (0%)	-1.02 (0%)	-0.05 (0%)	-0.05 (0%)	-0.05 (0%)
September	-0.01 (0%)	-0.01 (0%)	-0.01 (0%)	-1.01 (0%)	-0.32 (0%)	-0.33 (0%)	-0.32 (0%)
October	-0.02 (0%)	-0.02 (0%)	-0.02 (0%)	-0.66 (0%)	-0.15 (0%)	-0.15 (0%)	-0.15 (0%)

Source: DSM2 simulations (Node 129_5691)

Notes:

Simulation period: October 1921 – September 2003.

(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.

Key:

Alt = Alternative

ft msl = feet mean sea level

PEIS/R = Program Environmental Impact Statement/Report

Under all RPA scenarios, DSM2 simulations indicate that Alternatives A1 and A2 would cause a maximum decrease in water level exceeding 0.1 feet, and resulting in a water level below the 0.3 foot elevation threshold, in April and May of some years, as shown in Table 13-7. This condition indicates periods when the project-level actions would result in an adjustment in real-time operations to operations at Jones and Banks pumping plants. This condition would occur in 3.7 percent (Scenario 1 in May) to 18.3 percent (Scenario 5 in April) of the simulated months. This corresponds to a decrease in water level exceeding 0.1 feet (and a resulting water level below the 0.0 foot elevation threshold) in 3 months to 15 months, respectively, throughout the 82 years of simulated record. No decreases that would cause a maximum decrease in water level exceeding 0.1 feet, and resulting in a water level below the 0.3 foot elevation threshold, occurred in the months from June through October.

The months shown in Table 13-7 with multiple instances of decreases in water level exceeding 0.1 feet and resulting in a water level below the 0.3 foot elevation threshold (April and May under all scenarios) did not occur in consecutive years under Scenarios 1 and 2. Under scenarios 3, 4, and 6, these instances occurred in two consecutive months within two consecutive years twice in the simulation record, and three times under Scenario 5. However, these instances did not occur in more than two consecutive years under any scenario. No decreases that would cause a maximum decrease in water level exceeding 0.1 feet, and resulting in a water level below the 0.3 foot elevation threshold, occurred in the months from June through October. These data are provided in the Delta Simulation Modeling Output – DSM2 Attachment.

Because the average annual exports at Jones and Banks pumping plants would remain within the range of exports analyzed in the Draft PEIS/R, and the provisions of the Water Level Response Plan would continue to be met, maximum decreases in surface water elevation would not substantially affect agricultural users' ability to divert irrigation water. The significance conclusion of this impact would not change from the Draft PEIS/R, and would be less than significant.

Table 13-7.
Simulated Monthly Maximum 15-Minute Change in Water Levels at Middle River near Howard Road Bridge at Low-Low Tide, Alternatives A1 and A2 Under All RPA Scenarios

Month	Scenario 1 (ft msl)	Scenario 2 (ft msl)	Scenario 3 (ft msl)	Scenario 4 (ft msl)	Scenario 5 (ft msl)	Scenario 6 (ft msl)
April	-0.44 (12.2%)	-0.44 (15.9%)	-0.38 (17.1%)	-0.36 (15.9%)	-0.37 (18.3%)	-0.36 (14.6%)
May	-0.46 (3.7%)	-0.55 (6.1%)	-0.44 (11.0%)	-0.45 (11.0%)	-0.44 (9.8%)	-0.48 (11.0%)
June	-0.10 (0.0%)	-1.62 (0.0%)	-0.10 (0.0%)	-0.22 (0.0%)	-1.62 (0.0%)	-1.61 (0.0%)
July	-0.03 (0.0%)	-0.02 (0.0%)	-0.01 (0.0%)	-0.01 (0.0%)	-0.02 (0.0%)	-0.02 (0.0%)
August	-0.02 (0.0%)	-0.03 (0.0%)	-0.02 (0.0%)	-0.02 (0.0%)	-0.02 (0.0%)	-0.01 (0.0%)
September	-0.03 (0.0%)	-0.03 (0.0%)	-0.03 (0.0%)	-0.02 (0.0%)	-0.03 (0.0%)	-0.03 (0.0%)
October	-0.02 (0.0%)	-0.03 (0.0%)	-0.05 (0.0%)	-0.02 (0.0%)	-0.02 (0.0%)	-0.01 (0.0%)

Source: DSM2 simulations (Node 129_5691)

Notes:

Simulation period: October 1921 – September 2003.

(%) indicates percent of months with a maximum decrease in water level exceeding 0.1 feet resulting in a water level below the identified limit.

Key:

Alt = Alternative

ft msl = feet mean sea level

RPA = reasonable and prudent alternative

Impact SWS-5 (Alternatives A1 and A2): ***Change in Recurrence of Delta Excess Conditions – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not result in a change of recurrence of Delta excess conditions at a frequency potentially impacting CCWD's ability to fill Los Vaqueros Reservoir. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

The Interim and Restoration flows impact Millerton Lake storage, which can indirectly result in changes to flood operations and the quantity of flood flows released from Friant Dam. These changes have the potential to change the Delta to balanced conditions when the Delta would otherwise be under excess conditions. If this occurs during the period from November 1 to June 30, CCWD's ability to fill Los Vaqueros Reservoir would be reduced.

As described in the Draft PEIS/R and shown in Table 13-8 (Table 13-58 of the Draft PEIS/R), Alternatives A1 and A2 would cause very few changes from excess to balanced conditions compared to the existing conditions and No-Action Alternative during the critical months of November through June. February was most impacted, but even this frequency of change in the simulation record is relatively small (between one and four percent of months during the 82 years of simulated record). The impacted months were scattered throughout the simulation record and were not clustered in one season such that CCWD's ability to fill Los Vaqueros Reservoir would be substantially affected. This impact was found to be less than significant in the Draft PEIS/R.

Table 13-8.
Table 13-58 of the Draft PEIS/R: Simulated Number of Years the Delta Changes from Excess to Balanced Condition for Alternatives A1 and A2

Comparison Level	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Existing Conditions	2 (2%)	3 (4%)	2 (2%)	3 (4%)	1 (1%)	1 (1%)	0 (0%)	0 (0%)
No-Action Alternative	1 (1%)	2 (2%)	2 (2%)	6 (7%)	0 (0%)	0 (0%)	2 (2%)	3 (4%)

Source: Summarized from CalSim-II-II 2005 and 2030 simulations.
Notes:
Simulation period: 1922 – 2003.
Significance criteria apply for period between November 1 and June 30.
(%) indicates percentage of months Delta condition change occurs.
Key:
PEIS/R = Program Environmental Impact Statement/Report

Under the RPA scenarios, CalSim-II simulations indicate that Alternatives A1 and A2 would cause very few changes from excess to balanced conditions compared to the existing conditions and No-Action Alternative during the critical months of November through June, as shown in Table 13-9. March and June experienced the most change under all scenarios, but even the frequencies of changes in the simulation record is relatively small (between one percent and four percent of months during the 82 years of simulated record). The impacted months were scattered throughout the simulation record and were not clustered in one season such that CCWD's ability to fill Los Vaqueros Reservoir would be substantially affected. These data are provided in the Delta Simulation Modeling Output – DSM2 Attachment. The significance conclusion of this impact would not change from the Draft PEIS/R, and would be less than significant.

Table 13-9.
Simulated Number of Years the Delta Changes from Excess to Balanced Condition, Alternatives A1 and A2 Under All RPA Scenarios

Comparison Level	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Scenario 1 – Existing Conditions	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	1 (1%)
Scenario 2 – Existing Conditions	0 (0%)	1 (1%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	3 (4%)
Scenario 3 – Existing Conditions	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	1 (1%)
Scenario 4 – Existing Conditions	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	1 (1%)
Scenario 5 – Existing Conditions	0 (0%)	1 (1%)	0 (0%)	0 (0%)	2 (2%)	0 (0%)	1 (1%)	2 (2%)
Scenario 6 – Existing Conditions	0 (0%)	0 (0%)	0 (0%)	1 (1%)	2 (2%)	0 (0%)	1 (1%)	2 (2%)

Source: Summarized from CalSim-II simulations.

Notes:
Simulation Period: October 1921 – September 2003
Significance criteria may apply for period between November 1 and June 30.
(%) indicates percentage of months Delta condition change occurs.
Key:
RPA = reasonable and prudent alternative

Chapter 14.0 Hydrology – Surface Water Quality

This chapter describes the potential for impacts of Alternatives A1 and A2 on surface water quality under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 14.0 of the Draft PEIS/R, "Hydrology – Surface Water Quality." The discussion of potential impacts on surface water quality presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 14.1, "Environmental Setting" –** Describes existing surface water quality conditions along the San Joaquin River upstream from Friant Dam, within the Restoration Area, along the San Joaquin River from the Merced River to the Delta, within the Delta, and within the Friant Division.

- **Section 14.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to surface water quality.

- **Section 14.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to surface water quality conditions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 14-1. As shown in Table 14-1, none of the impact conclusions of the program alternatives on surface water quality would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 14.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 14-1.

Table 14-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

<table>
<tr><th colspan="5">Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R</th><th colspan="2">Sensitivity Analyses of Program Alternatives with RPAs</th></tr>
<tr><th rowspan="2">Impacts</th><th rowspan="2">Alternative</th><th rowspan="2">Level of Significance Before Mitigation</th><th rowspan="2">Mitigation Measures</th><th rowspan="2">Level of Significance After Mitigation</th><th colspan="2">Change in Level of Significance</th></tr>
<tr><th>Before Mitigation</th><th>After Mitigation</th></tr>
<tr><td colspan="7">Hydrology – Surface Water Quality: Program-Level</td></tr>
<tr><td rowspan="2">SWQ-1: Temporary Construction-Related Effects on Surface Water Quality in the San Joaquin River from Friant Dam to the Merced River, San Joaquin River from the Merced River to the Delta, the Delta, and CVP/SWP Water Service Areas</td><td>No-Action</td><td>LTS and Beneficial</td><td>--</td><td>LTS and Beneficial</td><td>--</td><td>--</td></tr>
<tr><td>A1 & A2</td><td>PS</td><td>SWQ-1A: Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities

SWQ-1B: Conduct and Comply with Phase I Environmental Site Assessments in the Restoration Area</td><td>LTS</td><td>No[1,2]</td><td>No[1,2]</td></tr>
<tr><td rowspan="2">SWQ-2: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the CVP/SWP Water Service Areas</td><td>No-Action</td><td>No Impact</td><td>--</td><td>No Impact</td><td>--</td><td>--</td></tr>
<tr><td>A1 & A2</td><td>LTS</td><td>--</td><td>LTS</td><td>No[1,2]</td><td>No[1,2]</td></tr>
</table>

Table 14-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Change in Level of Significance	
					Before Mitigation	After Mitigation
Hydrology – Surface Water Quality: Project-Level						
SWQ-3: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in Millerton Lake	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
SWQ-4: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the San Joaquin River from Friant Dam to the Merced River	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]

Table 14-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Hydrology – Surface Water Quality: Project-Level (contd.)						
SWQ-5: Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the San Joaquin River from the Merced River to the Delta	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
SWQ-6: Effects on X2 Position	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]
SWQ-7: Delta Salinity in San Joaquin River at Vernalis, San Joaquin River at Brandt Bridge, Old River near Middle River, and Old River at Tracy Road Bridge	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
SWQ-8: Delta Salinity in San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 14-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Hydrology – Surface Water Quality: Project-Level (contd.)						
SWQ-9: Delta Water Quality at Contra Costa Water District's Contra Costa Canal Pumping Plant No. 1, Old River at Los Vaqueros Intake, and Proposed Victoria Canal Intake, and City of Stockton's Proposed Delta Intake	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
SWQ-10: Water Quality in the Delta-Mendota Canal at Jones Pumping Plant and in the West Canal at the Clifton Court Forebay	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Notes:
1 Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
2 Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
3 Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

14.1 Program-Level Impacts

The potential program-level impact to surface water quality as described in the Draft PEIS/R would be associated with construction activities. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO; therefore, the significance conclusion and mitigation requirements identified for this impact would not change from those presented in the Draft PEIS/R.

Impact SWQ-1 (Alternatives A1 and A2): ***Temporary Construction-Related Effects on Surface Water Quality in the San Joaquin River from Friant Dam to the Merced River, San Joaquin River from the Merced River to the Delta, the Delta, and CVP/SWP Water Service Areas – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure SWQ-1A (Alternatives A1 and A2): ***Prepare and Implement a Stormwater Pollution Prevention Plan that Minimizes the Potential Contamination of Surface Waters, and Complies with Applicable Federal Regulations Concerning Construction Activities – Program-Level.*** This mitigation measure is identical to Mitigation Measure SWQ-1A (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Mitigation Measure SWQ-1B (Alternatives A1 and A2): ***Conduct and Comply with Phase I Environmental Site Assessments in the Restoration Area – Program-Level.*** This mitigation measure is identical to Mitigation Measure SWQ-1B (Alternatives A1 and A2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact SWQ-2 (Alternatives A1 and A2): ***Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the CVP/SWP Water Service Areas – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

14.2 Project-Level Impacts

As described in the Draft PEIS/R, the assessment of potential project-level impacts focuses on water temperature and salinity. Water temperature is an important water quality parameter for fisheries. Salinity is an important water quality parameter for multiple beneficial uses. The alternatives could affect salinity in the San Joaquin River, the Delta, and CVP/SWP service areas; water temperature conditions in the San Joaquin River; and X2 position in the Delta.

For the purposes of this PEIS/R, the alternatives were determined to result in a significant impact related to surface water quality if they would do any of the following:

- Violate existing water quality standards or otherwise substantially degrade water quality.
- Result in substantial water quality changes that adversely affect beneficial uses.
- Result in substantive impacts on public health or environmental receptors.

Impact SWQ-3 (Alternatives A1 and A2): ***Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in Millerton Lake – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Because this impact would occur upstream from the Merced River confluence in an area that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact SWQ-4 (Alternatives A1 and A2): ***Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the San Joaquin River from Friant Dam to the Merced River – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Because this impact would occur upstream from the Merced River confluence in an area that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact SWQ-5 (Alternatives A1 and A2): ***Long-Term Effects on Water Quality that Cause Violations of Existing Water Quality Standards or Adversely Affect Beneficial Uses in the San Joaquin River from the Merced River to the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, San Joaquin River water quality conditions from the Merced River to the Delta would generally improve under Alternatives A1 and A2. Where simulated historical monthly average salinity would increase, the increases are small enough that they would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, on a historical monthly average basis, salinity at San Joaquin River sites below the Merced River and below the Tuolumne River would be less under Alternatives A1 and A2 than under the No-Action Alternative, particularly during March and April. Below the Merced River confluence, monthly average San Joaquin River water temperatures under Alternatives A1 and A2 would be similar to the No-Action Alternative on a historical monthly average basis, with increases of up to

1 percent from March through May and in November. Impacts to water temperature within the San Joaquin River from the Merced River to the Delta would be less than significant. These potential surface water quality effects within the San Joaquin River from the Merced River to the Delta would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. Overall, surface water quality impacts in the San Joaquin River from the Merced River to the Delta under Alternatives A1 and A2 would be less than significant.

With the RPAs in place, on a historical monthly average basis, salinity at San Joaquin River sites below the Merced River and below the Tuolumne River would remain less under Alternatives A1 and A2 than under the No-Action Alternative. Historical monthly average salinity would be reduced in all months under all RPA scenarios as compared to the No-Action Alternative, but particularly in March and April, when salinity was reduced by as much as 49 percent at the Merced River confluence in April of Above Normal years (RPA scenarios 1 and 2), and by as much as 26 percent at the Tuolumne River confluence in March of Critical years (all RPA scenarios), in April of Below Normal Years (RPA scenarios 1 and 2), and in April of Above Normal years (all RPA scenarios). Effects on salinity in the San Joaquin River below the Merced River under Alternatives A1 and A2 and with the RPAs in place would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health.

Changes in water temperature under Alternatives A1 and A2 would be the same as described in the Draft PEIS/R. Monthly average water temperatures of San Joaquin River flows leaving the Restoration Area under Alternatives A1 and A2 would be similar to the No-Action Alternative, and these temperatures would not change with the RPAs in place. Because flows on the lower San Joaquin River and its tributaries would be managed to meet specific instream flow and temperature requirements for fisheries, implementing Alternative A1 or A2 would not result in substantial changes to temperatures with the RPAs in place(see Chapter 5.0, “Biological Resources – Fisheries” for further discussion). Impacts to water temperature within the San Joaquin River from the Merced River to the Delta would be less than significant.

These potential surface water quality effects within the San Joaquin River from the Merced River to the Delta would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. The significance conclusion of this impact would not change and would be less than significant.

Impact SWQ-6 (Alternatives A1 and A2): ***Effects on X2 Position – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, average monthly X2 position under Alternatives A1 and A2 would be similar to X2 positions for the No-Action Alternative. While in several months the X2 position may be out of compliance under the bases of comparison, the change resulting from the action alternatives would not further impact X2 position compliance. Alternatives A1 and

A2 would not impact the X2 position. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would have no impact.

Impact SWQ-7 (Alternatives A1 and A2): ***Delta Salinity in San Joaquin River at Vernalis, San Joaquin River at Brandt Bridge, Old River near Middle River, and Old River at Tracy Road Bridge – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, simulated historical monthly average salinity in the San Joaquin River at Vernalis, San Joaquin River at Brandt Bridge, Old River near the Middle River, and Old River at Tracy Road Bridge would generally improve under Alternatives A1and A2 compared to the No-Action Alternative, particularly during March, April, and November. Where simulated historical monthly average salinity would increase, the increases are small enough they would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

As described in the Draft PEIS/R, simulated monthly average salinity in the San Joaquin River at Vernalis, San Joaquin River at Brandt Bridge, Old River near Middle River, and Old River at Tracy Road Bridge would be less under Alternatives A1and A2 compared to the No-Action Alternative, particularly during March and April. With the RPAs in place, simulated historical monthly average salinity would be lower, or would have no change, under Alternatives A1 and A2 as compared to the No-Action Alternative, during March through January. The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 would occur during February of Wet Years under Scenario 2 at San Joaquin River at Vernalis (1.4 percent), San Joaquin River at Brandt Bridge (1.3 percent), Old River at Tracy Road Bridge (1.3 percent), and Old River near the Middle River (1.3 percent). The maximum decrease in simulated monthly average salinity under Alternatives A1 and A2 would occur during April of Below Normal Years under Scenario 2 at San Joaquin River at Vernalis (11.4 percent), San Joaquin River at Brandt Bridge (12.2 percent), and Old River near the Middle River (12.5 percent). At Old River at Tracy Road Bridge, the maximum decrease would occur during April of Above Normal years under Scenario 3 (15.8 percent).

Where simulated historical monthly average salinity would increase under Alternatives A1 and A2 as compared to the No-Action Alternative, the simulated increases are small enough that they are not likely to result in violations of existing water quality standards, or substantial water quality changes that adversely affect beneficial uses, or have substantive impacts on public health. However, in most months and year types, salinity would decrease under Alternative A1 and A2. The significance conclusion of this impact would not change and would be less than significant and beneficial.

Impact SWQ-8 (Alternatives A1 and A2): ***Delta Salinity in San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville – Project Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, simulated historical monthly average salinity under Alternatives A1 and A2 in the San Joaquin River at Jersey Point, Sacramento River at Emmaton, and

Sacramento River at Collinsville would be similar to the No-Action Alternative. Where simulated historical monthly average salinity would increase, the increases are small enough they would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, simulated historical monthly average salinity under Alternatives A1 and A2 in the San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville would be similar to the No-Action Alternative during most months. Simulated historical monthly average salinity would decrease during April, November, and December. Simulated historical monthly average salinity at San Joaquin River at Jersey Point would be up to 1 percent higher during January and August, and up to 4 percent higher during February. In the Sacramento River at Emmaton and at Collinsville, simulated historical monthly average salinity would be up to 6 percent higher during February, up to 3 percent higher during March, and up to 1 percent higher during July and August.

With the RPAs in place, simulated historical monthly average salinity in the San Joaquin River at Jersey Point during November through March would decrease, or would have no change, under Alternatives A1 and A2 as compared to the No-Action Alternative. Simulated historical monthly average salinity would be up to 2.7 percent higher (under Scenarios 2 and 5) during April, and up to 1.2 percent higher from May through October (under Scenario 2). The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 would occur under Scenario 2 at San Joaquin River at Jersey Point during April of Above Normal Years (5.2 percent). The maximum decrease in simulated monthly average salinity under Alternatives A1 and A2 at San Joaquin River at Jersey Point would occur during January of Below Normal Years under Scenario 1 (5.2 percent).

Simulated historical monthly average salinity in the Sacramento River at Collinsville during February through June and from November through December would decrease, or would have no change, under Alternatives A1 and A2 as compared to the No-Action Alternative. During January, simulated historical monthly average salinity would be up to 0.1 percent higher (under Scenario 2). July through October, historical monthly average salinity in the Sacramento River at Collinsville would be up to 1.1 percent higher (July, under Scenario 2). The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 would occur under Scenario 2 at Sacramento River at Collinsville during June of Below Normal Years (4.0 percent). The maximum decrease in simulated monthly average salinity under Alternatives A1 and A2 at Sacramento River at Collinsville would occur during April of Below Normal Years under Scenario 2 (7.8 percent).

In the Sacramento River at Emmaton, historical monthly average salinity would decrease or would have little to no change under Alternatives A1 and A2 as compared to the No-Action Alternative during September to May. Increases during October, November, January, and April through June would be less than 1 percent in any month and would not occur under more than three scenarios; decreases in salinity during these months would occur under one or more scenarios. Simulated historical monthly average salinity would be up to 0.6 percent higher during June (under Scenario 2), 1.5 percent higher during July (under Scenario 2), and up to 1 percent higher during August (under Scenario 2). The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 (3.6 percent) would occur at Sacramento River at Emmaton during June and July of Below Normal Years under Scenario 2 and July of Below Normal Years under Scenario 5. The maximum decrease in simulated monthly average salinity under Alternatives A1 and A2 at Sacramento River at Emmaton would occur during December of Critical Years under Scenario 4 (3.7 percent).

With the RPAs in place, simulated historical monthly average salinity under Alternatives A1 and A2 in the San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville would be similar to the No-Action Alternative during most months. Where simulated historical monthly average salinity would increase under Alternatives A1 and A2 as compared to the No-Action Alternative, the simulated increases are small enough that they are not likely to result in violations of existing water quality standards, or substantial water quality changes that adversely affect beneficial uses, or have substantive impacts on public health. The significance conclusion of this impact would not change and would be less than significant.

Impact SWQ-9 (Alternatives A1 and A2): ***Delta Water Quality at Contra Costa Water District's Contra Costa Canal Pumping Plant No. 1, Old River at Los Vaqueros Intake, and Proposed Victoria Canal Intake, and City of Stockton's Proposed Delta Intake – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, simulated historical monthly average salinity and chloride concentrations at CCWD's Contra Costa Canal Pumping Plant No. 1, Old River at Los Vaqueros Intake, and proposed Victoria Canal Intake, and Stockton Proposed Intake under Alternatives A1 and A2 would remain comparable to the No-Action Alternative. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

As described in the Draft PEIS/R, simulated historical monthly average salinity at CCWD's Contra Costa Canal Pumping Plant No.1 would decrease under Alternative A1 and Alternative A2 compared to the No-Action Alternative during January, May, and November through December. Simulated historical monthly average salinity would not be impacted by Alternatives A1 and A2 during February, and June through October. From March to April, simulated historical monthly average salinity would increase by up to 1 percent under Alternatives A1 and A2 compared to the No-Action Alternative. The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 (3 percent) would occur during April in Above-Normal years, January in Below Normal years, March in Dry years, and April in Critical years, while the maximum decrease (4 percent) would occur during December in Above-Normal years. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 during January, May, and November through December. Simulated historical monthly average chloride concentrations under Alternatives A1 and A2 would increase by up to 3 percent from March through April, and in September, and would not be impacted during February, June through August, or in October.

Under the RPAs, simulated historical monthly average salinity at CCWD's Contra Costa Canal Pumping Plant No.1 would decrease under Alternatives A1 and A2 compared to the No-Action Alternative during January (all RPA scenarios), February and March (RPA scenarios 1 through 4), June (all RPA scenarios), October (RPA scenarios 1, 2, 4, 5, and 6), November (RPA scenarios 1, 4, and 6), and December (all RPA scenarios). A maximum increase in simulated historical monthly average salinity (3.1 percent) would occur in May under Scenario 5. The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 with the RPAs in place (9.4 percent) would occur in May in Above Normal years under Scenario 5, while the maximum decrease (4.6 percent) would occur during February of Below Normal years under Scenario 1. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 during January (all RPA scenarios), February and March (Scenarios 1, 2, 3, and 4), June (under all Scenarios), October (under Scenarios 1, 2, 4, 5, and 6), November (under Scenarios 1, 4, and 6), and December (under all Scenarios). Simulated historical monthly average chloride concentrations under Alternatives A1 and A2 would increase by up to 4 percent during April and May under Scenario 5.

The maximum increase in simulated monthly average chloride concentrations CCWD's Contra Costa Canal Pumping Plant No.1 would be 12 percent during May of Above Normal years under Scenario 5, while the maximum decrease (5.0 percent) would occur during February of Below Normal years under Scenario 1. As described in the Draft PEIS/R, at CCWD's Old River at Los Vaqueros Intake, simulated historical monthly average salinity under Alternatives A1 and A2 would decrease compared to the No Action Alternative during January, May, November, and December. Simulated historical monthly average salinity would increase by up to 3 percent during March, April, and June, and would not be impacted during February and July through October. Under Alternatives A1 and A2, the maximum increase in simulated monthly average salinity (6 percent) would occur during the month of April in Dry years. The maximum decrease (4 percent) compared to the No-Action Alternative would occur during December in Above Normal years. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 compared to the No-Action Alternative during January, May, November, and December. Simulated historical monthly average chloride concentrations would increase under Alternatives A1 and A2 compared to the No-Action Alternative by up to 3 percent during March, April, June, July, and September, and would not be impacted during February, August, or October.

Under the RPAs, simulated historical monthly average salinity at CCWD's Old River at Los Vaqueros Intake under Alternatives A1 and A2 would decrease compared to the No Action Alternative during January (Scenarios 1 through 4), February (Scenarios 1 and 3), April through June (all Scenarios), September (Scenarios 4, 5, and 6), October (Scenarios 5 and 6), and November through December (all Scenarios). A maximum increase in simulated historical monthly average salinity (1.1 percent) would occur during March under Scenario 5. Under Alternatives A1 and A2, the maximum increase in simulated monthly average salinity (4.1 percent) would occur during the month of January in Below Normal years under Scenario 5, while the maximum decrease (7.9 percent) would occur during April of Wet years under Scenario 6. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 during January (under Scenarios 1, 2, 3, and 4), February (under Scenarios 1 and 3), April through June (under all Scenarios), September (under Scenarios 4, 5, and 6), and October through December (under all Scenarios). Simulated historical monthly average chloride concentrations under Alternatives A1 and A2 would increase by up to 2.1 percent during March under Scenario 5. The maximum increase in simulated monthly average chloride concentrations at CCWD's Old River at Los Vaqueros Intake would be 6.5 percent during January of Below Normal years under Scenario 5, while the maximum decrease (19.7 percent) would occur during April of Wet years under Scenario 3.

As described in the Draft PEIS/R, simulated historical monthly average salinity at CCWD's proposed Victoria Canal Intake would decrease under Alternatives A1 and A2 compared to the No Action Alternative during May, November, and December. Simulated historical monthly average salinity under Alternatives A1 and A2 would increase by up to 4 percent during April, and would not be impacted during January, and July through October.

The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 (8 percent) would occur during April in Dry years. The maximum decrease (5 percent) compared to the No-Action Alternative would occur during May in Above Normal years. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 compared to the No-Action Alternative during May, November, and December. Simulated historical monthly average chloride concentrations would increase by up to 5 percent during February, March, April, June, and September, and would not be impacted during January, July, August, or October.

Under the RPAs, simulated historical monthly average salinity at CCWD's Victoria Canal Intake would decrease under Alternatives A1 and A2 compared to the No Action Alternative during January (Scenarios 1, 2, 3, and 4), February (Scenario 1), April through June (all Scenarios), September (Scenario 4), and November (Scenarios 1, 4, 5, and 6) and December (all Scenarios). A maximum increase in simulated historical monthly average salinity (1.3 percent) would occur during March under Scenarios 4 and 5. Under Alternatives A1 and A2, the maximum increase in simulated monthly average salinity under Alternatives A1 and A2 with the RPAs in place (4.8 percent) would occur during the month of April in Critical years under Scenario 4, while the maximum decrease (8.8 percent) would occur during May of Above Normal years under Scenario 3. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 during January (RPA scenarios 1, 2, 3, and 4), February (1 and 3), April through June (all RPA scenarios), September (RPA scenario 4, 5, and 6), October (1, 2, 5, and 6), November (all Scenarios), and December (all Scenarios). Simulated historical monthly average chloride concentrations under Alternatives A1 and A2 would increase by up to 1.9 percent during March under Scenarios 4 and 5. The maximum increase in simulated monthly average chloride concentrations at CCWD's Victoria Canal Intake would be 7.4 percent during April of Critical years under Scenario 4, while the maximum decrease (20 percent) would occur during April of Wet years under Scenario 4.

As described in the Draft PEIS/R, at the City of Stockton's proposed Delta Intake, simulated historical monthly average salinity under Alternatives A1 and A2 would decrease compared to the No Action Alternative during May and December, and increase by up to 5 percent during February through April, and in June. Compared to the No-Action Alternative, simulated historical monthly average salinity would not be impacted during January, or July through November. Under Alternatives A1 and A2, the maximum increase in simulated monthly average salinity (9 percent) would occur in March in Dry years. The maximum decrease (3 percent) compared to the No-Action Alternative would occur during May in Above Normal years. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 compared to the No-Action Alternative during May, November, and December. Simulated historical monthly average chloride concentrations would increase by up to 10 percent in February through April, June, and September. Simulated historical monthly average chloride concentrations would not be impacted under Alternatives A1 and A2 during January, July, August, and October.

Under the RPAs, at the City of Stockton's proposed Delta Intake, simulated historical monthly average salinity under Alternatives A1 and A2 would decrease compared to the No Action Alternative during January (all Scenarios), April (Scenario 5), July (all Scenarios), August (Scenarios 1, 3, and 4), and December (all Scenarios). A maximum increase in simulated historical monthly average salinity (4.5 percent) would occur in October under Scenario 4. The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 with the RPAs in place (5.7 percent) would occur during October in Dry and Critical years under Scenario 4, while the maximum decrease (4.8 percent) would occur during December of Above Normal years under Scenario 4. Simulated historical monthly average chloride concentrations would decrease under Alternatives A1 and A2 during January (all Scenarios), April (Scenarios 1 and 5), July (Scenarios 1, 2, 3, and 4), August (Scenario 1), and November and December (all Scenarios). Simulated historical monthly average chloride concentrations under Alternatives A1 and A2 would increase by up to 8.2 percent during October under Scenarios 3 and 4. The maximum increase in simulated monthly average chloride concentrations at City of Stockton's proposed Delta Intake would be 11.1 percent during October of Above Normal years under Scenarios 2 and 6, while the maximum decrease (8.8 percent) would occur during December of Above Normal years under Scenario 4.

With the RPAs in place, simulated historical monthly average salinity and chloride concentrations under Alternatives A1 and A2 at existing and planned CCWD or City of Stockton pumping facilities in the Delta would be similar to the No-Action Alternative during most months. Where simulated historical monthly average salinity would increase under Alternatives A1 and A2 as compared to the No-Action Alternative, the simulated increases are small enough that they are not likely to result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. The significance conclusion of this impact would not change and would remain less than significant.

Impact SWQ-10 (Alternatives A1 and A2): *Water Quality in the Delta-Mendota Canal (DMC) at Jones Pumping Plant and in the West Canal at the Clifton Court Forebay – Project-Level.* This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, simulated historical monthly average salinity in the DMC at Jones Pumping Plant and in the West Canal at Clifton Court Forebay under Alternatives A1 and A2 would remain comparable to the No-Action Alternative. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

As described in the Draft PEIS/R, simulated historical monthly average salinity in the DMC at Jones Pumping Plant and in the West Canal at Clifton Court Forebay would be comparable to the No-Action Alternative. At the DMC at Jones Pumping Plant and in the West Canal at Clifton Court Forebay, simulated historical monthly average salinity would decrease under Alternatives A1 and A2 compared to the No-Action Alternative from March through April, and November through December. Simulated historical monthly average salinity in the DMC at Jones Pumping Plant would not be impacted by Alternatives A1 or A2 during February, or July through October, and would increase by up to 1 percent during June. Simulated historical monthly average salinity in the West Canal at Clifton Court Forebay under Alternatives A1 and A2 would increase by up to 1 percent higher during June, and would not be impacted during January through February, in May, or July through October.

Simulated historical monthly average chloride concentrations under Alternatives A1 and A2 in the DMC at Jones Pumping Plant and in the West Canal at Clifton Court Forebay would also be comparable to the No-Action Alternative, as described in the Draft PEIS/R. Under Alternatives A1 and A2, simulated historical monthly average chloride concentrations at the DMC at Jones Pumping Plant and in the West Canal at the Clifton Court Forebay would decrease during January, March through May, and November through December. Simulated historical monthly average chloride concentrations at the DMC at Jones Pumping Plant would increase by up to 1 percent under Alternatives A1 and A2 during June, and would not be impacted by Alternatives A1 or A2 during February, or July through October. Simulated historical monthly average salinity in the West Canal at the Clifton Court Forebay under Alternatives A1 and A2 would increase by up to 1 percent higher from June through July, and would not be impacted during February, or August through October.

With the RPAs in place, simulated historical monthly average salinity in the DMC at Jones Pumping Plant would decrease, or would have no change, under Alternatives A1 and A2 as compared with the No-Action Alternative during October (Scenarios 1, 4, 5, and 6), November through January (all Scenarios), February (Scenarios 1, 2, 3, 4, and 6), March through June and September (all Scenarios). A maximum increase in simulated historical monthly average salinity (0.6 percent) would occur in August under Scenario 1. The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 with the RPAs in place (1.8 percent) would occur during October of Above Normal years under Scenario 3 and June of Critical years under Scenario 6, while the maximum decrease (10.2 percent) would occur during April of Above Normal years under Scenario 1.

Simulated historical monthly average chloride concentrations in the DMC at Jones Pumping Plant would decrease with the RPAs in place under Alternatives A1 and A2 during October (Scenarios 1, 4, 5, and 6), November to January (all Scenarios), February (Scenario 3), March to June (all Scenarios), and September (all Scenarios). Under Alternatives A1 and A2 with the RPAs in place, simulated historical monthly average chloride concentrations would increase by up to 1 percent during July (Scenario 2) and August (Scenarios 1 and 2). The maximum increase in simulated monthly average chloride concentrations at DMC at Jones Pumping Plant would be 3.1 percent during June of Critical years under Scenarios 2 and 5, while the maximum decrease (19.1 percent) would occur during April of Wet years under Scenario 1.

In the West Canal at Clifton Court Forebay, simulated historical monthly average salinity under Alternatives A1 and A2 with the RPAs in place would decrease, or would have no change, under Alternatives A1 and A2 as compared to the No-Action Alternative during October (Scenarios 1, 4, 5, and 6), November through January (all Scenarios), February (Scenarios 1, 2, 3, and 6), March through June and September (all Scenarios). A maximum increase in simulated historical monthly average salinity (0.7 percent) would occur in August under Scenario 2. The maximum increase in simulated monthly average salinity under Alternatives A1 and A2 with the RPAs in place (2.2 percent) would occur during May of Critical years under Scenario 2, while the maximum decrease (11.4 percent) would occur during May of Above Normal years under Scenario 5.

Simulated historical monthly average chloride concentrations in the West Canal at Clifton Court Forebay would decrease with the RPAs in place under Alternatives A1 and A2 during October (Scenarios 1, 5, and 6), November to January (all Scenarios), March to June (all Scenarios), and September (Scenarios 2, 3, 4, 5, and 6). Under Alternatives A1 and A2 with the RPAs in place, simulated historical monthly average chloride concentrations would increase by up to 1.5 percent during July (Scenario 2). The maximum increase in simulated monthly average chloride concentrations at DMC at Jones Pumping Plant would be 4.1 percent during July of Below Normal years under Scenario 2, while the maximum decrease (22.6 percent) would occur during April of Wet years under Scenario 1.

With the RPAs in place, impacts to water quality at CVP and SWP pumping facilities in the Delta under Alternatives A1 and A2 would be similar to those described in the Draft PEIS/R, and would not result in any additional violations of existing water quality standards or substantial water quality changes that would adversely affect beneficial uses, or have substantive impacts on public health. The significance conclusion of this impact would not change and would remain less than significant and beneficial.

Chapter 15.0 Indian Trust Assets

This chapter describes the potential for impacts of Alternatives A1 and A2 on Indian Trust Assets (ITA) under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 15.0 of the Draft PEIS/R, "Indian Trust Assets." The discussion of potential impacts on ITAs presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 15.1, "Environmental Setting" –** Describes ITAs along the San Joaquin River upstream from Friant Dam, the Restoration Area, the San Joaquin River downstream from the Restoration Area, and the Delta. Implementation of the Settlement is not anticipated to cause impacts to ITAs in the CVP/SWP service areas.

- **Section 15.2, "Regulatory Setting" –** Describes the Federal laws and regulations pertaining to ITAs.

- **Section 15.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to ITAs to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts for each of the program alternatives, including the No-Action Alternative.

The impacts presented in the Draft PEIS/R are summarized in Table 15-1. As shown in Table 15-1, none of the impact conclusions of Alternatives A1 and A2 on ITAs would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 15.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 15-1.

Table 15-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Indian Trust Assets: Program-Level						
ITA-1: Affect Land Minerals, Federally Reserved Hunting and Fishing Rights, Federally Reserved Water Rights, and Instream Flows Associated With Trust Land	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]
Indian Trust Assets: Project-Level						
ITA-2: Affect Land, Minerals, Federally Reserved Hunting and Fishing Rights, Federally Reserved Water Rights, and Instream Flows Associated With Trust Land	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
PEIS/R = Program Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

15.1 Program-Level Impacts

As described in Chapter 15.0, “Indian Trust Assets,” of the Draft PEIS/R, potential impacts to ITAs would stem from any actions that affect land, minerals, federally reserved hunting and fishing rights, federally reserved water rights, and instream flows associated with trust land in the study area. No reservations or rancherias are located within the San Joaquin River upstream from Friant Dam, the Restoration Area, San Joaquin River from Merced River to the Delta, and the Delta. Future ITA analysis would be conducted for program-level actions and documented in subsequent site-specific National Environmental Policy Act (NEPA) documentation, as required by law.

Impact ITA-1 (Alternatives A1 and A2): ***Affect Land Minerals, Federally Reserved Hunting and Fishing Rights, Federally Reserved Water Rights, and Instream Flows Associated With Trust Land.*** This impact was found to have no impact in the Draft PEIS/R. No reservations or rancherias are located along the San Joaquin River upstream from Friant Dam, the Restoration Area, the San Joaquin River from Merced River to the Delta, or the Delta. The nearest ITA is Table Mountain Rancheria, which is approximately 3 miles east-southeast of Millerton Lake. Because ITAs are not located in the San Joaquin River Restoration Area, along the San Joaquin River from Merced River to the Delta, or in the Delta no program-level impacts would occur to ITAs under Alternatives A1 or A2, and this would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

15.2 Project-Level Impacts

As described in Chapter 15.0, “Indian Trust Assets,” of the Draft PEIS/R, no reservations or rancherias are located within the San Joaquin River upstream from Friant Dam, the Restoration Area, San Joaquin River from Merced River to the Delta, and the Delta.

Impact ITA-2 (Alternatives A1 and A2): ***Affect Land, Minerals, Federally Reserved Hunting and Fishing Rights, Federally Reserved Water Rights, and Instream Flows Associated With Trust Land.*** This impact was found to have no impact in the Draft PEIS/R. Restoration actions would not affect ITAs because no reservations or Rancherias are located within the Restoration Area, on the San Joaquin River, or in the Delta. The nearest ITA is Table Mountain Rancheria, which is approximately 3 miles east-southeast of Millerton Lake. Because ITAs are not located in the San Joaquin River Restoration Area, along the San Joaquin River from Merced River to the Delta, or in the Delta, no program-level impacts would occur to ITAs under Alternatives A1 or A2, and this would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

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Chapter 16.0 Land Use Planning and Agricultural Resources

This chapter describes the potential for impacts of Alternatives A1 and A2 on land use under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 16.0, "Land Use Planning and Agricultural Resources," of the Draft PEIS/R. The discussion of potential impacts on land use presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 16.1, "Environmental Setting" –** Describes land use along the San Joaquin River from Friant Dam to the Merced River, downstream from the Merced River to the Delta, and in the CPV/SWP service areas. Implementation of the Settlement will not cause impacts to land use upstream of Friant Dam or in the Delta.

- **Section 16.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to land use planning and agricultural resources.

- **Section 16.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to land use to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 16-1. As shown in Table 16-1, none of the impact conclusions of Alternatives A1 and A2 on land use would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 16.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 16-1.

Table 16-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Land Use Planning and Agricultural Resources

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Land Use Planning and Agricultural Resources: Program-Level						
LUP-1: Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	No-Action	SU	--	SU	--	--
	A1& A2	Significant	LUP-1a: Design and Implement Levee Setbacks to Preserve Agricultural Productivity of Important Farmland to the Extent Possible and Comply with the Surface Mining and Reclamation Act LUP-1b: Minimize Impacts on Williamson Act-Contracted Lands, Comply with Government Code Sections 51290-51293, and Coordinate with Landowners and Agricultural Operators	SU	No[1,2]	No[1,2]
LUP-2: Conversion of Riparian Forest to Non-Forest Uses	No-Action	LTS	--	LTS	--	--
	A1& A2	LTS	--	LTS	No[1,2]	No[1,2]
LUP-3: Conflict with Adopted Land Use Plans, Goals, Policies, and Ordinances of Affected Jurisdictions	No-Action	No Impact	--	No Impact	--	--
	A1& A2	SU	--	SU	No[1,2]	No[1,2]

Table 16-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Land Use Planning and Agricultural Resources (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Land Use Planning and Agricultural Resources: Project-Level						
LUP-4: Physically Divide or Disrupt an Established Community	No-Action	No Impact	--	No Impact	--	--
	A1& A2	PS	LUP-4: Implement Vehicular Traffic Detour Planning	LTS	No[1]	No[1]
LUP-5: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation	No-Action	No Impact	--	No Impact	--	--
	A1& A2	PS	LUP-5: Preserve Agricultural Productivity of Important Farmland to Minimize Effects of Inundation and Saturation Effects	PSU	No[1]	No[1]
LUP-6: Diminishment of Agricultural Production by Increased Orchard and Vineyard Diseases	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[1]	No[1]
LUP-7: Potential Conversion of Riparian Forest Because of Altered Inundation	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS and Beneficial	--	LTS and Beneficial	No[1]	No[1]

Table 16-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Land Use Planning and Agricultural Resources (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Land Use Planning and Agricultural Resources: Project-Level (contd.0						
LUP-8: Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries	No-Action	No Impact	--	No Impact	--	--
	A1& A2	SU	--	SU	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative
SU = Significant and Unavoidable

16.1 Program-Level Impacts

The potential program-level impact to land use as described in the Draft PEIS/R would be associated with construction activities. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact LUP-1 (Alternatives A1 and B1): ***Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts – Program-Level.*** This impact was found to be significant in the Draft PEIS/R. This impact is related to construction of modifications to the Reach 2B levee system and constructing Mendota Pool Bypass, which would convert Important Farmland to nonagricultural uses and require cancellation of lands under Williamson Act and Super Williamson Act contracts. Additional Important Farmland would be temporarily converted and additional Williamson Act and Super Williamson Act contracts could be canceled to allow use of the farmland as borrow sites. In addition, land at construction staging areas and access haul roads could be temporarily removed from agricultural production, and construction activities that occur during the growing season may result in a temporary loss in agricultural productivity. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain significant.

Mitigation Measure LUP-1a (Alternatives A1 and B1): ***Design and Implement Levee Setbacks to Preserve Agricultural Productivity of Important Farmland to the Extent Possible and Comply with the Surface Mining and Reclamation Act – Program-Level.*** This mitigation measure is identical to Mitigation Measure LUP-1a (Alternatives A1 and B1) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain significant and unavoidable.

Mitigation Measure LUP-1b (Alternatives A1 and B1): ***Minimize Impacts on Williamson Act-Contracted Lands, Comply with Government Code Sections 51290-51293, and Coordinate with Landowners and Agricultural Operators – Program-Level.*** This mitigation measure is identical to Mitigation Measure LUP-1b (Alternatives A1 and B1) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain significant and unavoidable.

Impact LUP-2 (Alternatives A1 and B1): Conversion of Riparian to Non-Forest Uses – Program-Level. This impact was found to be less than significant in the Draft PEIS/R. Under Alternatives A1 and B1, in-channel riparian forest may be removed. Constructing haul roads, staging areas, new levees, and other potential ancillary facilities, and improving existing levees, could also result in removal of riparian forest. However, implementing the riparian habitat conservation measures included in these alternatives would offset adverse effects on riparian forests. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact LUP-3 (Alternatives A1 and B1): ***Conflict with Adopted Land Use Plans, Goals, Policies, and Ordinances of Affected Jurisdictions – Program-Level.*** This impact was found to be significant and unavoidable in the Draft PEIS/R. The restoration actions, including modifications to the Reach 2 levee system, construction of the Mendota Pool Bypass, and integrated floodplain habitat would be inconsistent with land uses in the adopted general plan and zoning ordinances of Fresno and Madera counties. Because the general plan designations are intended to maintain an important resource in the counties (i.e., agricultural land), inconsistency in this case would indicate a significant impact under California Environmental Quality Act (CEQA) because the resulting loss of the agricultural land resources would be an environmental effect. No mitigation is available for these impacts. Because this impact is related to construction activities that would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would remain significant and unavoidable.

16.2 Project-Level Impacts

As described in the Draft PEIS/R, project-level actions could affect land use planning, agricultural resources, and forest land directly by increasing the areas inundated by seasonal flows and altering the existing duration and seasonality of inundation in the Restoration Area, or by altering surface water deliveries to the Friant Division water service areas.

Impact LUP-4 (Alternatives A1 and A2): ***Physically Divide or Disrupt an Established Community – Project-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to an increase in inundated areas in the Restoration Area as a result of Interim and Restoration flows, which could physically divide or disrupt an established community. Impacts occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure LUP-4 (Alternatives A1 and A2): ***Implement Vehicular Traffic Detour Planning – Project-Level.*** This mitigation measure is identical to Mitigation Measure TRN-7 (Alternatives A1 through C2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact LUP-5 (Alternatives A1 and A2): ***Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation – Project-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. At some locations in the Restoration Area, Interim and Restoration flows could change the duration and seasonality of inundation, or soil saturation, which could potentially affect crop production. Impacts occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure LUP-5 (Alternatives A1 and A2): *Preserve Agricultural Productivity of Important Farmland to Minimize Effects of Inundation and Saturation Effects – Project-Level.* This mitigation measure is identical to Mitigation Measure LUP-5 (Alternatives A1 through C2) presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Impact LUP-6 (Alternatives A1 and A2): *Diminishment of Agricultural Production by Increased Orchard and Vineyard Diseases – Project-Level.* This impact was found to be less than significant in the Draft PEIS/R. Additional water and vegetation along river and bypass channels within the Restoration Area could affect the incidence of some diseases on adjacent land by serving as a source of causal organisms, but would not substantially reduce agricultural activity. Impacts occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact LUP-7 (Alternatives A1 and A2): *Potential Conversion of Riparian Forest Because of Altered Inundation – Project-Level.* This impact was found to be less than significant and beneficial in the Draft PEIS/R. Reoperation of Friant Dam would permanently inundate and, thus, eliminate some patches of riparian forest. However, reoperation also would expand or create additional areas of riparian forest, and a net increase in the extent of riparian forest is anticipated. Impacts occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact LUP-8 (Alternatives A1 and A2): *Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries – Project-Level.* This impact was found to be significant and unavoidable in the Draft PEIS/R. Under the RPAs, surface water deliveries to Friant Division long-term contractors Alternatives A1 and A2 would be reduced, which would result in a shortfall of surface water supplies during some dry years and, thus, would result in additional groundwater pumping, changes in agricultural practices (e.g., crop selection), and idling of cropland. This impact conclusion **would not change** from the Draft PEIS/R, and would remain significant and unavoidable.

As described in the Draft PEIS/R, implementing Alternatives A1 and A2 would result in reduced deliveries of surface water to the Friant Division. Friant Division long-term contractors could compensate for this reduction in water deliveries through changes to cropping patterns or other agricultural practices, additional groundwater pumping, or idling of cropland. An analysis using the CVPM was conducted to assess the effects on agricultural crop production (see Chapter 22.0 of the Draft PEIS/R, “Socioeconomics,” which includes a discussion of employment and economic effects related to changes in agricultural production). According to the CVPM simulations (which were based on existing irrigated acreage and crop mix), implementing Alternatives A1 or A2 would on average reduce irrigated acreages by less than 1,000 acres. However, the CVPM modeling did not address some issues resulting from the replacement of some water deliveries with additional groundwater pumping that could affect agricultural productivity. These issues include the need to install or modify wells at some sites, and limited access to adequate quality groundwater at other sites. Thus, some reduction in irrigated acreage in addition to CVPM estimates could occur. Therefore, irrigated acreages could be reduced by more than 1,000 acres.

With the RPAs in place, implementing Alternatives A1 or A2 would on average reduce irrigated acreages by less than 1,000 acres. The maximum potential decrease in surface water deliveries to the Friant Division; therefore, the maximum potential impact to agricultural land resources in the Friant Division, would occur if none of the water released as Interim and Restoration flows was recaptured downstream and recirculated to the Friant Division. This is the same maximum potential impact described in the Draft PEIS/R, and could result in a reduction in irrigated acreage of more than 1,000 acres.

As described in the Draft PEIS/R, no feasible mitigation is available to reduce this potentially significant impact. Because of the close relationship between the quality of agricultural resources and water supply (i.e., soil capability increases when it is irrigated), mechanisms for reducing this adverse effect on agricultural resources are limited and related to providing alternative water supplies. Feasible means of providing alternative water supplies have been included in Alternatives A1 and A2 or would be implemented to reduce potential impacts on groundwater resources, including creating an economic incentive for Friant Division long-term contractors to purchase surplus water during wet hydrologic years (i.e., Paragraph 16(b) water), and committing to considering regional overdraft conditions in evaluation of candidate groundwater banking projects developed under Title III of the Act. After these actions were implemented, effects on agricultural productivity and the quality and importance of agricultural land would remain significant. No other means of providing an alternative supply of water to Friant long-term contractors are feasible for Reclamation. Therefore, this impact would not change from the Draft PEIS/R, and would remain significant and unavoidable.

Chapter 17.0 Noise

This chapter describes the potential for impacts of Alternatives A1 and A2 on the noise environment under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 17.0 of the Draft PEIS/R, "Noise." The discussion of potential impacts on the noise environment presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 17.1, "Environmental Setting" –** Describes the existing noise (and vibration) environment along the San Joaquin River from Friant Dam to the Merced River and from the Merced River to the Delta. Implementation of the Settlement is not anticipated to cause impacts to noise in the Delta or CVP/SWP service areas.

- **Section 17.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to noise.

- **Section 17.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to the noise environment to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 17-1. As shown in Table 17-1, none of the impact conclusions of Alternatives A1 and A2 on noise would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 17.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 17-1.

Table 17-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Noise

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Noise: Program-Level						
NOI-1: Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-1: Implement Measures to Reduce Temporary and Short-Term Noise Levels from Construction-Related Equipment Near Sensitive Receptors	PSU	No[1]	No[1]
NOI-2: Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-2: Implement Measures to Reduce Temporary Noise Levels from Construction-Related Traffic Increases Near Sensitive Receptors	PSU	No[1]	No[1]
NOI-3: Exposure of Sensitive Receptors to Long-Term Operation-Related Noise Levels from Stationary Sources	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	LTS	NOI-3: Implement Measures to Reduce Long-Term Operation-Related Noise Levels from Stationary Sources on Sensitive Receptors	LTS	No[1]	No[1]

Table 17-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Noise (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Noise: Program-Level (contd.)						
NOI-4: Exposure of Sensitive Receptors to Increased Noise from Borrow Site-Related Activities	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-4: Implement Measures to Reduce Borrow Site Noise Levels Near Sensitive Receptors	LTS	No[1,2]	No[1,2]
NOI-5: Exposure of Sensitive Receptors to or Generation of Excessive Groundborne Vibration	No-Action	Too Speculative for Meaningful Consideration		Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	NOI-5: Implement Measures to Reduce Temporary and Short-term Groundborne Noise and Vibration Levels Near Sensitive Receptors	LTS	No[1]	No[1]
Noise: Project-Level						
NOI-6: Effects of the Reoperation of Friant Dam on the Noise Environment	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]

Notes:
1 Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
2 Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative

17.1 Program-Level Impacts

The potential program-level impacts to the noise environment as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. These impacts would not change with the RPAs in place, as described in Chapter 1.0, “Introduction.” Therefore, these impacts are not discussed further in this chapter.

17.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to noise would be associated with the effects of the reoperation of Friant Dam. The reoperation of Friant Dam could affect the noise environment as a consequence of altering releases from Friant Dam. The project-level evaluation of effects on the noise environment included consideration of the potential effects resulting from the recapture of Interim Flows at existing facilities in the Restoration Area and in the Delta, and from the recapture of Restoration flows using existing Delta facilities. No associated changes that would occur to the noise environment outside of the Restoration Area were identified.

Impact NOI-6 (Alternatives A1 and A2): ***Effects of the Reoperation of Friant Dam on the Noise Environment – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact would only occur within the Restoration Area, and would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R and would remain less than significant.

Chapter 18.0 Paleontological Resources

This chapter describes the potential for impacts of Alternatives A1 and A2 on paleontological resources under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 18.0 of the Draft PEIS/R, "Paleontological Resources." The discussion of potential impacts on Paleontological Resources presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 18.1, "Environmental Setting" –** Describes the regional formations of paleontological resources of the Restoration Area and along the San Joaquin River from the Merced River to the Delta. Implementation of the Settlement is not anticipated to cause impacts to paleontological resources upstream from Friant Dam, in the Delta or CVP/SWP service areas.

- **Section 18.2, "Regulatory Setting" –** Describes State regulations pertaining to paleontological resources on public lands.

- **Section 18.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to paleontological resources to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 18-1. As shown in Table 18-1, none of the impact conclusions of Alternatives A1 and A2 on paleontological resources would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 18.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 18-1.

Table 18-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Paleontological Resources

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Paleontological Resources: Program-Level						
PAL-1: Possible Damage to or Destruction of Unique Paleontological Resources	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	PAL-1: Stop Work if Paleontological Resources Are Encountered During Earthmoving Activities and Implement Recovery Plan	LTS	No[1]	No[1]
Paleontological Resources: Project-Level						
PAL-2: Possible Damage to or Destruction of Unique Paleontological Resources	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

18.1 Program-Level Impacts

The potential program-level impact to paleontological resources as described in the Draft PEIS/R would be associated with construction activities. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact PAL-1 (Alternatives A1 and A2): ***Possible Damage to or Destruction of Unique Paleontological Resources – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to construction activities that would not change with the RPAs in place, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure PAL-1 (Alternatives A1 and A2): ***Stop Work if Paleontological Resources Are Encountered During Earthmoving Activities and Implement Recovery Plan – Program-Level.*** This mitigation measure is identical to Mitigation Measure PAL-1 (for Alternatives A1 through C2) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

18.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to paleontological resources would be associated with the effects of reoperating Friant Dam and recapturing water on paleontological resources. Because no construction activities are associated with reoperating Friant Dam and recapturing water, there would be no impacts on paleontological resources.

Impact PAL-2 (Alternatives A1 and A2): ***Possible Damage to or Destruction of Unique Paleontological Resources – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. Project-level actions to reoperate Friant Dam would not involve construction or groundbreaking activities; therefore, they would not impact paleontological resources. Because this impact is related to construction activities that would not change with the RPAs in place, this impact conclusion **would not change** from the Draft PEIS/R, and would have no impact.

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Chapter 19.0 Power and Energy

This chapter describes the potential for impacts of Alternatives A1 and A2 on power and energy under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 19.0, “Power and Energy,” of the Draft PEIS/R. The discussion of potential impacts on power and energy presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 19.1, “Environmental Setting” –** Describes power generation and pumping facilities on the San Joaquin River upstream of Friant Dam and in the CPV/SWP service areas. Implementation of the Settlement is not anticipated to cause impacts to power and energy in the Restoration Area, the San Joaquin River downstream from the Merced River confluence, or the Delta.

- **Section 19.2, “Regulatory Setting” –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to power and energy.

- **Section 19.3, “Environmental Consequences and Mitigation Measures” –** Includes a discussion of the methodology used to determine the potential for impacts to power and energy to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 19-1. As shown in Table 19-1, none of the impact conclusions of Alternatives A1 and A2 on power and energy would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 19.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 19-1.

Table 19-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Power and Energy

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Power and Energy: Program-Level						
PWR-1: Decrease in CVP and SWP Energy Generation	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]
PWR-2: Increase in CVP and SWP Energy Consumption	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]
PWR-3: Increased Energy Consumption as a Result of Construction Activities	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]
PWR-4: Increased Energy Consumption Within Friant Division	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	---	No Impact	No[1,3]	No[1,3]
Power and Energy: Project-Level						
PWR-5: Decrease in CVP and SWP Energy Generation	No-Action	LTS and Beneficial	--	LTS and Beneficial	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
PWR-6: Increase in CVP and SWP Energy Consumption	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
PWR-7: Change in Energy Generation at Friant Dam	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]
PWR-8: Increased Energy Consumption Within Friant Division	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 19-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Power and Energy (contd.)

Notes:

[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.

[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.

[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
NHPA = National Historic Preservation Act
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

19.1 Program-Level Impacts

The potential program-level impact to power and energy as described in the Draft PEIS/R would be associated with construction activities and long-term operations. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

19.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to power and energy would be associated with the effects of reoperation of Friant Dam, and recapture of Interim and Restoration flows in the Delta using existing facilities, operated under existing operating criteria. Additional energy consumption also could occur due to increased groundwater pumping within the Friant Division in response to reduced surface water supplies as a result of the release of Interim and Restoration flows. To determine the potential for changes in energy generation and consumption as a result of project-level actions under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO, two tools were applied (Long _Term_Gen and SWP_Power). RPA scenario 5 was selected from the CalSim-II output and analyzed in the two power models described above to determine the changes to long-term system power, as described in Chapter 3.0 of this appendix, “Tools and Methodology.”

Impact PWR-5 (Alternatives A1 and A2): ***Decrease in CVP and SWP Energy Generation – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. Under the RPAs, the maximum potential increase in CVP/SWP energy generation that would occur under Alternatives A1 and A2 would be less than without the RPAs, as a result of reduced opportunities for recapture of Interim and Restoration flows. However, the CVP/SWP energy generation under Alternatives A1 and A2 would remain greater than or equal to generation under the No-Action Alternative. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

As described in the Draft PEIS/R, project-level actions that would impact CVP and SWP energy generation under Alternatives A1 and A2 include the recapture and recirculation of Interim and Restoration flows in the Delta using existing facilities, operated under existing operating criteria. Simulated annual average CVP and SWP energy generation under Alternatives A1 and A2 are shown in Table 19-2 (Table 19-15 of the Draft PEIS/R). Under Alternatives A1 and A2, energy generation at CVP and SWP power plants would increase by less than 1 percent in both the existing and future level of demand. This impact was found to be less than significant and beneficial in the Draft PEIS/R.

Table 19-2.
Table 19-15 of the Draft PEIS/R:
Simulated Annual Average Hydropower for Alternatives A1 and A2

Impact Indicator	Existing Condition	Alternatives A1 and A2		No Action	Alternatives A1 and A2	
	(GWh)	(GWh)	(%) Change	(GWh)	(GWh)	(%) Change
CVP/SWP Energy Generation	9,855	9,884	<1%	9,915	9,935	<1%
CVP/SWP Energy Consumption	10,547	10,648	1%	11,086	11,165	1%
Energy Generation at Friant Dam	89	74	-17%	89	74	-17%

Note: Simulation period: 1922-2003

Key:
% = percent
GWh = gigawatt-hour
PEIS/R = Program Environmental Impact Statement/Report

Under RPA Scenario 5, project-level actions under Alternatives A1 and A2 would increase energy generation at CVP and SWP power plants by less than 1 percent, as shown in Table 19-3. Overall energy generation would be less with the RPAs in place due to reduced opportunities for energy generation at San Luis reservoir and along the California Aqueduct, as a result of reduced Delta pumping under both the No-Action Alternative and Alternatives A1 and A2; however, the effect of Alternatives A1 and A2 would still be to increase energy generation over the No-Action Alternative. The significance conclusion of this impact would not change from the Draft PEIS/R, and would remain less than significant and beneficial.

Table 19-3.
Simulated Annual Average Hydropower for Alternatives A1 and A2 Under RPA Scenario 5

Impact Indicator	RPA Scenario 5	
	(GWh)	(%) Change
CVP/SWP Energy Generation	9,377	<1%
CVP/SWP Energy Consumption	8,685	<1%
Energy Generation at Friant Dam	74	-17%

Note: Simulation period: 1922-2003

Key:
% = percent
GWh = gigawatt-hour
PEIS/R = Program Environmental Impact Statement/Report

Impact PWR-6 (Alternatives A1 and A2): ***Increase in CVP and SWP Energy Consumption – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Under the RPAs, the maximum potential increase in CVP/SWP energy consumption that would occur under Alternatives A1 and A2 would be less than without the RPAs, as a result of reduced opportunities for recapture of Interim and Restoration flows. However, the CVP/SWP energy consumption under Alternatives A1 and A2 would remain greater than or equal to generation under the No-Action Alternative. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, project-level actions that would impact CVP and SWP energy consumption under Alternatives A1 and A2 include the recapture and recirculation of Interim and Restoration flows in the Delta using existing facilities, operated under existing operating criteria. Additional energy consumption also could occur due to increased groundwater pumping within the Friant Division in response to reduced surface water supplies as a result of the release of Interim and Restoration flows. Simulated annual average CVP and SWP energy consumption under Alternatives A1 and A2 are shown in Table 19-2 (Table 19-15 of the Draft PEIS/R). Under Alternatives A1 and A2, energy consumption at CVP and SWP power plants would increase by about 1 percent in both the existing and future level of demand. This impact was found to be less than significant in the Draft PEIS/R.

Under RPA Scenario 5, project-level actions under Alternatives A1 and A2 would increase energy consumption in the CVP and SWP by less than 1 percent, as shown in Table 19-3. Overall energy consumption would be less with the RPAs in place due to reduced Delta pumping under both the No-Action Alternative and Alternatives A1 and A2. The significance conclusion of this impact would not change from the Draft PEIS/R, and would remain less than significant.

Impact PWR-7 (Alternatives A1 and A2): ***Change in Energy Generation at Friant Dam – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact would occur as a result of changes in releases for hydropower generation at Friant Dam. Because these releases would not be affected by the RPAs, this impact conclusion **would not change** from the Draft PEIS/R, and would be less than significant.

As described in the Draft PEIS/R and shown in Table 19-2, under Alternatives A1 and A2 energy generation at Friant Dam power plants would decrease by 17 percent in both the existing and future level of demand.

Releases at Friant Dam would not be affected by the RPAs. Therefore, as shown in Table 19-3, with the RPAs in place energy generation at Friant Dam power plants under Alternatives A1 and A2 would decrease by 17 percent, the same change from the No-Action Alternative as described in the Draft PEIS/R. The significance conclusion of this impact would not change from the Draft PEIS/R, and would remain less than significant.

Impact PWR-8 (Alternatives A1 and A2): ***Increased Energy Consumption Within Friant Division – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Under the RPAs, surface water deliveries to Friant Division long-term contractors Alternatives A1 and A2 would be reduced, increasing the need to pump groundwater and thereby increasing energy consumption within the Friant Division. The maximum potential increase in energy consumption within the Friant Division due to increased groundwater pumping would be less than 5 percent of the overall consumption by the agricultural sector for regional utility providers Pacific Gas and Electric Company

(PG&E) and Southern California Edison (SCE). This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, the maximum potential increase in groundwater pumping, and therefore in energy consumption, would occur if none of the water released as Interim and Restoration flows was recaptured downstream and recirculated to the Friant Division. The expected increase in energy consumption within the Friant Division due to increased groundwater pumping would be less than 5 percent of the overall consumption by the agricultural sector for regional utility providers PG&E and SCE.

With the RPAs in place, the maximum potential increase in groundwater pumping, and therefore in energy consumption, would occur if none of the water released as Interim and Restoration flows was recaptured downstream and recirculated to the Friant Division. This is the same maximum potential impact described in the Draft PEIS/R, and would result in the same energy consumption within the Friant Division. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

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Chapter 20.0 Public Health and Hazardous Materials

This chapter describes the potential for impacts on public health or potential risk of exposure to hazardous materials from Alternatives A1 and A2 under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 20.0 of the Draft PEIS/R, "Public Health and Hazardous Materials." The discussion of potential impacts on public health and hazardous materials presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 20.1, "Environmental Setting" –** Describes the anthropogenic and naturally occurring hazards along the San Joaquin River upstream from Friant Dam, in the Restoration Area, and along the San Joaquin River downstream from the Restoration Area. Implementation of the Settlement is not anticipated to cause impacts to public health or potential risk of exposure to hazardous materials in the CVP/SWP service areas.

- **Section 20.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to public health and hazardous materials.

- **Section 20.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to public health and potential risk of exposure to hazardous materials to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 20-1. As shown in Table 20-1, none of the impact conclusions of Alternatives A1 and A2 on public health and potential risk of exposure to hazardous materials would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 20.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 20-1.

Table 20-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Public Health and Hazardous Materials

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Public Health and Hazardous Materials: Program-Level						
PHH-1: Exposure of Construction Workers and Others to Hazardous Materials	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-1: Conduct Phase I Environmental Site Assessments	LTS	No[1,2]	No[1,2]
PHH-2: Creation of a Substantial Hazard to the Public or the Environment Through the Use of Hazardous Materials	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
PHH-3: Exposure to Naturally Occurring Asbestos	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,2]	No[1,2]
PHH-4: Exposure to Diseases	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-4: Implement Workplace Precautions against West Nile Virus and Valley Fever	LTS	No[1,2]	No[1,2]
PHH-5: Creation of a Substantial Hazard to School Safety	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-5: Minimize Hazards to School Safety	LTS	No[1,2]	No[1,2]
PHH-6: Creation of a Substantial Hazard from Idle and Abandoned Wells	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-6: Minimize Hazards from Idle and Abandoned Wells	LTS	No[1,2]	No[1,2]

Table 20-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Public Health and Hazardous Materials (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Public Health and Hazardous Materials: Program-Level (contd.)						
PHH-7: Creation of a Substantial Hazard from Wildland Fires	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
PHH-8: Creation of a Substantial Hazard to Aircraft Safety	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
Public Health and Hazardous Materials: Project-Level						
PHH-9: Exposure to Diseases in the San Joaquin River upstream from Friant Dam, in the Restoration Area, and in the San Joaquin River from Merced River to the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	PHH-9: Coordinate with and Support Vector Control District(s)	LTS	No[2,3]	No[2,3]
PHH-10: Exposure to Diseases in the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

20.1 Program-Level Impacts

The potential program-level impacts to public health including potential risk of exposure to hazardous materials, as described in the Draft PEIS/R, would be associated with construction activities, modification of facilities, or with other ground-disturbing restoration activities. No construction activities would occur upstream from Friant Dam, in the Delta, or in the CVP/SWP water service areas. No effects to public health or exposure to hazardous materials would occur in these three areas. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact PHH-1 (Alternatives A1 and A2): ***Exposure of Construction Workers and Others to Hazardous Materials – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction and other ground-disturbing activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure PHH-1 (Alternatives A1 and A2): ***Conduct Phase I Environmental Site Assessments – Program-Level.*** This mitigation measure is identical to Mitigation Measure PHH-1 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** with the RPAs in place, and would remain less than significant.

Impact PHH-2 (Alternatives A1 and A2): ***Creation of a Substantial Hazard to the Public or the Environment Through the Use of Hazardous Materials – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to construction and improvement activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact PHH-3 (Alternatives A1 and A2): ***Exposure to Naturally Occurring Asbestos – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. This impact is related to construction activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact PHH-4 (Alternatives A1 and A2): ***Exposure to Diseases – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction and improvement activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure PHH-4 (Alternatives A1 and A2): ***Implement Workplace Precautions against West Nile Virus and Valley Fever – Program-Level.*** This mitigation measure is identical to Mitigation Measure PHH-4 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** with the RPAs in place, and would remain less than significant.

Impact PHH-5 (Alternatives A1 and A2): ***Creation of a Substantial Hazard to School Safety – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction and other activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure PHH-5 (Alternatives A1 and A2): ***Minimize Hazards to School Safety – Program-Level.*** This mitigation measure is identical to Mitigation Measure PHH-5 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not** change with the RPAs in place, and would remain less than significant.

Impact PHH-6 (Alternatives A1 and A2): ***Creation of a Substantial Hazard from Idle and Abandoned Wells – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to ground-disturbing activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure PHH-6 (Alternatives A1 and A2): ***Minimize Hazards from Idle and Abandoned Wells – Program-Level.*** This mitigation measure is identical to Mitigation Measure PHH-6 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not** change with the RPAs in place, and would remain less than significant.

Impact PHH-7 (Alternatives A1 and A2): ***Creation of a Substantial Hazard from Wildland Fires – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to construction and other activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact PHH-8 (Alternatives A1 and A2): ***Creation of a Substantial Hazard to Aircraft Safety – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to construction and improvement activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

20.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to public health and potential risk of exposure to hazardous materials would be associated with the effects of the reoperation of Friant Dam.

Impact PHH-9 (Alternatives A1 and A2): ***Exposure to Diseases in the San Joaquin River upstream from Friant Dam, in the Restoration Area, and in the San Joaquin River from Merced River to the Delta – Project-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would increase mean monthly flows in the San Joaquin River between the Merced River and the Delta during some months of most years, potentially increasing the amount of calm, free-standing water for mosquito breeding habitat in the San Joaquin River from Merced River to the Delta. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Under any of the action alternatives, reoperation of Friant Dam would draw down water levels in Millerton Lake, resulting in exposure of a shoreline zone for longer duration that may contain isolated, calm water and, thus, potentially increasing breeding habitat for mosquitoes. Any of the action alternatives also would increase water volume and change the timing of flows in the San Joaquin River below Friant Dam, increasing the frequency and duration of inundation of channel and floodplain areas. Additional inundation could increase the extent of calm water and, thus, could increase the extent of mosquito breeding habitat. Any of the action alternatives could increase mosquito abundance and potential for exposure to mosquito-borne viruses upstream of Friant Dam or along the San Joaquin River from Friant Dam to the Merced River. Releases from Friant Dam will not change with the RPAs in place; therefore, the potential to increase mosquito habitat and mosquito-borne virus exposure would not change with the RPAs in place.

Interim and Restoration flows would also increase water volume and change the timing and volume of flows in the San Joaquin River from the Merced River to the Delta, increasing the frequency and duration of inundation of channel and floodplain areas. . This portion of the San Joaquin River already has perennial flow, and during most of the year, the increase in flow would not substantially increase flow volume in this segment of the river or the area of inundated floodplain. However, during spring of some years, increased flow could increase the overall amount of calm, free-standing water in this segment of the river, providing additional mosquito breeding habitat and potentially increasing exposure of the public to diseases. Though flows in the San Joaquin River between the Merced River and the Delta could change with the RPAs in place, the difference from those described in the Draft PEIS/R would be minimal. Creation of mosquito breeding habitat and potential for exposure to mosquito-borne viruses would not be reduced with the RPAs in place; therefore, this impact conclusion would not change from the Draft PEIS/R and would remain potentially significant.

Mitigation Measure PHH-9 (Alternatives A1 and A2): ***Coordinate with and Support Vector Control District(s) – Project-Level.*** This mitigation measure is identical to Mitigation Measure PHH-9 (for Alternatives A1 through C2) as presented in the Draft

PEIS/R. With mitigation, this impact conclusion **would not change** with the RPAs in place, and would remain less than significant.

Impact PHH-10 (Alternatives A1 and A2): ***Exposure to Diseases in the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not cause a considerable increase in the extent or duration of inundation in the Delta and, thus, would not create considerable additional mosquito breeding habitat. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Interim and Restoration flows under any of the action alternatives would increase water volume and change the timing and volume of flows from the San Joaquin River to the Delta. However, the increase in releases from Friant Dam into the San Joaquin River would not cause a considerable increase in the extent or duration of inundated area in the Delta and, thus, would not create considerable additional mosquito breeding habitat. Though flows from the San Joaquin River into the Delta could change with the RPAs in place, the difference from the Draft PEIS/R will be minimal. Creation of mosquito breeding habitat and potential for exposure to mosquito-borne viruses in the Delta would not be significantly increased with the RPAs in place; therefore, this impact conclusion would not change from the Draft PEIS/R and would remain less than significant.

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Chapter 21.0 Recreation

This chapter describes the potential for impacts of Alternatives A1 and A2 on recreation under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 21.0 of the Draft PEIS/R, "Recreation." The discussion of potential impacts on recreation presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 21.1, "Environmental Setting" –** Describes the recreational opportunities of the San Joaquin River upstream from Friant Dam, the Restoration Area, and along the San Joaquin River downstream from the Restoration Area.

- **Section 21.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to recreation.

- **Section 21.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to recreational opportunities to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 21-1. As shown in Table 21-1, none of the impact conclusions of Alternatives A1 and A2 on recreation would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 21.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 21-1.

Table 21-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Recreation

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Recreation: Program-Level						
REC-1: Increased Use of Facilities at Millerton Lake State Recreation Area and Demand for Recreation Opportunities at Millerton Lake and Vicinity	No-Action	LTS	--	LTS	--	--
	A1 & A2	No Impact	--	No Impact	No[2]	No[2]
REC-2: Increased Use of Recreation Facilities and Demand for Recreation Opportunities in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
REC-3: Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities in the Restoration Area	No-Action	LTS	--	LTS	--	--
	A1	LTS	--	LTS	No[1,2]	No[1,2]
	A2	PS	REC-3: Restore Recreation Access and Facilities Affected by Construction, Operation, and Maintenance from Settlement Actions in the San Luis Unit of the San Luis National Wildlife Refuge	LTS	No[1,2]	No[1,2]

Table 21-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Recreation (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Recreation: Program-Level (contd.)						
REC-4: Effects of Reintroducing Salmon to the Restoration Area on Reach 1 Angling Opportunities	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	REC-4: Enhance Fishing Access and Fish Populations on the Kings River below Pine Flat Dam	LTS	No[2]	No[2]
REC-5: Effects on Reach 1 Warm-Water Angling Opportunities from Program Actions within the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	REC-5: Enhance Warm-Water Fishing Access and Fish Populations in the Vicinity of the San Joaquin River below Friant Dam	LTS	No[2]	No[2]
REC-6: Effects on Wildlife-Based Recreation Opportunities from Enhanced Wildlife Habitat Conditions Caused by Program Actions Within the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 21-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Recreation (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Recreation: Program-Level (contd.)						
REC-7: Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities on the San Joaquin River Between Merced River and the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,3]	No[1,3]
REC-8: Effects of Reintroducing Salmon to the San Joaquin River Between Friant Dam and the Merced River on Angling Opportunities Downstream	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2,3]	No[2,3]
Recreation: Project-Level						
REC-9: Effects on Recreation Opportunities from Earlier Seasonal Drawdown of Millerton Lake Related to Timing of Release of Interim and Restoration Flows	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	REC-9: Extend Millerton Lake Boat Ramps or Construct a New Low-Water Ramp to Allow Boat Launching at the Lower Pool Elevations that May Result from Interim and Restoration Flows during Dry and Critical-High Years	LTS	No[2]	No[2]

Table 21-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Recreation (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Recreation: Project-Level (contd.)						
REC-10: Effects on Recreation Facilities from Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
REC-11: Effects on Swimming or Wading and Fishing Opportunities from Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[2]	No[2]
REC-12: Effects on Boating Opportunities from Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	Significant	REC-12: Develop and Implement Recreation Outreach Program	LTS	No[2]	No[2]
REC-13: Effects on Wildlife-Based Recreation Opportunities from Enhanced Wildlife Habitat Conditions Related to Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]

Table 21-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Recreation (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Recreation: Project-Level (contd.)						
REC-14: Effects on Warm-Water Fishing Opportunities from Enhanced Fish Populations Related to Increased Flow in the Restoration Area	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[2]	No[2]
REC-15: Effects on Warm-Water Fishing Opportunities from Increased Flow in the San Joaquin River from the Merced River to the Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]
REC-16:Effects on Warm-Water and Cold-Water Fishing Opportunities from Increased Flow into the Sacramento-San Joaquin Delta	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

21.1 Program-Level Impacts

The potential program-level impacts to recreation as described in the Draft PEIS/R would be associated with restoration actions affecting recreation resources directly (e.g., by providing or enhancing the sport fishery through reintroducing salmon to the river). Implementation of the Settlement could also result in indirect effects (e.g., by improving wildlife habitat and enhancing wildlife viewing opportunities, through creation or enhancement of floodplain and side-channel habitat for fish). Construction activities and impacts in the Restoration Area would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact REC-1 (Alternatives A1 and A2): *Increased Use of Facilities at Millerton Lake State Recreation Area and Demand for Recreation Opportunities at Millerton Lake and Vicinity – Program-Level.* This impact was found to have no impact in the Draft PEIS/R. Because this impact would occur upstream from Friant Dam, it would not be altered with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact REC-2 (Alternatives A1 and A2): *Increased Use of Recreation Facilities and Demand for Recreation Opportunities in the Restoration Area – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Because this impact would occur within the Restoration Area, it would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-3 (Alternative A1): *Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities on the San Joaquin River Between Friant Dam and the Merced River – Program-Level.* This impact was found to be less than significant in the Draft PEIS/R. Because this impact is related to construction activities and would occur within the Restoration Area, it would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-3 (Alternative A2): *Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities on the San Joaquin River Between Friant Dam and the Merced River – Program-Level.* This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to construction activities and would occur within the Restoration Area, it would not change with the RPAs in place. Impacts under Alternative A2 would be similar to Impact REC-3 (Alternative A1). Under Alternative A2, however, restoration actions along Reaches 2 through 5 include improving Reach 4B1 to convey at least 4,500 cfs. New levees would be constructed along both sides of Reach 4B1. Construction, operation, and maintenance of these new levees could have substantial adverse effects on recreation access and facilities in one unit of the San Luis National Wildlife Refuge. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure REC-3 (Alternative A2): ***Restore Recreation Access and Facilities Affected by Construction, Operation, and Maintenance from Settlement Actions in the San Luis Unit of the San Luis National Wildlife Refuge – Program-Level.*** This mitigation measure is identical to Mitigation Measure REC-3 (for Alternatives A2 and B2) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** with the RPAs in place, and would remain less than significant.

Impact REC-4 (Alternatives A1 and A2): ***Effects of Reintroducing Salmon to the Restoration Area on Reach 1 Angling Opportunities – Program Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to actions within the Restoration Area, it would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure REC-4 (Alternatives A1 and A2): ***Enhance Fishing Access and Fish Populations on the Kings River below Pine Flat Dam – Program Level.*** This mitigation measure is identical to Mitigation Measure REC-4 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** with the RPAs in place, and would remain less than significant.

Impact REC-5 (Alternatives A1 and A2): ***Effects on Reach 1 Warm-Water Angling Opportunities from Program Actions within the Restoration Area – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. Because this impact is related to actions within the Restoration Area, it would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure REC-5 (Alternatives A1 and A2): ***Enhance Warm-Water Fishing Access and Fish Populations in the Vicinity of the San Joaquin River below Friant Dam – Program Level.*** This mitigation measure is identical to Mitigation Measure REC-5 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-6 (Alternatives A1 and A2): ***Effects on Wildlife-Based Recreation Opportunities from Enhanced Wildlife Habitat Conditions Caused by Program Actions Within the Restoration Area – Program-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. Because this impact is related to actions within the Restoration Area, it would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact REC-7 (Alternatives A1 and A2): ***Effects of Construction, Operation, and Maintenance of New Projects or Facilities on Recreation Opportunities on the San Joaquin River Between Merced River and the Delta – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, no new projects or facilities would be constructed on the San Joaquin River between the Merced River and the Delta in the vicinity of existing recreation facilities or use areas. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact REC-8 (Alternatives A1 and A2): ***Effects of Reintroducing Salmon to the San Joaquin River Between Friant Dam and the Merced River on Angling Opportunities Downstream – Program-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. This impact is related to actions within the Restoration Area that would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

21.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to recreation would be associated with the reoperation of Friant Dam for Interim and Restoration flows in the Restoration Area and potential immediate actions to address nonattainment of management objectives.

Impact REC-9 (Alternatives A1 and A2): ***Effects on Recreation Opportunities from Earlier Seasonal Drawdown of Millerton Lake Related to Timing of Release of Interim and Restoration Flows – Project-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to water levels in Millerton Lake, which would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure REC-9 (Alternatives A1 and A2): ***Extend Millerton Lake Boat Ramps or Construct a New Low-Water Ramp to Allow Boat Launching at the Lower Pool Elevations that May Result from Interim and Restoration Flows during Dry and Critical-High Years – Project-Level.*** This mitigation measure is identical to Mitigation Measure REC-9 (for Alternatives A1 through C2) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-10 (Alternatives A1 and A2): ***Effects on Recreation Facilities from Increased Flow in the Restoration Area – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to increased flows within the Restoration area, which would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-11 (Alternatives A1 and A2): ***Effects on Swimming or Wading and Fishing Opportunities from Increased Flow in the Restoration Area – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to increased flows within the Restoration area, which would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-12 (Alternatives A1 and A2): ***Effects on Boating Opportunities from Increased Flow in the Restoration Area – Project-Level.*** This impact was found to be significant in the Draft PEIS/R. This impact is related to increased flows within the Restoration area, which would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain significant.

Mitigation Measure REC-12 (Alternatives A1 and A2): ***Develop and Implement Recreation Outreach Program – Project-Level.*** This mitigation measure is identical to Mitigation Measure REC-12 (for Alternatives A1 through C2) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact REC-13 (Alternatives A1 and A2): ***Effects on Wildlife-Based Recreation Opportunities from Enhanced Wildlife Habitat Conditions Related to Increased Flow in the Restoration Area – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. This impact is related to increased flows within the Restoration area, which would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact REC-14 (Alternatives A1 and A2): ***Effects on Warm-Water Fishing Opportunities from Enhanced Fish Populations Related to Increased Flow in the Restoration Area – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. Because this impact is related to angling opportunities within the Restoration Area, it would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact REC-15 (Alternative A1 and A2): ***Effects on Warm-Water Fishing Opportunities from Increased Flow in the San Joaquin River from the Merced River to the Delta – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, under Alternatives A1 and A2 Interim and Restoration flows would increase flows and improve water quality in the river between the Merced River and the Delta, which would be expected to increase warm-water game fish populations and enhance fishing opportunities. Though flows in the San Joaquin River from the Merced River to the Delta could change with the RPAs in place, the difference from the Draft PEIS/R will be minimal. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact REC-16 (Alternatives A1 and A2): ***Effects on Warm-Water and Cold-Water Fishing Opportunities from Increased Flow into the Sacramento-San Joaquin Delta – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, under Alternatives A1 and A2 Interim and Restoration flows would increase flows and improve water quality in the San Joaquin River as the river flows into the Delta and in adjacent Delta waterways, such as the Old River and Middle River, which could increase game fish populations and enhance fishing opportunities. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

With Interim and Restoration flows and associated improvements in water quality, game fish populations would be expected to increase in the Delta, and in the south Delta waterways in particular. It is unknown whether any fish population increases would be large enough to enhance sportfishing opportunities measurably. Nonetheless, it is expected that there would be some increases in fish populations that could enhance sportfishing opportunities. Further related water quality discussions are presented in Chapter 14 of this Appendix, and further related fisheries discussions are presented in Chapter 5 of this Appendix. Though flows from the San Joaquin River into the Delta could change with the RPAs in place, the difference from the Draft PEIS/R will be minimal. With the RPAs in place, water quantity and quality entering the Delta will continue to improve, which could increase game fish populations and enhance fishing opportunities. Therefore, this impact would not change from the Draft PEIS/R and would be less than significant and beneficial.

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Chapter 22.0 Socioeconomics

This chapter describes the potential for impacts of Alternatives A1 and A2 on socioeconomics under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 22.0 of the Draft PEIS/R, "Socioeconomics." The discussion of potential impacts on socioeconomics presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 22.1, "Environmental Setting" –** Describes socioeconomic conditions along the San Joaquin River upstream of Friant Dam, from Friant Dam to the Merced River, downstream from the Merced River to the Delta and in the Friant Division of the CVP/SWP service areas. Implementation of the Settlement is not anticipated to cause impacts to socioeconomics in the Delta.

- **Section 22.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to socioeconomics.

- **Section 22.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to socioeconomic conditions to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 22-1. As shown in Table 22-1, none of the impact conclusions of Alternatives A1 and A2 on socioeconomic conditions would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 22.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 22-1.

Table 22-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Socioeconomics

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Socioeconomics: Program-Level						
SOC-1: Change in Regional Employment Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS and Beneficial	--	LTS and Beneficial	No[1,2]	No[1,2]
SOC-2: Change in Regional Population Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[1,2]	No[1,2]
SOC-3: Change in Regional Housing Demand	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[1,2]	No[1,2]
Socioeconomics: Project-Level						
SOC-4: Change in Regional Employment Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
SOC-5: Change in Regional Population Levels	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
SOC-6: Change in Regional Housing Demand	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]
SOC-7: Physical Decay in Communities	No-Action	No Impact	--	No Impact	--	--
	A1& A2	LTS	--	LTS	No[3]	No[3]

Table 22-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Socioeconomics (contd.)

Notes:

[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.

[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.

[3] Conclusions are based on further analyses as presented in this chapter.

Key:

-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
RPA = reasonable and prudent alternative

22.1 Program-Level Impacts

The potential program-level impact to socioeconomics as described in the Draft PEIS/R would be associated with construction activities and a potential reduction in agricultural operations within the Restoration Area. Construction activities and agricultural operations within the Restoration Area would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R, as described below.

Impact SOC-1 (Alternatives A1 and A2): ***Change in Regional Employment Levels – Program-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. With the RPAs in place, increased short-term socioeconomic activity could occur in the counties within the Restoration Area if substantial construction activity occurred quickly under Alternatives A1 and A2, while lands potentially taken out of agricultural production from Restoration actions are considered to have relatively small effects on agricultural production. Therefore, short-term effects on regional employment levels would be beneficial, and long-term effects would be less than significant. Impacts occurring upstream from the Merced River confluence would not be affected by changes in CVP/SWP operations in the Delta. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact SOC-2 (Alternatives A1 and A2): ***Change in Regional Population Levels – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Increased socioeconomic activity may occur in the counties within the Restoration Area if substantial construction activity occurs quickly under Alternative A1. The effects on regional population levels would be greater during construction activities than in the long term after construction-related activities were completed and some currently agricultural lands were taken out of production for Restoration actions. This increased socioeconomic activity would not change with the RPAs in place, as the RPAs would not affect construction activities or the amount of land taken out of production in the Restoration Area. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

Impact SOC-3 (Alternatives A1 and A2): ***Change in Regional Housing Demand – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. Increased socioeconomic activity may occur in the counties within the Restoration Area if substantial construction activity for program-level Restoration actions occurs quickly. Conversely, loss of agricultural land as a result of construction of Restoration actions may result in job losses, causing a long-term decrease in housing demand, but these effects are small and are considered to be less than significant. This increased socioeconomic activity would not change with the RPAs in place, as the RPAs would not affect construction activities or the amount of land taken out of production in the Restoration Area. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

22.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to socioeconomics would occur from reoperation of Friant Dam and recapture of Interim and Restoration flows.

Impact SOC-4 (Alternatives A1 and A2): ***Change in Regional Employment Levels – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, project-level actions under Alternatives A1 and A2 would result in increased socioeconomic activities in the Friant Division, though annual-average Friant Division employment would not noticeably increase. The loss of agricultural production from changes in land use is estimated to result in a decline in farm labor employment in the Friant Division; however, the increase in retail jobs would outweigh the loss in agricultural jobs. The overall increase in employment is not expected to be substantial. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, increased socioeconomic activity may occur in the counties within the Friant Division as a result of actions under Alternatives A1 through C2. This increased socioeconomic activity is anticipated to be less than the planned annual-average Friant Division employment growth of 1.2 percent. Table 22-2 (Table 22-39 of the Draft PEIS/R) shows the impacts that actions under Alternatives A1 through C2 may have on annual employment in the Friant Division. Annual-average Friant Division employment would not noticeably increase. Table 22-2 shows the maximum loss of agricultural production from changes in land use (Table 22-39 of the Draft PEIS/R). This would occur if no recaptured Interim or Restoration flows are recirculated to the Friant Division, and would result in a decrease in agricultural industry output of approximately $6.2 million dollars, and a decline in farm labor of about 20 agricultural jobs. The reduction in agricultural production and employment that would occur if all recaptured Interim or Restoration flows were recirculated to the Friant Division would be smaller than that shown in Table 22-2 (Table 22-39 of the Draft PEIS/R), but more than zero. The loss of agricultural production from changes in land use is estimated to result in a decline in farm labor employment in the Friant Division; however, the increase in retail jobs would outweigh the loss in agricultural jobs.

Table 22-2.
Table 22-39 of the Draft PEIS/R: Annual Regional Economic Impacts on Industry Output and Employment – Friant Division Change from Existing Base to Alternatives A1 Through C2

Industry	Total Industry Output			Employment (number of employees)		
	Existing Base	Friant Division Change, Alts A1 through C2	Percent of Base	Existing Base	Friant Division Change, Alts A1 through C2	Percent of Base
Agriculture, Forestry, Fishing, and Hunting	$23,233,194,000	-$2,703,339	-0.01	199,030	-20	-0.01
Mining	$5,920,873,000	-$165,908	0.00	11,700	0	0.00
Utilities	$4,447,976,000	-$144,275	0.00	4,920	0	0.00
Construction	$11,066,246,000	-$82,337	0.00	71,580	0	0.00
Manufacturing	$35,344,381,000	-$900,642	0.00	71,500	-1	0.00
Wholesale Trade	$5,116,683,000	-$505,800	-0.01	32,900	-3	-0.01
Retail Trade	$8,458,236,000	$2,987,280	0.04	116,280	65	0.06
Transportation and Warehousing	$4,684,445,000	-$236,872	-0.01	32,760	-1	0.00
Information	$3,562,185,000	-$119,556	0.00	10,920	-1	0.00
Finance and Insurance	$5,738,403,000	-$811,585	-0.01	30,000	-4	-0.01
Real Estate and Rental	$11,030,271,000	-$1,974,463	-0.02	27,820	-2	-0.01
Professional, Scientific, and Tech Services	$4,887,323,000	-$177,882	0.00	43,050	-1	0.00
Management of Companies	$1,292,948,000	-$1,034	0.00	7,880	0	0.00
Administrative and Waste Services	$3,080,623,000	-$89,517	0.00	50,880	-2	0.00
Educational Services	$481,475,000	-$123,290	-0.03	9,740	-3	-0.03

Table 22-2.
Table 22-39 of the Draft PEIS/R: Annual Regional Economic Impacts on Industry Output and Employment – Friant Division Change from Existing Base to Alternatives A1 Through C2 (contd.)

Industry	Total Industry Output			Employment (No. of employees)		
	Existing Base	Friant Division Change, Alts A1 through C2	Percent of Base	Existing Base	Friant Division Change, Alts A1 through C2	Percent of Base
Health and Social Services	$8,960,410,000	-$1,886,170	-0.02	105,200	-23	-0.02
Arts, Entertainment, and Recreation	$544,882,000	-$108,413	-0.02	11,410	-2	-0.02
Accommodation and Food Services	$3,474,102,000	$2,285,811	0.07	63,920	33	0.05
Other Services	$4,003,654,000	-$710,525	-0.02	66,610	-13	-0.02
Government and Non-North American Industry Classification System	$17,339,661,000	-$184,978	0.00	224,540	-1	0.00
Institutions	$0	-$554,372	N/A	0	0	N/A
Totals	**$162,667,971,000**	**-$6,207,867**	**0.00**	**1,192,640**	**22**	**0.00**

Source: 2007 IMPLAN data from Minnesota IMPLAN Group, Inc., with modifications made by Cascade Economics LLC

Key:
Alts = Alternatives
N/A = not applicable

Under RPA Scenario 5, increased socioeconomic activity would occur in the counties within the Friant Division as a result of actions under Alternatives A1 and A2, but would remain less than the planned annual-average Friant Division employment growth of 1.2 percent. The impacts that actions under Alternatives A1 and A2 may have on annual employment in the Friant Division with RPA Scenario 5 in place are shown in Table 22-3, resulting in an increase in employment of about 58 employees, compared with 22 employees

With the RPAs in place, if no recaptured Interim or Restoration flows are recirculated to the Friant Division, the reduction in agricultural industry output and employment would not change from that shown in Table 22-2 (a decrease in agricultural industry output of approximately $6.2 million dollars, and a decline in farm labor of about 20 agricultural jobs). However, with the RPAs in place, average Delta exports would be reduced, as described in Chapter 13.0 of this Appendix, “Hydrology – Surface Water Supplies and

Facilities Operations." Accordingly, the maximum amount of water available for recirculation to the Friant Division would be lower, and the associated reduction in agricultural productivity and employment higher with the RPAs in place. Thus, if all recaptured Interim or Restoration flows were recirculated to the Friant Division, the Alternatives A1 and A2 would result in a decrease in agricultural industry output of approximately $2.2 million dollars, and a decline in farm labor of about 15 agricultural jobs, as shown in Table 22-3. This is within the range described in the Draft PEIS/R; therefore, this impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Table 22-3.
Annual Regional Economic Impacts on Industry Output and Employment – Friant Division Change from Existing Base to Alternatives A1 and A2 Under RPA Scenario 5

Industry	Total Industry Output			Employment (number of employees)		
	Existing Base	Friant Division Change, Alts A1 and A2, RPA Scenario 5	Percent of Base	Existing Base	Friant Division Change, Alts A1 and A2, RPA Scenario 5	Percent of Base
Agriculture, Forestry, Fishing, and Hunting	$23,233,194,000	-$2,238,959	-0.01	199,030	-15	-0.01
Mining	$5,920,873,000	-$116,932	0.00	11,700	0	0.00
Utilities	$4,447,976,000	-$78,414	0.00	4,920	0	0.00
Construction	$11,066,246,000	-$38,057	0.00	71,580	0	0.00
Manufacturing	$35,344,381,000	-$575,961	0.00	71,500	-1	0.00
Wholesale Trade	$5,116,683,000	-$326,797	-0.01	32,900	-2	-0.01
Retail Trade	$8,458,236,000	$3,463,923	0.04	116,280	72	0.06
Transportation and Warehousing	$4,684,445,000	-$135,012	0.00	32,760	-1	0.00
Information	$3,562,185,000	$4,877	0.00	10,920	0	0.00
Finance and Insurance	$5,738,403,000	-$511,293	-0.01	30,000	-3	-0.01
Real Estate and Rental	$11,030,271,000	-$1,271,191	-0.01	27,820	-1	0.00
Professional, Scientific, and Tech Services	$4,887,323,000	-$70,283	0.00	43,050	-1	0.00

Table 22-3.
Annual Regional Economic Impacts on Industry Output and Employment – Friant Division Change from Existing Base to Alternatives A1 and A2 Under RPA Scenario 5 (contd.)

Industry	Total Industry Output			Employment (No. of employees)		
	Existing Base	Friant Division Change, Alts A1 through C2	Percent of Base	Existing Base	Friant Division Change, Alts A1 through C2	Percent of Base
Management of Companies	$1,292,948,000	$24,818	0.00	7,880	0	0.00
Administrative and Waste Services	$3,080,623,000	-$9,306	0.00	50,880	0	0.00
Educational Services	$481,475,000	-$83,952	-0.02	9,740	-2	-0.02
Health and Social Services	$8,960,410,000	-$1,281,369	-0.01	105,200	-16	-0.01
Arts, Entertainment, and Recreation	$544,882,000	-$70,743	-0.01	11,410	-1	-0.01
Accommodation and Food Services	$3,474,102,000	$2,507,335	0.07	63,920	37	0.06
Other Services	$4,003,654,000	-$542,520	-0.01	66,610	-9	-0.01
Government and Non-North American Industry Classification System	$17,339,661,000	-$85,636	0.00	224,540	0	0.00
Institutions	$0	-$401,300	N/A	0	0	N/A
Totals	**$162,667,971,000**	**-$6,207,867**	**0.00**	**1,192,640**	**58**	**0.00**

Source: 2007 IMPLAN data from Minnesota IMPLAN Group, Inc., with modifications made by Cascade Economics LLC

Key:
Alts = Alternatives
N/A = not applicable

Impact SOC-5 (Alternatives A1 and A2): ***Change in Regional Population Levels – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, project-level actions under Alternatives A1 and A2 would result in increased socioeconomic activity in the Friant Division. However, this increased socioeconomic activity would not cause a substantial increase in growth of the region's population. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, the increase in socioeconomic activity and its effect on jobs and population is the combined result of different effects on several industries, especially agriculture and retail trade. The operation of Alternatives A1 or A2 would result in agricultural job losses, and the effect of these job losses would be to decrease population. Conversely, job gains are projected in the retail trade and accommodation and food services as a result of increased tourism and sporting opportunities. The combined result of these effects and effects on other industries would be an estimated net gain of 22 jobs, as shown in Table 22-2 (Table 22-39 in the Draft PEIS/R). Based on ratios derived from the U.S. Census Bureau (2008), an estimated increase of 22 jobs may result in a population increase of approximately 53 people. This contribution to overall population increase would not cause population growth to be greater than the significance criterion of 2.7 percent. Operational effects could also include some reduction of the agricultural productivity of land along the San Joaquin River, in addition to effects estimated by IMPLAN modeling, and summarized in Table 22-2 (Table 22-39 in the Draft PEIS/R). These effects are discussed in Chapter 16.0 of the Draft PEIS/R, "Land Use and Agricultural Resources," and would be smaller than the effects on agricultural employment estimated by IMPLAN modeling.

With the RPAs in place, the maximum potential decrease in surface water deliveries to the Friant Division and, therefore, the maximum potential number of agricultural job losses, would occur if none of the water released as Interim and Restoration flows was recaptured downstream and recirculated to the Friant Division. This is the same maximum potential impact described in the Draft PEIS/R. Potential job gains are related to potential increased tourism and sporting opportunities in the Restoration Area, which would not be affected by changes in CVP/SWP operations in the Delta. These offsetting effects would result in changes population of less than the significance criterion of 2.7 percent. A reduction in agricultural productivity of land along the San Joaquin River could also affect socioeconomic activity; however, as these effects would occur upstream from the Merced River confluence, changes in CVP/SWP operations in the Delta would not change this impact.

As shown in Table 22-3, the maximum amount of water available for recirculation to the Friant Division would be lower, and the associated reduction in agricultural productivity and employment higher with the RPAs in place. Based on ratios derived from the U.S. Census Bureau (2008), the estimated increase of 58 jobs may result in a population increase of approximately 140 people. This contribution to overall population increase would not cause population growth to be greater than the significance criterion of 2.7 percent. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Impact SOC-6 (Alternatives A1 and A2): ***Change in Regional Housing Demand – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, increased socioeconomic activity could occur in the counties within the Friant Division because of operations resulting from implementing Alternatives A1 or A2. These socioeconomic activities correspond to an increase in jobs and population, which could result in additional housing demand within the Friant Division. However, this increased socioeconomic activity would not cause a substantial increase in the region's housing demand. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R, increased socioeconomic activity could occur in the counties within the Friant Division because of operations resulting from implementing Alternatives A1 or A2. These socioeconomic activities correspond to an increase in jobs and population, which could result in additional housing demand within the Friant Division. However, this increased socioeconomic activity would not cause a substantial increase in the region's housing demand. This impact was found to be less than significant in the Draft PEIS/R.

With the RPAs in place the potential increase in socioeconomic activity that could occur in the counties within the Friant Division because of operations resulting from implementing Alternatives A1 or A2 would not substantially differ from that described in the Draft PEIS/R. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Impact SOC-7 (Alternatives A1 and A2): ***Physical Decay in Communities – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, physical decay in communities as a result of implementing Alternatives A1 or A2 would not be substantial, such as physical structures being abandoned from substantial decreases in regional employment or populations. These changes are not substantially different than would occur under existing conditions or the No-Action Alternative. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

As described in the Draft PEIS/R and stated above, the increase in socioeconomic activity, and its effect on population, employment, and housing, is the combined result of different effects on several industries, especially agriculture and retail trade. The operation of Alternatives A1 and A2 would result in agricultural job losses, which could negatively affect population and housing demand in the region. Conversely, job gains are projected in the retail trade and accommodation and food services as a result of increased tourism and recreation opportunities. The combined result of these effects (and effects on other industries) would be a net gain of 22 jobs (see Table 22-2). This job growth would not change overall population or housing demand that would exceed their respective significance criteria. Only minor project-level effects on physical decay in communities, such as physical structures being abandoned from substantial decreases in regional employment or populations, would occur over time, and these changes are not substantially different than would occur under existing conditions or the No-Action Alternative. This impact was found to be less than significant in the Draft PEIS/R.

With the RPAs in place Alternatives A1 and A2 would result a net gain of 58 jobs (see Table 22-3). This job growth would not change overall population or housing demand that would exceed their respective significance criteria. Only minor project-level effects on physical decay in communities, such as physical structures being abandoned from substantial decreases in regional employment or populations, would occur over time, and these changes are not substantially different than would occur under existing conditions or the No-Action Alternative. This impact conclusion would not change from the Draft PEIS/R, and would remain less than significant.

Chapter 23.0 Transportation and Infrastructure

This chapter describes the potential for impacts of Alternatives A1 and A2 on transportation and infrastructure under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 23.0, "Transportation and Infrastructure," of the Draft PEIS/R. The discussion of potential impacts on transportation and infrastructure presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 23.1, "Environmental Setting" –** Describes the existing traffic conditions and the various roadway, railroad, and utility crossings in the Restoration Area and along the San Joaquin River from the Merced River to the Delta. Implementation of the Settlement is not anticipated to cause impacts to transportation and infrastructure upstream from Friant Dam, in the Delta or in CVP/SWP service areas.

- **Section 23.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to transportation and infrastructure.

- **Section 23.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to roadway, railroad, and utility crossings to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 23-1. As shown in Table 23-1, none of the impact conclusions of Alternatives A1 and A2 on transportation and infrastructure would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 23.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 23-1.

Table 23-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Transportation and Infrastructure

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Transportation and Infrastructure: Program-Level						
TRN-1: Reduced Traffic Circulation and Roadway Capacity	No-Action	LTS	--	LTS	--	--
	A1 & A2	PS	TRN-1: Minimize Short-term Impacts on Traffic Circulation and Roadway Capacity	PSU	No[1,2]	No[1,2]
TRN-2: Creation of a Hazard as a Result of a Design Feature	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-2: Avoid Disruption of Subsurface Utility Facilities	LTS	No[1,2]	No[1,2]
TRN-3: Reduced Emergency Access	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-1: Minimize Short-term Impacts on Traffic Circulation and Roadway Capacity	LTS	No[1,2]	No[1,2]
TRN-4: Reduced Bicycle and Pedestrian Circulation	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-4: Minimize Impacts on Public Bicycle and Pedestrian Circulation Facilities	LTS	No[1,2]	No[1,2]
Transportation and Infrastructure: Project-Level						
TRN-5: Reduced Traffic Circulation and Roadway Capacity	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Table 23-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Transportation and Infrastructure (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Transportation and Infrastructure: Project-Level (contd.)						
TRN-6: Creation of a Hazard as a Result of a Design Feature	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	No Impact	--	No Impact	No[1,2]	No[1,2]
TRN-7: Inadequate Emergency Access	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	PS	TRN-7: Implement Vehicular Traffic Detour Planning	LTS	No[3]	No[3]
TRN-8: Reduced Bicycle and Pedestrian Circulation	No-Action	No Impact	--	No Impact	--	--
	A1 & A2	LTS	--	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative

23.1 Program-Level Impacts

The potential program-level impacts to transportation and infrastructure as described in the Draft PEIS/R would be associated with modification or construction of facilities and other restoration actions. These activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact TRN-1 (Alternatives A1 and A2): ***Reduced Traffic Circulation and Roadway Capacity – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure TRN-1 (Alternatives A1 and A2): ***Minimize Short-term Impacts on Traffic Circulation and Roadway Capacity – Program-Level.*** This mitigation measure is identical to Mitigation Measure TRN-1 (for Alternatives A1 and B1), as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Impact TRN-2 (Alternatives A1 and A2): ***Creation of a Hazard as a Result of a Design Feature – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction activities in the Restoration Area that would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure TRN-2 (Alternatives A1 and A2): ***Avoid Disruption of Subsurface Utility Facilities – Program-Level.*** This mitigation measure is identical to Mitigation Measure TRN-2 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact TRN-3 (Alternatives A1 and A2): Reduced Emergency Access – ***Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction and improvement activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure TRN-1 (Alternatives A1 and A2): ***Minimize Short-term Impacts on Traffic Circulation and Roadway Capacity – Program-Level.*** This mitigation measure is identical to Mitigation Measure TRN-1 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not**

change from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Impact TRN-4 (Alternatives A1 and A2): *Reduced Bicycle and Pedestrian Circulation – Program-Level.* This impact was found to be potentially significant in the Draft PEIS/R. This mitigation measure is related to construction activities in the Restoration Area that would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure TRN-4 (Alternatives A1 and A2): *Minimize Impacts on Public Bicycle and Pedestrian Circulation Facilities – Program-Level.* This mitigation measure is identical to Mitigation Measure TRN-4 (for Alternatives A1 and A2) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

23.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to transportation and infrastructure would be associated with reoperating Friant Dam and the effects of releasing Interim and Restoration flows.

Impact TRN-5 (Alternatives A1 and A2): *Reduced Traffic Circulation and Roadway Capacity – Project-Level.* This impact was found to be less than significant in the Draft PEIS/R. This impact is related to traffic increases from additional visitors to the Restoration Area and the Delta due to increased flows in the San Joaquin River between Friant Dam and the Delta. The traffic increases are not expected to be substantial nor cause a substantial degradation in traffic circulation or roadway capacity. Though flows in the San Joaquin River between the Merced River and the Delta could change with the RPAs in place, the difference in this impact from the Draft PEIS/R will be minimal and would not cause a substantial degradation in levels of service. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact TRN-6 (Alternatives A1 and A2): *Creation of a Hazard as a Result of a Design Feature – Project-Level.* This impact was found to have no impact in the Draft PEIS/R. Project level actions would not involve design or construction of any transportation infrastructure, and this would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact TRN-7 (Alternatives A1 and A2): *Inadequate Emergency Access – Project-Level.* This impact was found to be potentially significant in the Draft PEIS/R. With the RPAs in place, water levels in the San Joaquin River between Merced River and the Delta could increase, which could impede access to some locations by emergency vehicles or cause temporary closure of roadways. Though flows in the San Joaquin River between the Merced River and the Delta could change with the RPAs in place, the difference in this impact from the Draft PEIS/R will be minimal. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure TRN-7 (Alternatives A1 and A2): ***Implement Vehicular Traffic Detour Planning – Project-Level.*** This mitigation measure is identical to Mitigation Measure TRN-7 (for Alternatives A1 through C2) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact TRN-8 (Alternatives A1 and A2): ***Reduced Bicycle and Pedestrian Circulation – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to temporary inundation of bicycle and pedestrian pathways in the Restoration area that would not change with the RPAS in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Chapter 24.0 Utilities and Service Systems

This chapter describes the potential for impacts of Alternatives A1 and A2 on utilities and service systems under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 24.0 of the Draft PEIS/R, "Utilities and Service Systems." The discussion of potential impacts on utilities and service systems presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 24.1, "Environmental Setting" –** Describes the existing utilities and service systems along the San Joaquin River from Friant Dam to the Merced River and from the Merced River to the Delta. Implementation of the Settlement is not anticipated to cause impacts to utilities and service systems upstream from Friant Dam, in the Delta or in CVP/SWP service areas.

- **Section 24.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to utilities and service systems.

- **Section 24.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to utilities and service systems to occur, the criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 24-1. As shown in Table 24-1, none of the impact conclusions of Alternatives A1 and A2 on utilities and service systems would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 24.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 24-1.

Table 24-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Utilities and Service Systems

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Utilities and Service Systems: Program-Level						
UTL-1: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	No-Action	PS	--	PS	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
UTL-2: Potential Reduction in Ability of Facilities in the Restoration Area to Meet Wastewater Treatment Requirements	No-Action	LTS	–	LTS	--	--
	A1 & A2	PS	UTL-2: Obtain Required Permits for Hatchery Wastewater Discharges and Implement Best Management Practices to Reduce Pollutant Discharges	LTS	No[2]	No[2]
UTL-3: Potential for Insufficient Water Supply and Resources in the Restoration Area	No-Action	PS	–	PS	--	--
	A1 & A2	Too Speculative for Meaningful Consideration	–	Too Speculative for Meaningful Consideration	No[2]	No[2]
UTL-4: Potential for Generation of Solid Waste in the Restoration Area in Excess of Permitted Landfill Capacity	No-Action	LTS	–	LTS	--	--
	A1 & A2	PS	UTL-4: Identify Landfills with Adequate Permitted Capacity to Accept Solid Waste Generated by Settlement Activities and Dispose of Waste in Accordance with Applicable Regulations	LTS	No[1,2]	No[1,2]

Table 24-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Utilities and Service Systems (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Before Mitigation**	**After Mitigation**
Utilities and Service Systems: Program-Level (contd.)						
UTL-5: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services in the Restoration Area	No-Action	LTS	–	LTS	--	--
	A1 & A2	LTS	–	LTS	No[1,2]	No[1,2]
UTL-6: Potential for Insufficient Existing Water Supply and Resources Between the Merced River and the Delta	No-Action	PS	–	PS	--	--
	A1 & A2	LTS	–	LTS	No[1]	No[1]
UTL-7: Potential for Generation of Solid Waste Between the Merced River and the Delta in Excess of Permitted Landfill Capacity	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]
UTL-8: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services Between the Merced River and the Delta	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]

Table 24-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Utilities and Service Systems (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Utilities and Services Systems: Project-Level						
UTL-9: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area	No-Action	PS	–	PS	--	--
	A1 & A2	No Impact	–	No Impact	No[2]	No[2]
UTL-10: Potential Reduction in Ability of Facilities in the Restoration Area to Meet Wastewater Treatment Requirements	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[2]	No[2]
UTL-11: Potential for Insufficient Existing Water Supply and Resources	No-Action	PS	–	PS	--	--
	A1 & A2	PSU	–	PSU	No[3]	No[3]
UTL-12: Potential for Generation of Solid Waste in the Restoration Area in Excess of Permitted Landfill Capacity	No-Action	LTS	–	LTS	--	--
	A1 & A2	No Impact	–	No Impact	No[2,3]	No[2,3]

Table 24-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Utilities and Service Systems (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]					Sensitivity Analyses of Program Alternatives with RPAs	
Impacts	**Alternative**	**Level of Significance Before Mitigation**	**Mitigation Measures**	**Level of Significance After Mitigation**	**Change in Level of Significance**	
					Before Mitigation	**After Mitigation**
Utilities and Services Systems: Project-Level (contd.)						
UTL-13: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services in the Restoration Area	No-Action	LTS	–	LTS	--	--
	A1 & A2	LTS	–	LTS	No[2]	No[2]
UTL-14: Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities Between the Merced River and the Delta	No-Action	No Impact	–	No Impact	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]
UTL-15: Potential Reduction in Ability of Facilities Between the Merced River and the Delta to Meet Wastewater Treatment Requirements	No-Action	No Impact	–	No Impact	--	--
	A1 & A2	No Impact	–	No Impact	No[3]	No[3]

Table 24-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Utilities and Service Systems (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R[4]					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Utilities and Services Systems: Project-Level (contd.)						
UTL-17: Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services Between the Merced River and the Delta	No-Action	No Impact	–	No Impact	--	--
	A1 & A2	LTS	–	LTS	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.
[4] Impacts and mitigation measures are presented as modified in Appendix B of this Final PEIS/R, “Errata.”

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative

24.1 Program-Level Impacts

The potential program-level impact to utilities and service systems as described in the Draft PEIS/R would be associated with potential effects of recapture of Interim and Restoration flows using existing facilities on the San Joaquin River between the Merced River and the Delta and using a potential new pumping facility in this segment of the river. Construction activities and restoration actions within the Restoration Area would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact UTL-1 (Alternatives A1 and A2): ***Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to construction activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact UTL-2 (Alternatives A1 and A2): ***Potential Reduction in Ability of Facilities in the Restoration Area to Meet Wastewater Treatment Requirements – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to actions in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure UTL-2 (Alternatives A1 and A2): ***Obtain Required Permits for Hatchery Wastewater Discharges and Implement Best Management Practices to Reduce Pollutant Discharges – Program-Level.*** This mitigation measure is identical to Mitigation Measure UTL-2 (for Alternatives A1 and A2) as presented in the Draft PEIS/R. With mitigation, this impact would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact UTL-3 (Alternatives A1 and A2): ***Potential for Insufficient Existing Water Supply and Resources in the Restoration Area – Program-Level.*** This impact was found to be too speculative for meaningful consideration in the Draft PEIS/R. This impact is related to actions in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain too speculative for meaningful consideration.

Impact UTL-4 (Alternative A1 and A2): ***Potential for Generation of Solid Waste in the Restoration Area in Excess of Permitted Landfill Capacity – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction activities that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure UTL-4 (Alternative A1 and A2): ***Identify Landfills with Adequate Permitted Capacity to Accept Solid Waste Generated by Settlement Activities and Dispose of Waste in Accordance with Applicable Regulations – Program-Level.*** This mitigation measure is identical to Mitigation Measure UTL-4 (Alternative A1 and A2) as presented in the Draft PEIS/R. With mitigation, this impact would not change with the RPAs in place. This impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact UTL-5 (Alternatives A1 and A2): ***Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services in the Restoration Area – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to construction activities in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact UTL-6 (Alternatives A1 and A2): ***Potential for Insufficient Existing Water Supply and Resources Between the Merced River and the Delta – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to actions in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact UTL-7 (Alternatives A1 and A2): ***Potential for Generation of Solid Waste Between the Merced River and the Delta in Excess of Permitted Landfill Capacity – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. Program-level actions under these alternatives would not affect the amount of solid waste generated along the San Joaquin River between the Merced River and the Delta. Therefore, landfill capacity would not be affected. With the RPAs in place, program level actions under Alternatives A1 and A2 would not change and, therefore, the amount of solid waste generated along the San Joaquin River between the Merced River and the Delta and would not be altered. This impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact UTL-8 (Alternatives A1 and A2): ***Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services Between the Merced River and the Delta – Program-Level.*** This impact was found to have no impact in the Draft PEIS/R. Implementing Alternatives A1 and A2 would not affect demand for emergency services or facilities along the San Joaquin River between the Merced River and the Delta. As a result, no new or altered facilities would be needed to accommodate such demand. With the RPAs in place, Alternatives A1 and A2 would not change and, therefore, demand for emergency services or facilities along the San Joaquin River between the Merced River and the Delta would not be altered. This impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

24.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to utilities and service systems would be associated with the effects of reoperating Friant Dam and the effects of Interim and Restoration flows within the Restoration Area and along the San Joaquin River from the Merced River to the Delta. Reoperation of Friant Dam and restoration actions within the Restoration Area would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact UTL-9 (Alternatives A1 and A2): ***Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities in the Restoration Area – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. This impact is related to actions in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact UTL-10 (Alternatives A1 and A2): ***Potential Reduction in Ability of Facilities in the Restoration Area to Meet Wastewater Treatment Requirements – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. This impact is related to actions in the Restoration Area that would not change with the RPAs in place; therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact UTL-11 (Alternatives A1 and A2): ***Potential for Insufficient Existing Water Supply and Resources – Project-Level.*** This impact was found to be potentially significant and unavoidable in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would result in an overall reduction in water deliveries to Friant Division long-term contractors if all Interim and Restoration flows are not recaptured and recirculated to the Friant Division. This impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

An overall reduction in water deliveries to Friant Division long-term contractors would result if all Interim and Restoration flows are not recaptured. This impact mechanism is affected by the RPAs, which directly affect the potential to recapture Interim and Restoration flows at existing facilities in the Delta.

As described in the Draft PEIS/R, Implementing Alternatives A1 and A2 would change surface water deliveries to Friant Division long-term contractors by releasing a greater amount of water to the San Joaquin River as Interim and Restoration flows, and then recapturing and returning to Friant Division long-term contractors as much of those flows as possible. Overall reductions in water deliveries to Friant Division long-term contractors have been anticipated under the Settlement, and these contractors have agreed to these potential reductions. Nonetheless, water supply impacts to Friant Division long-term contractors would occur and would be potentially significant.

The Settlement's Water Management Goal is to reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors. Accordingly, the action alternatives include recapture of Interim and Restoration flows at existing facilities in the Restoration Area and Delta. As described in Chapter 12.0, "Hydrology – Groundwater," of the Draft PEIS/R, the potential range of recapture options for Friant Division water ranges from recapture of no water, to recapture of all Interim and Restoration flows. A reduction in surface water supplies would result in increased use of groundwater supplies, thereby increasing overdraft. Reclamation would consider regional groundwater overdraft conditions in evaluating candidate groundwater banking projects developed under Title III of the Act. There are no mitigation measures available to reduce the impact and, therefore, the impact would be potentially significant and unavoidable.

With the RPAs in place, the potential range of recirculation of recaptured Interim and Restoration flows to the Friant Division remains the same as that evaluated in the Draft PEIS/R, and ranges from recirculation of no water, to recirculation of all Interim and Restoration flows. However as described in Chapter 12.0, "Hydrology – Groundwater," of this appendix, the RPAs would reduce the anticipated maximum amount of water that would be recaptured at existing facilities in the Delta. The minimum amount that would be recaptured would remain recapture of no water. As described in the Draft PEIS/R, a reduction in surface water deliveries to the Friant Division would result in increased use of groundwater supplies, thereby increasing groundwater overdraft. Reclamation would consider regional groundwater overdraft conditions in evaluating candidate groundwater banking projects developed under Title III of Public Law 111-11. There are no mitigation measures available to reduce the impact and, therefore, the impact would not change from the Draft PEIS/R and would remain potentially significant and unavoidable.

Impact UTL-12 (Alternatives A1 and A2): ***Potential for Generation of Solid Waste in the Restoration Area in Excess of Permitted Landfill Capacity – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. Implementing Interim and Restoration flows would not generate any solid waste, and this would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact UTL-13 (Alternatives A1 and A2): ***Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services in the Restoration Area – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact would occur in the Restoration Area and would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact UTL-14 (Alternatives A1 and A2): ***Potential Environmental Effects Associated with Needed Construction or Expansion of Water and Wastewater Treatment Facilities Between the Merced River and the Delta – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not result in the need for new or expanded water or wastewater treatment facilities along the San Joaquin River between the Merced River and the Delta. Water quality, wastewater generation, and water diversions in this region of the study area would not be substantially affected. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact UTL-15 (Alternatives A1 and A2): ***Potential Reduction in Ability of Facilities Between the Merced River and the Delta to Meet Wastewater Treatment Requirements – Project-Level.*** This impact was found to have no impact in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 would not involve generation or reuse of wastewater along the San Joaquin River between the Merced River and the Delta. Water quality in this region of the study area would not change substantially enough to require new or expanded wastewater treatment facilities, or to affect the ability of existing facilities to meet wastewater treatment requirements. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and there would be no impact.

Impact UTL-17 (Alternatives A1 and A2): ***Potential Need for New or Altered Facilities to Accommodate Increased Demand for Emergency Services Between the Merced River and the Delta – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. With the RPAs in place, Alternatives A1 and A2 could potentially increase use of the San Joaquin River between the Merced River and the Delta for recreation and, thus, could potentially increase demand for emergency services. Though flows in the San Joaquin River between the Merced River and the Delta could change with the RPAs in place, the changes would be minimal, and would not alter demand for emergency services. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

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Chapter 25.0 Visual Resources

This chapter describes the potential for impacts of Alternatives A1 and A2 on visual resources under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 25.0 of the Draft PEIS/R, "Visual Resources." The discussion of potential impacts on visual resources presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 25.1, "Environmental Setting" –** Describes visual vividness, intactness and unity of landscapes along the San Joaquin River upstream from Friant Dam, in the Restoration Area, and along the San Joaquin River downstream from the Restoration Area. Implementation of the Settlement is not anticipated to cause impacts to visual resources in the Delta or in CVP/SWP service areas.

- **Section 25.2, "Regulatory Setting" –** Describes rules, regulations, policies, and/or goals of Federal, State, regional, and local agencies pertaining to visual resources conditions.

- **Section 25.3, "Environmental Consequences and Mitigation Measures" –** Includes a discussion of the methodology used to determine the potential for impacts to visual resources conditions to occur, the significance criteria used to determine the level of significance of individual impacts, and the analysis of program- and project-level impacts and proposed mitigation measures (as relevant) for each of the program alternatives, including the No-Action Alternative.

The impacts and mitigation measures presented in the Draft PEIS/R are summarized in Table 25-1. As shown in Table 25-1, none of the impact conclusions of Alternatives A1 and A2 on visual resources would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 25.3 of the Draft PEIS/R, the following sections describe the threshold of significance, summarize the significance determination presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 25-1.

Table 25-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Visual Resources

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Visual Resources: Program-Level						
VIS-1: Temporary and Short-Term Construction-Related Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No-Action	No-Impact	--	No-Impact	--	--
	A1 & A2	LTS	--	LTS	No[1,2]	No[1,2]
VIS-2: Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	PS	VIS-2: Screen New Facilities and Minimize Adverse Visual Impacts	PSU	No[1,2]	No[1,2]
VIS-3: Substantial Changes in Light or Glare	No-Action	No-Impact	--	No-Impact	--	--
	A1 & A2	PS	VIS-3: Establish and Require Conformance to Lighting Standards, and Prepare and Implement a Lighting Plan	LTS	No[1,2]	No[1,2]
Visual Resources: Project-Level						
VIS-4: Effects of Friant Dam Reoperation on Scenic Vistas, Scenic Resources, and Existing Visual Character Upstream from Friant Dam	No-Action	LTS	--	LTS	--	--
	A1 & A2	LTS	--	LTS	No[1]	No[1]

Table 25-1.
Summary of Impacts and Mitigation Measures and Summary of Changes in Significance Conclusions – Visual Resources (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R					Sensitivity Analyses of Program Alternatives with RPAs	
					Change in Level of Significance	
Impacts	Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation	Before Mitigation	After Mitigation
Visual Resources: Project-Level (contd.)						
VIS-5: Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character Downstream from Friant Dam	No-Action	Too Speculative for Meaningful Consideration	--	Too Speculative for Meaningful Consideration	--	--
	A1 & A2	LTS and Beneficial	--	LTS and Beneficial	No[3]	No[3]

Notes:
[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.
[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.
[3] Conclusions are based on further analyses as presented in this chapter.

Key:
-- = not applicable
LTS = less than significant
PEIS/R = Program Environmental Impact Statement/Report
PS = potentially significant
PSU = potentially significant and unavoidable
RPA = reasonable and prudent alternative

25.1 Program-Level Impacts

The potential program-level impacts to visual resources as described in the Draft PEIS/R would be associated with modification or construction of facilities or during other restoration actions. Construction activities would not be affected by the 2008 USFWS CVP/SWP Operations BO or the 2009 NMFS CVP/SWP Operations BO, and long-term operations of facilities and equipment would remain subject to existing permitting processes. Therefore, the significance conclusion and mitigation requirements identified for these impacts would not change from those presented in the Draft PEIS/R.

Impact VIS-1 (Alternatives A1 and A2): ***Temporary and Short-Term Construction-Related Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character – Program-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to construction activities within the Restoration Area that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VIS-2 (Alternatives A1 and A2): ***Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction activities within the Restoration Area that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure VIS-2 (Alternatives A1 and A2): ***Screen New Facilities and Minimize Adverse Visual Impacts – Program-Level.*** This mitigation measure is identical to Mitigation Measure VIS-2 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant and unavoidable.

Impact VIS-3 (Alternatives A1 and A2): ***Substantial Changes in Light or Glare – Program-Level.*** This impact was found to be potentially significant in the Draft PEIS/R. This impact is related to construction activities and long-term operation of new facilities within the Restoration Area that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

Mitigation Measure VIS-3 (Alternatives A1 and A2): ***Establish and Require Conformance to Lighting Standards, and Prepare and Implement a Lighting Plan – Program-Level.*** This mitigation measure is identical to Mitigation Measure VIS-3 (for Alternatives A1 and B1) as presented in the Draft PEIS/R. With mitigation, this impact conclusion **would not change** from the Draft PEIS/R, and would remain potentially significant.

25.2 Project-Level Impacts

As described in the Draft PEIS/R, potential project-level impacts to visual resources would be associated with the effects of reoperating Friant Dam by altering the timing and extent of drawdown of Millerton Lake.

Impact VIS-4 (Alternatives A1 and A2): ***Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character Upstream from Friant Dam – Project-Level.*** This impact was found to be less than significant in the Draft PEIS/R. This impact is related to water level fluctuations in Millerton Lake, which would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant.

Impact VIS-5 (Alternatives A1 and A2): ***Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character Downstream from Friant Dam – Project-Level.*** This impact was found to be less than significant and beneficial in the Draft PEIS/R. This impact is related to scenic resources within the Restoration Area that would not change with the RPAs in place. Therefore, this impact conclusion **would not change** from the Draft PEIS/R, and would remain less than significant and beneficial.

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Chapter 26.0 Cumulative Impacts

This chapter describes the potential for the cumulative impacts of Alternatives A1 and A2 under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO to differ from those presented in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts." The discussion of cumulative impacts presented in the Draft PEIS/R includes several key sections that are relevant to this chapter, including:

- **Section 26.1, "Definitions of Cumulative Effects" –** Describes NEPA and CEQA regulations pertaining to cumulative impact assessments.
- **Section 26.2, "Methods and Assumptions" –** Describes the use of quantitative and qualitative assessments of cumulative effects to generate the most comprehensive future projections possible, and provides a description of the reasonably foreseeable future actions included in the analysis of cumulative impacts.
- **Section 26.3, "Geographic Scope of Effects" –** Summarizes the geographic scope of potential cumulative impacts by resource topic in a table format.
- **Section 26.4, "Significance Criteria" –** Describes the significance criteria used to determine whether the action alternatives could result in cumulatively considerable incremental contributions to an overall significant cumulative impact.
- **Section 26.5, "Mitigation Measures for Significant Cumulative Impacts" –** Describes the use of mitigation measures in the Draft PEIS/R with relation to significant cumulative impacts. To reduce any cumulatively considerable incremental contributions from action alternatives to an overall significant cumulative impact, feasible mitigation measures were proposed for all potentially significant and significant direct and indirect effects; these measures are presented in the individual resource sections. In all cases where a less-than-significant effect would be cumulatively considerable, no further feasible mitigation could be applied to reduce overall significant, or potentially significant, cumulative impacts to less-than-significant levels. In this case, the cumulatively considerable incremental contribution to the overall significant cumulative impact is considered to be significant and unavoidable.
- **Section 26.6, "Cumulative Effects Analysis" –** Presents an assessment of the potential for the action alternatives to result in cumulatively considerable incremental contributions to an overall significant cumulative impact by resource topic, based on the significance criteria presented in Section 26.4.

The combined effects of past actions and the list of related present and reasonably foreseeable probable future projects are described further in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts." Table 26-1 provides the list considered in this analysis and in the Draft PEIS/R for each resource area. In addition to those projects listed in Table 26-1, the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO RPAs are also included as reasonably foreseeable projects in this analysis. The potential operational parameters of the RPAs are quantitatively incorporated into all quantitative analyses presented in this appendix.

The cumulative impacts presented in the Draft PEIS/R are summarized in Table 26-2. As shown in Table 26-2, none of the potential cumulative impact conclusions of the action alternatives would change under the 2008 USFWS CVP/SWP Operations BO and the 2009 NMFS CVP/SWP Operations BO. For each impact presented in Section 26.6 of the Draft PEIS/R, the following sections summarize the significance determinations presented in the Draft PEIS/R, and provide the basis for the analysis of potential changes in the level of significance as presented in Table 26-1. By definition, cumulative impacts must consider SJRRP project- and program-level actions together with other past, present, and reasonably foreseeable probable future actions. Consequently, no distinction is made in this chapter with respect to project- and program-level actions; the cumulative analysis is the same for both.

Table 26-1.
Reasonably Foreseeable Future Actions Included in Qualitative Analysis of Cumulative Resource Area Effects

Project	Surface Water Supplies and Facilities Operations	Surface Water Quality	Flood Management	Groundwater	Fisheries	Vegetation and Wildlife	Geology and Soils	Paleontological Resources	Cultural Resources	Indian Trust Assets	Land Use Planning and Agricultural Resources	Recreation	Power and Energy	Visual Resources	Utilities and Service Systems	Public Health and Hazardous Materials	Transportation and Infrastructure	Air Quality	Climate Change	Noise	Socioeconomics
CALFED Water Resources Projects																					
CALFED Conveyance Programs																					
Bay-Delta Conservation Plan and Alternative Delta Conveyance Facilities	√	√			√																√
Delta-Mendota Canal/California Aqueduct Intertie		√															√				√
Delta-Mendota Canal Recirculation Project		√															√				√
Lower San Joaquin Flood Improvement Project			√		√												√				
North Delta Flood Control and Ecosystem Restoration Project					√																
South Delta Improvements Program	√	√			√																
Franks Tract Project		√			√								√								
Two Gates Fish Protection Demonstration Project	√	√			√	√	√		√		√	√		√		√	√	√		√	√
CALFED Drinking Water Quality Program																					
Bay Area Water Quality and Supply Reliability Program																					√
North Bay Aqueduct Alternative Intake Project					√																
San Luis Reservoir Low Point Improvement Project		√																			
South Bay Aqueduct Improvement and Enlargement Project																	√				√

Table 26-1.
Reasonably Foreseeable Future Actions Included in Qualitative Analysis of Cumulative Resource Area (contd.)

Project	Surface Water Supplies and Facilities Operations	Surface Water Quality	Flood Management	Groundwater	Fisheries	Vegetation and Wildlife	Geology and Soils	Paleontological Resources	Cultural Resources	Indian Trust Assets	Land Use Planning and Agricultural Resources	Recreation	Power and Energy	Visual Resources	Utilities and Service Systems	Public Health and Hazardous Materials	Transportation and Infrastructure	Air Quality	Climate Change	Noise	Socioeconomics
CALFED Water Resources Projects (contd.)																					
In-Delta Storage Program (Delta Wetlands Project)		√			√																
Los Vaqueros Reservoir Expansion Project		√											√								
North-of-the-Delta Offstream Storage Investigation (Sites Reservoir)	√				√								√								
Shasta Lake Water Resources Investigation (Shasta Reservoir Enlargement)	√				√								√								
Upper San Joaquin River Basin Storage Investigation	√	√		√	√								√	√							
Other Water Resources Projects																					
California Water Plan																					
Conditional Waiver of Waste Discharge Requirements for Irrigated Lands		√									√										
Conveyance of Refuge Water Supply, South San Joaquin Valley Study Area, Mendota Wildlife Area						√								√		√					
FloodSAFE California			√																		
Folsom Dam Safety and Flood Damage Reduction Project																					
Long-Term CVP and SWP Operations	√	√			√																

Table 26-1.
Reasonably Foreseeable Future Actions Included in Qualitative Analysis of Cumulative Resource Area (contd.)

Project	Surface Water Supplies and Facilities Operations	Surface Water Quality	Flood Management	Groundwater	Fisheries	Vegetation and Wildlife	Geology and Soils	Paleontological Resources	Cultural Resources	Indian Trust Assets	Land Use Planning and Agricultural Resources	Recreation	Power and Energy	Visual Resources	Utilities and Service Systems	Public Health and Hazardous Materials	Transportation and Infrastructure	Air Quality	Climate Change	Noise	Socioeconomics
Other Water Resources Projects (contd.)																					
Red Bluff Diversion Dam Pumping Plant					√																
Sacramento River Water Reliability Study					√								√								
San Joaquin River Salinity Management Plan		√				√															
San Joaquin River Water Quality Improvement Project		√			√	√								√		√					
South Delta Flood Bypass		√	√											√							
Tracy Fish Collection Facility and Tracy Fish Facility Improvement Program					√									√							
Resource Management Plans and Programs																					
Central Valley Joint Venture																					
Central Valley Project Improvement Act		√			√									√							
CALFED Ecosystem Restoration Program					√	√								√		√					
Comprehensive Conservation Management Plans for National Wildlife Refuges						√					√			√		√					
Habitat Management Preservation, and Restoration Plan for Suisun Marsh						√								√		√					
Jensen River Ranch Habitat Enhancement and Public Access Project		√				√								√		√					

Table 26-1.
Reasonably Foreseeable Future Actions Included in Qualitative Analysis of Cumulative Resource Area (contd.)

Project	Surface Water Supplies and Facilities Operations	Surface Water Quality	Flood Management	Groundwater	Fisheries	Vegetation and Wildlife	Geology and Soils	Paleontological Resources	Cultural Resources	Indian Trust Assets	Land Use Planning and Agricultural Resources	Recreation	Power and Energy	Visual Resources	Utilities and Service Systems	Public Health and Hazardous Materials	Transportation and Infrastructure	Air Quality	Climate Change	Noise	Socioeconomics
Resource Management Plans and Programs (contd.)																					
Lost Lake Park Master Plan						√					√			√		√					
Millerton Lake Resource Management Plan/General Plan						√								√							
Peoria Wildlife Management Area						√								√		√					
Riparian Habitat Joint Venture						√								√							
San Joaquin River Parkway Plan											√	√		√			√				
Vernalis Adaptive Management Program	√	√			√																
New Friant River Outlet Powerhouse													√		√						
Development Projects																					
Fresno County General Plan		√				√	√				√			√	√	√	√	√		√	
Madera County General Plan Policy Document		√				√	√				√			√	√	√	√	√		√	
Merced County General Plan		√				√	√				√			√	√	√	√	√		√	
City of Fresno General Plan		√				√	√				√			√	√	√	√	√		√	
Brighton Crest		√					√				√			√		√	√	√			
Gunner Ranch West Specific Plan		√					√				√			√		√	√	√			
Ventana Annexation		√					√				√			√		√	√	√			
Gateway Village Specific Plan		√					√				√			√		√	√	√			

Key:
CALFED = CALFED Bay-Delta Program
Delta = Sacramento-San Joaquin Delta

Table 26-2.
Summary of Cumulative Impacts and Summary of Changes in Conclusions

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R		Sensitivity Analyses of Program Alternatives with RPAs
Resource Topic	**Impacts**	**Change in Potential Cumulative Impact Conclusions**
Air Quality	Construction-Related Emissions of Criteria Air Pollutants and Precursors	No[1,2]
Biological Resources – Fisheries	Potential Direct Mortality or Reduced Fecundity of Wild Fall-Run Chinook Salmon in San Joaquin River Tributaries Resulting from Disease Outbreak	No[3]
Biological Resources – Vegetation and Wildlife	None	No[3]
Climate Change	Cumulative impacts associated with climate change are discussed in Chapter 7.0, “Climate Change.”	Cumulative impacts associated with climate change are discussed in Chapter 7.0, “Climate Change.”
Cultural Resources	Disturbance or Destruction of Cultural Resources	No[3]
Geology and Soils	None	No[3]
Hydrology – Flood Management	None	No[3]
Hydrology – Groundwater	Changes in Groundwater Levels and Groundwater Quality in CVP/SWP Water Service Areas	No[3]
Hydrology – Surface Water Supply and Facilities Operations	Change in Contra Costa Water District Water Supplies	No[3]
Hydrology – Surface Water Quality	None	No[3]
Indian Trust Assets	None	No[3]
Land Use Planning and Agricultural Resources	Conversion of Important Farmland to Nonagricultural Uses and Cancellation of Williamson Act Contracts	No[1,2]
	Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Inundation and/or Soil Saturation	No[2]
	Substantial Diminishment of Agricultural Land Resource Quality and Importance Because of Altered Water Deliveries	No[3]
Noise	Exposure of Sensitive Receptors to Generation of Temporary and Short-Term Construction Noise	No[1,2]
	Exposure of Sensitive Receptors to Increased Off-Site Traffic Noise Levels	No[2]
Paleontological Resources	None	No[1]

Table 26-2.
Summary of Cumulative Impacts and Summary of Changes in Conclusions (contd.)

Summary of Impacts and Mitigation Measures Without RPAs as Presented in Draft PEIS/R		Sensitivity Analyses of Program Alternatives with RPAs
Resource Topic	**Impacts**	**Change in Potential Cumulative Impact Conclusions**
Power and Energy	None	No[3]
Public Health and Hazardous Materials	None	No[3]
Recreation	None	No[3]
Socioeconomics	None	No[3]
Transportation and Infrastructure	None	No[3]
Utilities and Service Systems	Reduced Water Supplies for Friant Division Water Contractors	No[3]
Visual Resources	Long-Term Changes in Scenic Vistas, Scenic Resources, and Existing Visual Character	No[2]

Notes:

[1] Impacts related solely to construction would not be affected by changes in CVP/SWP operations.

[2] Impacts upstream from Friant Dam or within the Restoration Area would not be affected by changes in CVP/SWP operations.

[3] Conclusions are based on further analyses as presented in this chapter.

Key:
PEIS/R = Program Environmental Impact Statement/Report
RPA = reasonable and prudent alternative

26.1 Air Quality

As described in the Draft PEIS/R, the SJVAPCD has established a significance threshold of 10 tons per year for emissions of the ozone precursors reactive organic gas (ROG) and oxides of nitrogen (NO_X). For particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}), SJVAPCD requires project applicants to implement effective and comprehensive control measures and comply with applicable rules and regulations (e.g., Regulation VII of Rule 9510, "Indirect Source Review") rather than quantifying construction emissions in detail. The project proponent would be required by law to comply with SJVAPCD Regulation VIII, "Fugitive Dust PM_{10} Prohibitions," to implement Alternative A1 or A2. However, additional control measures recommended by SJVAPCD that would be applicable to and feasible for the SJRRP are not currently part of Alternative A1 or A2 because project design and construction details are not yet known.

As described in Chapter 4.0 of the Draft PEIS/R, "Air Quality," construction-generated emissions could make a cumulatively considerable incremental contribution to cumulative pollutant concentrations that exceed California ambient air quality standards and represent an overall significant cumulative impact. Implementation of mitigation measures identified in the same chapter would reduce construction-related impacts from PM_{10} emissions to a less-than-significant level. As construction activities would not change with the RPAs in place, this impact conclusion would not change, as described in Chapter 4.0 of this appendix, "Air Quality." Assuming that all reasonably foreseeable probable future projects also implement all feasible construction emissions control measures consistent with SJVAPCD guidelines and regulations, the impact of construction emissions from cumulative projects may be less than significant, although larger projects would likely result in significant and unavoidable air quality impacts on their own. However, given the scale of development that would occur with the reasonably foreseeable probable future projects combined with the nonattainment status of the San Joaquin Valley Air Basin for ozone, PM_{10}, and particulate matter with an aerodynamic diameter of 2.5 micrometers or less ($PM_{2.5}$), Alternatives A1 and A2 would likely make a cumulatively considerable incremental contribution to a significant cumulative construction-related air quality impact.

The Draft PEIS/R includes all available feasible mitigation to reduce the contribution of construction emissions to significant cumulative air quality impacts. These mitigation measures would substantially reduce air emissions associated with Alternatives A1 and A2, but they would not be sufficient to reduce the cumulatively considerable incremental contribution of Alternatives A1 and A2 to below a level that is considerable. Consequently, Alternatives A1 and A2 would have a cumulatively considerable incremental contribution to a significant cumulative air quality impact during construction activities. This cumulative impact and cumulative impact conclusion would not change from the Draft PEIS/R, and would remain significant and unavoidable.

Long-term reoperation of Friant Dam would not emit ROG, NO_X, PM_{10}, and PM2.5, and this would not change with the RPAs in place. Therefore, Alternatives A1 and A2 would not contribute to significant cumulative impacts. Restoration and water management actions under Alternatives A1 and A2 would result in regional emissions of ROG, NO_X, PM_{10}, and $PM_{2.5}$ from area, stationary, and mobile sources. Emissions generated during SJRRP operations would not exceed SJVAPCD's significance thresholds for ROG and NO_X, and would not generate substantial operational emissions of PM_{10} or toxic air contaminants. Consequently, Alternatives A1 and A2 would not make a cumulatively considerable incremental contribution to a significant cumulative impact from regional emissions.

As described in Chapter 4.0 of this appendix, "Air Quality," implementation of Alternatives A1 and A2 would not result in a significant long-term impact to air quality, and this would not change with the RPAs in place. Further, because long-term emissions would not exceed applicable standards, Alternatives A1 and A2 would also comply with growth projections in the air quality attainment plan. The contribution of Alternatives A1 and A2 to nonattainment of air quality standards therefore would not represent a cumulatively considerable incremental contribution to a significant cumulative air quality impact. These cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.2 Biological Resources – Fisheries

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," cumulative impacts to fisheries could occur in the San Joaquin River upstream from Friant Dam, in the Restoration Area, downstream from the Merced River, and in the Delta. Impacts to fisheries from implementing the Settlement would include adverse effects from pollutant discharge, sediment discharge, short- and long-term geomorphic changes from channel alterations, displacement, predation, interbreeding, introduction of disease, and entrainment at diversions and pumping plants. Mitigation measures include construction schedule restrictions, implementation of construction BMPs, construction of grade control structures, fish salvage and relocation, implementation of a predator fish reduction program, implementation of a reintroduction plan, and installation and modifications of fish screens. The RPAs would not change potential impacts in the San Joaquin River upstream from Friant Dam or in the Restoration Area.

As described in the Draft PEIS/R, the fish assemblages in the San Joaquin River between the Merced River and the Delta are dominated by nonnative warmwater species. Spring-run Chinook salmon, which historically occurred in the San Joaquin River between the Merced River and the Delta during their migratory and juvenile-rearing life stages, no longer occur upstream from the Merced River due to loss of access to historic habitat. Adult and juvenile fall-run Chinook salmon and steelhead migrate through this section of the river to and from spawning habitat in the major San Joaquin River tributaries, but their populations in the San Joaquin River Basin have declined substantially compared to historical conditions. Under extended wet conditions, anadromous fish including steelhead and fall-run Chinook salmon may occasionally be found in the Restoration Area.

The existing fisheries in the San Joaquin River between the Merced River and the Delta have experienced past adverse cumulative impacts related to changes in the distribution, abundance, and species composition of native fish assemblages. These impacts have been caused primarily by human-caused factors, including introduction of nonnative fish species; highly altered flow regimes and substantial flow reductions; isolation of floodplains from the river channel by channelization and levee construction; substantial reductions in the frequency, magnitude, and duration of floodplain inundation; creation of false migration pathways by flow diversions; and poor water quality.

Water temperatures in the Reaches 1 and 2 are expected to change as a result of the combined effects of Alternatives A1 and A2 and implementation of the Upper San Joaquin River Basin Storage Investigation. While this would benefit salmonid and other native fishes, a shift in species abundance may occur. The potential impacts are outweighed by the benefits that will arise from this project with respect to water temperature. Although the overall effect of Alternatives A1 and A2 is expected to be beneficial to most representative fish species in the San Joaquin River, several actions under Alternatives A1 and A2 could result in adverse impacts on existing populations of anadromous salmonids and contribute to cumulative impacts. Reintroducing spring-run Chinook salmon to the San Joaquin River in the Restoration Area could result in compromised genetic integrity and fitness of wild stocks in the major San Joaquin River tributaries (the Merced, Tuolumne, and Stanislaus rivers) if reintroduction includes hatchery stock and hybridization between wild and hatchery fish occurs. Disease organisms could also be carried by brood stock from sources in the Sacramento River Basin or by hatchery fish used to supplement the reintroduced spring-run Chinook salmon population. Such a disease outbreak could lead to direct mortality or reduced fecundity among wild fall-run Chinook salmon in the major San Joaquin River tributaries. Wild fall-run Chinook salmon in the major San Joaquin River tributaries have already experienced a significant cumulative impact from past and present projects alone. Direct mortality or reduced fecundity resulting from such an outbreak would be considered a potentially cumulatively considerable incremental contribution to this overall significant cumulative impact on wild fall-run Chinook salmon in the San Joaquin River tributaries. The RPAs would not change the potential for these effects to occur, as described in Chapter 5.0 of this appendix, "Biological Resources – Fisheries." This potential cumulative impact would be potentially significant and unavoidable. These cumulative impact conclusions would not change from the Draft PEIS/R.

The combined effects of past and present activities in the Delta and its tributaries have led to declines in a number of special-status species inhabiting the Delta. Ongoing activities that have adversely affected these species and their habitats include altered flow regimes, dredging, wastewater discharge, agricultural drainage, levee maintenance, water diversions, and introduction of exotic species. Species in decline as a result of these ongoing activities include delta smelt, longfin smelt, green sturgeon, Sacramento splittail, Central Valley fall-run Chinook salmon, Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and Central Valley steelhead. Striped bass, an important game species, is also in decline. Fisheries management plans and restoration programs, including the Central Valley Project Improvement Act, Anadromous Fish Restoration Program, and the CALFED Ecosystem Restoration Program Plan, have been initiated to offset the negative effects of ongoing activities.

In addition to the ongoing activities, several reasonably foreseeable future projects and programs may affect Delta fishes. New projects and programs recently implemented or likely to be implemented in the near future are listed in Table 26-2. Some of these projects and programs may adversely affect Delta fishes, but others are likely to improve their condition. The near-term net effect of new and ongoing programs, projects, and restoration efforts is difficult to predict; however, over time, the net effect expected would be a reduction or cessation of the fish declines. Despite potential future projects that could benefit Delta fisheries, it is clear that the effects of past, present, and reasonably foreseeable future projects on special-status Delta fish species and striped bass have resulted in a significant cumulative impact on these species.

With the RPAs in place, Alternatives A1 and A2 would have a beneficial effect, no impact, or a less-than-significant impact on most of the environmental conditions affecting Delta fish species and would not make a cumulatively considerable incremental contribution to a significant cumulative effect on these species (as described in Chapter 5.0 of this appendix, "Biological Resources – Fisheries."). Alternatives A1 and A2 would increase diversions at existing Delta facilities, but not beyond the limits allowed by the RPAs or other applicable laws, regulations, and court orders. Those limits are deemed effective to protect Delta fishes and maintain the impacts at a mitigated or less-than-significant level. Consequently, the cumulative incremental contribution to this overall significant cumulative impact is considered to be less than considerable and is less than significant.

In summary, with the RPAs in place, Alternatives A1 and A2 would only result in one potentially significant and unavoidable cumulative impact: the potential direct mortality or reduced fecundity of wild fall-run Chinook salmon in the San Joaquin River tributaries resulting from a disease outbreak. These cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.3 Biological Resources – Vegetation and Wildlife

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," cumulative impacts to vegetation and wildlife could occur in the San Joaquin River upstream from Friant Dam, in the Restoration Area, downstream from the Merced River, and in the Delta. The RPAs would not change potential impacts in the San Joaquin River upstream from Friant Dam or in the Restoration Area.

As described in Chapter 6.0 of this appendix, "Biological Resources – Vegetation and Wildlife," under all RPA scenarios, Alternatives A1 and A2 would continue to result in an increase in flows entering the San Joaquin River from the Restoration Area, and these additional inflows would not substantially change water surface elevations, water quality, or other conditions that could substantially affect vegetation or wildlife. Also, flood frequency and duration would remain well within the historic range of seasonal and annual fluctuations, and would be insufficient to alter habitats and vegetation or to affect special-status species, either directly or indirectly. Thus, there would not be a cumulatively considerable incremental contribution to significant cumulative impacts on riparian habitat, wetlands, or other sensitive communities, or to special-status plants and animals in the San Joaquin River downstream from the Merced River or in the Delta. The cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.4 Climate Change

Cumulative impacts associated with climate change are discussed in Chapter 7 of this appendix, “Climate Change.”

26.5 Cultural Resources

As described in Chapter 26.0 of the Draft PEIS/R, “Cumulative Impacts,” cumulative impacts to cultural resources could occur in the San Joaquin River upstream from Friant Dam, in the Restoration Area, downstream from the Merced River, and in the Delta. Impacts to cultural resources from implementing the Settlement could include disturbances or destruction of these resources through construction activities as well as through the release of Interim and Restoration flows. Though flows in the San Joaquin River between the Merced River and the Delta could change with the RPAs in place, the difference in this impact from the Draft PEIS/R will be minimal, as described in Chapter 8.0 of this appendix, “Cultural Resources.”

Mitigation measures that will be implemented to minimize the significance of these impacts include compliance with Section 106 of the National Historic Preservation Act and implementation of a programmatic agreement for the treatment of significant cultural resources and artifacts if they are found. Adverse effects, however, particularly on archaeological resources, may still occur; thus, the impact would be significant and unavoidable. Losses of archaeological resources would add to a historical trend in the loss of these resources as artifacts of cultural significance and as objects of research importance; therefore, there is an overall significant cumulative impact on cultural resources along the San Joaquin River. Despite the implementation of mitigation measures, Alternatives A1 and A2 have the potential to make a cumulatively considerable incremental contribution to a significant cumulative impact on cultural resources along the San Joaquin River. The cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.6 Geology and Soils

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," cumulative impacts to geology and soils could occur in the San Joaquin River upstream from Friant Dam, in the Restoration Area, downstream from the Merced River, and in the Delta. Impacts to geology and soils from implementing the Settlement would include localized soil erosion, sedimentation, and inadvertent soil loss; loss of availability of a valuable mineral; and increased channel erosion, sediment transport, and meander migration. Construction Best Management Practices (BMP) will be implemented to minimize the significance of these impacts. These effects could be caused during vegetation removal, channel construction, levee construction, and other ground-disturbing activities, and as a result of increased flows under the project-level reoperation of the Friant Dam for Interim and Restoration Flows. With the RPAs in place, Alternatives A1 and A2 would result in no change in the historical rates of stream channel erosion and meander migration, and the RPAs would not affect the impacts of construction activities. Implementing Alternatives A1 and A2 with the mitigation measures described in Chapter 10.0 of the Draft PEIS/R, "Geology and Soils," would result in some less-than-significant localized erosion and sedimentation transport that would not change with the RPAs in place, and would not cause a cumulatively considerable incremental contribution to the overall significant cumulative impact on San Joaquin River erosion and sedimentation. The cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.7 Hydrology – Flood Management

Under Alternatives A1 and A2, levee improvements in the Restoration Area, along with other hydraulic structures and channel modifications, could lead to increased risk of flood damage in adjacent areas. However, as described in Chapter 11.0 of the Draft PEIS/R, "Hydrology – Flood Management," flood management operations at the Friant Dam, Chowchilla Bypass Bifurcation Structure, and related facilities would not change under Alternatives A1 and A2 relative to the No-Action Alternative, and actions are included in Alternatives A1 and A2 that ensure that the flood risk in the Restoration Area and in downstream reaches would not be significantly increased. This would not change with the RPAs in place, as described in Chapter 11.0 of this appendix, "Hydrology – Flood Management."

Reasonably foreseeable water resources projects, as previously described, would also be designed to either have no effect on flood risk or to lessen flood risk. Consequently, past, present, and reasonably foreseeable probable future projects do not result in an overall significant cumulative impact that increases flood risk. Cumulatively, the flood risk has been reduced, which is a beneficial effect. Therefore, Alternatives A1 and A2 would not make a cumulatively considerable incremental contribution to a significant cumulative effect on flood management; the incremental contribution would be minor and the overall cumulative impact on flood management would continue to be beneficial. The cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.8 Hydrology – Groundwater

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," Alternatives A1 and A2 would not result in a cumulatively considerable incremental contribution to a significant cumulative impact on local groundwater quality or levels along the San Joaquin River, and this would not change with the RPAs in place as described in Chapter 12.0 of this appendix, "Hydrology – Groundwater."

In the short term (within 3 years after commencement of the program), Alternatives A1 and A2 would not substantially deplete groundwater supplies or interfere with groundwater recharge, because groundwater drawdown within the Friant Division would be within the range of historical fluctuations in groundwater levels. In the long term with the RPAs in place, however, Alternatives A1 and A2 would accelerate the downward trend of groundwater levels in the Friant Division. This incremental contribution would be considered to be cumulatively considerable because groundwater pumping would be anticipated to increase in response to a reduction in surface-water deliveries to the Friant Division long-term contractors.

The extent of and the speed in which groundwater quality would be degraded is not known and there are no feasible mitigation measures for this impact. Because of the uncertainty and lack of mitigation, Alternatives A1 and A2 would cause a cumulatively considerable incremental contribution to an overall significant cumulative impact on groundwater quality and the extent of groundwater upwelling in the Friant Division service area. This cumulative impact would be significant and unavoidable. The cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.9 Hydrology – Surface Water Supplies and Facilities Operations

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," Alternatives A1 and A2 would not result in a cumulatively considerable incremental contribution to a significant cumulative impact on surface water supplies or facilities operations along the San Joaquin River, and this would not change with the RPAs in place as described in Chapter 13.0 of this appendix, "Hydrology – Surface Water Supplies and Facilities Operations." Alternatives A1 and A2 would have minor, less-than-significant impacts on diversions in Reach 1, but the impacts would be mitigated to provide temporary or permanent alternative access, while the release of Interim and Restoration flows would improve the ability of Reclamation to comply with Holding Contract requirements along Reach 1 that could be adversely affected by other reasonably foreseeable probable future actions in the Restoration Area. The RPAs would not affect cumulative impacts within the Restoration Area.

Several past and present projects have affected and continue to affect flows in the San Joaquin and Sacramento rivers, resulting in changing Delta conditions. These changes in Delta conditions can lead to reoperation of CVP and SWP Delta export pumps, which would affect water levels in the south Delta. Alternatives A1 and A2 would have less-than-significant impacts on water levels in the south Delta, as shown in Chapter 13.0 of this appendix, “Hydrology – Surface Water Supplies and Facilities Operations.” These effects have been quantified through modeling runs that incorporate reasonably foreseeable future water projects into their analysis, including the RPAs. Consequently, Alternatives A1 and A2 would not cause a cumulatively considerable incremental contribution to a significant cumulative impact on south Delta water levels.

Delta outflow is primarily a product of Delta inflow and export pumping. Several past and present projects, especially storage projects associated with the CVP and SWP, have affected and continue to affect flows in the San Joaquin and Sacramento rivers, resulting in changing Delta conditions and an overall significant cumulative effect on Delta water supplies and the frequency of excess conditions in the Delta. With the RPAs in place, Alternatives A1 and A2 would have minor, less-than-significant impacts on Delta excess-water recurrence, as shown in Chapter 13.0 of this appendix, “Hydrology – Surface Water Supplies and Facilities Operations.” Alternatives A1 and A2 would cause infrequent impacts to CCWD’s ability to fill Los Vaqueros Reservoir; however, because CCWD’s ability to fill Los Vaqueros Reservoir would be frequently impacted by increased water demand under the No-Action Alternative and by reasonably foreseeable future projects described in Chapter 26.0 of the Draft PEIS/R, “Cumulative Impacts,” the action alternatives would cause a cumulatively considerable incremental contribution to a significant cumulative effect on CCWD water supplies. This cumulative impact would be significant and unavoidable. The cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.10 Hydrology – Surface Water Quality

As described in Chapter 26.0 of the Draft PEIS/R, “Cumulative Impacts,” cumulative impacts to surface water quality could occur in the San Joaquin River upstream from Friant Dam, in the Restoration Area, downstream from the Merced River, and in the Delta. Implementing the Settlement would impact surface water quality from ground-disturbing construction activities, and these impacts would not change with the RPAs in place. These impacts, in combination with past, present, and reasonably foreseeable probable future actions, would cause an overall significant cumulative impact on surface water quality in the San Joaquin River.

With the RPAs in place, San Joaquin River water quality conditions from the Merced River to the Delta would generally improve under Alternatives A1 and A2. The release of Interim and Restoration flows under Alternatives A1 and A2 would decrease concentrations of constituents for some established water quality criteria, and therefore would have a beneficial effect on water quality in the San Joaquin River from Friant Dam to the Delta. Implementation of Alternatives A1 and A2 in combination with the Upper San Joaquin River Basin Storage Investigation may enhance the ability of Reclamation and DWR to manage water temperatures within the Restoration Area; these impacts would not change with the RPAs in place.

Alternatives A1 and A2 therefore would not cause a cumulatively considerable incremental contribution to significant cumulative impacts on surface water quality in the San Joaquin River. Alternatives A1 and A2 would have overall beneficial effects, which would reduce the overall significant cumulative impact on San Joaquin River surface water quality downstream from Friant Dam. The cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.11 Indian Trust Assets

No ITAs are located within the study area, and this would not change with the RPAs in place. Alternatives A1 and A2 would have no effects on ITAs and therefore there would be no cumulatively considerable incremental contribution to a significant cumulative impact on ITAs. The cumulative impacts and cumulative impact conclusion **would not change** from the Draft PEIS/R.

26.12 Land Use Planning and Agricultural Resources

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," construction activities under Alternatives A1 and A2 would cause a cumulatively considerable incremental contribution to a significant cumulative impact on land use planning that would not change with the RPAs in place. Implementation of Mitigation Measures LUP-2 and LUP-3, as described in Chapter 16.0 of the Draft PEIS/R, "Land Use Planning and Agricultural Resources," would reduce potential impacts on Important Farmland and impacts associated with the cancellation of Williamson Act contracts. However, the impacts would not be reduced to a less-than-significant level because conversion of a substantial amount of Prime Farmland and cancellation of Williamson Act contracts would still occur. This analysis assumes that reasonably foreseeable probable future projects would develop and adopt mitigation to minimize the significance of the impacts on agricultural resources to the extent feasible. Nonetheless, it may not be feasible to fully mitigate all impacts on agricultural resources, and some of the effects from numerous projects may cause a cumulatively considerable incremental contribution to significant cumulative impacts on land use planning and agricultural resources. This cumulative impact would be significant and unavoidable.

Interim and Restoration flows would change the duration and seasonality of inundation and soil saturation, which could potentially adversely affect crop production in the Restoration Area. These effects would be reduced but cannot be eliminated through feasible mitigation, and would combine with other significant cumulative effects on agricultural productivity from other past, present, and reasonably foreseeable probable future actions. The RPAs would not change these impacts, which would occur within the Restoration Area.

With the RPAs in place, Alternatives A1 and A2 would cause reduced surface water deliveries to Friant Division long-term contractors that would affect cropping patterns, idling of farmland, and productivity, and would combine with other significant cumulative effects on agricultural productivity.

Overall, Alternatives A1 and A2 would cause a cumulatively considerable incremental contribution to a significant cumulative impact on agricultural resources and productivity, Important Farmland, and Williamson Act contracts. This cumulative impact would be significant and unavoidable. The cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.13 Noise

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," cumulatively considerable incremental contributions of Alternatives A1 and A2 to significant cumulative impacts related to noise and vibrations would be associated with construction activities or long-term operations and maintenance activities in the Restoration Area. These activities would not change with the RPAs in place. Overall, Alternatives A1 and A2 would cause a cumulatively considerable incremental contribution to a significant cumulative impact on construction-related noise. This cumulative impact would be significant and unavoidable. The cumulative impacts and impact conclusions **would not change** from the Draft PEIS/R.

26.14 Paleontological Resources

As described in Chapter 18.0 of this appendix, "Paleontological Resources," potential impacts to paleontological resources are related to construction activities that would not change with the RPAs in place. As described in Chapter 26.0 of the Draft PEIS/R, "Paleontological Resources," because of the low probability that any project under Alternatives A1 and A2 would encounter unique, scientifically important fossils, and the benefits that would occur from recovery and further study of those fossils if encountered, development of related projects and other development in the region would not result in a cumulatively considerable incremental contribution to a significant cumulative impact on paleontological resources. Implementation of the RPAs would not increase the probability of impacting paleontological resources. Therefore, Alternatives A1 and A2 would not result in a cumulatively considerable incremental contribution to a significant cumulative impact on paleontological resources. The cumulative impacts and impact conclusions **would not change** from the Draft PEIS/R.

26.15 Power and Energy

As described in Chapter 19.0 of this appendix, "Power and Energy," Alternatives A1 and A2 would not result in significant changes to hydropower generation and consumption by CVP and SWP facilities with the RPAs in place, and implementation of the RPAs would not affect energy generation at Friant Dam or change the maximum potential increase in energy consumption within the Friant Division. When Alternative A1 or A2 is combined with the projects presented in Table 26-1, river flows and reservoir elevations would be likely to change, but not considerably. Therefore, Alternatives A1 and A2 would not make a cumulatively considerable incremental contribution to a significant cumulative impact on power generation and consumption with the RPAs in place.

Temporary increases in energy consumption would result from construction activities associated with various development projects in the study area. Short-term construction-related power and energy impacts would be evaluated in the environmental review document for projects with which the impacts would be associated, and these impacts would be mitigated to the extent feasible. Because the impacts would be temporary or short-term and mitigated, the combined effects of these impacts would not cause a cumulatively considerable incremental contribution to a significant cumulative impact on energy consumption. The cumulative impacts and impact conclusions **would not change** from the Draft PEIS/R.

26.16 Public Health and Hazardous Materials

As described in Chapter 21.0 of this appendix, “Recreation,” Alternatives A1 and A2 could result in potentially significant public health effects or safety hazards associated with exposure to hazardous materials, disruption of idle or abandoned oil or gas wells, and exposure to disease vectors. Mitigation measures to reduce the significance of these potential impacts include complying with Phase I Environmental Site Assessments conducted for specific program elements, implementing workplace precautions for West Nile Virus and Valley Fever, minimizing potential hazards to school safety, implementing safety precautions around idle and abandoned wells, and coordinating with vector control districts.

Alternatives A1 and A2, when considered in combination with other projects that would occur nearby and at the same time, could contribute to some degree or amount to a cumulative impact from exposure to hazardous substances or materials, or disruption of idle or abandoned oil or gas wells, as described in Chapter 26.0 of the Draft PEIS/R, “Cumulative Impacts.” Similarly, potentially significant impacts of Alternatives A1 and A2 associated with exposure to disease vectors could combine with significant impacts of one or more past, present, or reasonably foreseeable actions, thereby resulting in a cumulatively significant effect. Mitigation Measures PHH-1 through PHH-4 would reduce potentially significant impacts of Alternatives A1 and A2 related to exposure to hazardous materials, exposure to disease vectors, school safety, and disruption of idle or abandoned oil or gas wells. Implementation of these recommended mitigation measures would serve to prevent the potential effects of Alternatives A1 and A2 from combining with other effects from past, present, or reasonable foreseeable probable future actions, including implementation of the RPAs. The measures would reduce the contribution of Alternatives A1 and A2 to these potentially significant cumulative effects. Therefore, Alternatives A1 and A2 would not cause a cumulatively considerable incremental contribution to a significant cumulative impact on public health and hazardous materials. The cumulative impacts and impact conclusions **would not change** from the Draft PEIS/R.

26.17 Recreation

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," cumulative impacts to recreational resources could occur in the San Joaquin River upstream from Friant Dam, in the Restoration Area, downstream from the Merced River, and in the Delta. Implementing the Settlement would increase usage of recreational facilities at Millerton Lake and in the Restoration Area, interfere with recreational opportunities during construction, change opportunities for fishing, reduce boat ramp access to the edge of Millerton Lake, and increase flow effects on swimmers and boaters in the Restoration Area. The RPAs would not affect impacts occurring in these areas. Mitigation measures to reduce the significance of these impacts, as described in Chapter 21.0 of the Draft PEIS/R, "Recreation," include restoring recreation access after construction, enhancing fishing access at various locations, extending existing boat ramps, and developing and implementing a public outreach program.

With the RPAs in place, Interim and Restoration flows would increase flows and improve water quality in the San Joaquin River from the Merced River confluence and into the Delta and in adjacent Delta waterways, such as the Old River and Middle River, which could increase game fish populations and enhance fishing opportunities. Overall, Alternatives A1 and A2 would not cause a cumulatively considerable incremental contribution to a significant cumulative impact on recreation. The cumulative impacts and impact conclusions **would not change** from the Draft PEIS/R.

26.18 Socioeconomics

As described in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," cumulatively considerable incremental contributions of Alternatives A1 and A2 and other past, present, and reasonably foreseeable probable future actions to cumulative socioeconomic impacts would include construction-related impacts that would not be affected by the RPAs.

If widespread areas of agricultural land were to be removed from production, cumulative socioeconomic impacts on the region may result. The accumulation of these impacts may be a significant cumulative impact if Alternative A1 or A2 were to drastically reduce the amount of agricultural land in production in the Friant Division as a result of reduced surface water deliveries and declining groundwater levels; the relative significance of this potential impact would not change with the RPAs in place, as described in Chapter 22.0 of this appendix, "Socioeconomics." Projects related to CVP/SWP system operations include several actions to change and improve the existing conveyance activities in the area that could offset some or all of these potential impacts. Additional residential development in the region may further reduce agricultural lands, but the added socioeconomic benefits that a larger population can provide would likely outweigh any losses caused by a decrease in agricultural acreage.

For the reasons discussed above and in Chapter 26.0 of the Draft PEIS/R, "Cumulative Impacts," the combined effects of reasonably foreseeable probable future urban growth (i.e., residential, commercial, and industrial development projects), water supply and other water resource projects, and habitat restoration projects, together with the effects of Alternatives A1 and A2 with the RPAs in place, would not result in a cumulatively considerable incremental contribution to a significant cumulative impact on socioeconomics (population, housing, employment, or urban blight). The cumulative impacts and impact conclusions **would not change** from the Draft PEIS/R.

26.19 Transportation and Infrastructure

As described in Chapter 26.0 of the Draft PEIS/R, “Cumulative Impacts,” most cumulatively considerable incremental contributions of Alternatives A1 and A2 to cumulative transportation and infrastructure impacts would include construction-related impacts or impacts within the Restoration Area that would not be affected by the RPAs.

As discussed in Chapter 12 of the Draft PEIS/R, “Hydrology – Groundwater,” deep-well groundwater pumping since the early 1920s has depleted groundwater supplies in the San Joaquin Valley and Tulare Lake hydrologic regions. In addition, groundwater levels fluctuate greatly in the groundwater subbasins of the San Joaquin Valley Groundwater Basin; groundwater levels drop during dry periods and rise during wet periods. The long-term decline of groundwater levels in combination with large fluctuations in groundwater levels during relatively short periods have resulted in land subsidence. This subsidence has occurred in the past, currently occurs, and will occur in the future because deep groundwater will continue to be extracted. Alternatives A1 and A2 would contribute to increased groundwater extraction with the RPAs in place and thus could contribute to subsidence, as described in Chapter 12.0 of this appendix, “Hydrology – Groundwater.”

Subsidence has the potential to affect existing transportation and utilities infrastructure during the ground settling process. However, standard engineering practices for designing infrastructure factor in potential subsidence based on geology, depths to groundwater, and numbers and locations of deep groundwater wells in the region. Thus, standard engineering practices ensure that effects of Alternatives A1 and A2 with the RPAs in place on subsidence risks to transportation and utilities infrastructure would not be cumulatively considerable.

Overall, Alternatives A1 and A2 would not cause a cumulatively considerable incremental contribution to a significant cumulative impact on transportation and infrastructure with the RPAs in place. The cumulative impact and cumulative impact conclusion **would not change** from the Draft PEIS/R.

26.20 Utilities and Service Systems

As described in Chapter 26.0 of the Draft PEIS/R, “Cumulative Impacts,” cumulative impacts to utilities and service systems could result from the need for new construction or expansion of water or wastewater treatment facilities, inability to meet wastewater treatment requirements, insufficient existing water supply entitlements, insufficient landfill capacity, or insufficient capacity to respond to emergencies. Mitigation measures will be implemented to reduce the significance of these potential impacts as described in Chapter 24.0 of the Draft PEIS/R, including obtaining required permits for hatchery wastewater discharges and implementing BMPs.

Alternatives A1 and A2 could include a new fish hatchery in the Restoration Area, which depending on the location and design, could require water or wastewater treatment services in excess of available capacity. Actions to provide new or expanded capacity would be subject to project-level environmental review, and mitigation to minimize impacts would be developed and adopted. Additionally, permits issued for the new or expanded facilities would include environmental impact minimization measures as conditions. Nonetheless, it is not known whether impacts could be partially or fully mitigated. Therefore, if a new hatchery would be constructed under Alternatives A1 and A2, the potential exists to cause a cumulatively considerable incremental contribution to a significant cumulative impact through construction of expanded or new water and wastewater treatment facilities. The RPAs would not affect this potential impact. This cumulative impact is potentially significant and unavoidable.

Water supply to the Central Valley and elsewhere in California is limited by groundwater availability and surface-water supply provided by the CVP and SWP and other local entities. As a result of increased agricultural production during the past century and long-term population growth throughout California, much of the available water is obligated through water rights and conjunctive use programs. During drier years, surface-water supplies to the study area may be insufficient to meet demand. Any new development to support population growth in the study area would exacerbate this problem. These conditions resulting from past, present, and reasonably foreseeable probable future growth and development constitute a significant cumulative impact related to water supply availability. With the RPAs in place, the anticipated maximum amount of water that would be recaptured at existing facilities in the Delta and delivered to CVP and SWP water contractors would be reduced, as described in Chapter 24.0 of this appendix, “Utilities and Service Systems,” but the minimum amount that would be recaptured would not change.

With the RPAs in place, Alternatives A1 and A2 would result in an overall reduction in water deliveries to Friant Division long-term contractors if all Interim and Restoration flows are not recaptured and recirculated to the Friant Division. This impact would be interactive with water supply reductions associated with regulatory compliance for habitat restoration, fisheries management, and constraints of existing facilities. Consistent with the Act, a plan to recirculate, recapture, reuse, exchange, or transfer water released for Interim and Restoration flows would be developed and implemented to minimize impacts of reduced deliveries to Friant Division long-term contractors. In addition, a Recovered Water Account would be established to provide an accounting of reductions in water supply deliveries to Friant Division long-term contractors and to make surplus water available at a discounted rate to the affected contractors. However, these actions would not fully mitigate the losses in water deliveries, and new water sources could be required. Therefore, Alternatives A1 and A2 would result in a cumulatively considerable incremental contribution to the significant cumulative impact of reduced water supplies to Friant Division water contractors.

Although some short-term construction-related actions and a new fish hatchery under Alternatives A1 and A2 would generate solid waste, implementation of mitigation measures would ensure that the permitted capacity of landfills would not be exceeded, and these actions would not change with the RPAs in place. Therefore, Alternatives A1 and A2 would not result in a cumulatively considerable incremental contribution to a significant cumulative impact on landfill capacity.

Reasonably foreseeable probable future development projects in the study area would also increase demand for emergency services. These increases would result in the need to expand some existing fire protection or law enforcement facilities and possibly construct new facilities. Therefore, there is an overall significant cumulative impact associated with the need to construct or expand facilities that provide emergency response services. With the RPAs in place, Alternatives A1 and A2 would not increase demands on emergency services beyond available capacity. Alternatives A1 and A2 would not cause a cumulatively considerable incremental contribution to this significant cumulative impact related to provision of emergency response services.

The cumulative impact conclusions **would not change** from the Draft PEIS/R.

26.21 Visual Resources

Development is increasingly changing the visual character of the study area from vast areas of open space to urban uses, thus altering and limiting the views available to recreationists and residents living in the area. This trend will continue as reasonably foreseeable probable future projects are implemented in the study area. Substantial changes in visual conditions will continue as agricultural lands and open space are replaced by urban and industrial development and infrastructure projects, and as vegetation is removed to make room for future development. Increased urban development will also lead to increased nighttime light and glare and subsequent skyglow in the region and more limited views of the night sky.

In the study area, several large projects in various stages of planning and implementation may have adverse impacts on visual resources. Those projects include the Delta Mendota Canal Recirculation Project, the City of Stockton Delta Water Supply Project, implementation of the U.S. Army Corps of Engineers policy on levee vegetation, and various proposed residential, commercial, and industrial developments. Conversely, several projects in the planning stages within the study area could have a beneficial effect on visual resources. The cumulative effect of these changes on visual resources from past, present, and reasonably foreseeable planned future projects would be significant. These cumulative impacts can be minimized to a degree through vegetative and topographic screening of structures, use of outdoor lighting that limits glare, appropriate building design, and other measures; however, the overall significant cumulative impact cannot be mitigated to a less-than-significant level. Therefore, the cumulative change of agricultural and open-space views in the study area to urban landscape and the associated increase in nighttime light and glare and subsequent skyglow would be significant under the No-Action Alternative.

The release of Interim and Restoration flows under Alternatives A1 and A2 would provide a net beneficial effect on visual resources by improving habitat along the San Joaquin River below Friant Dam. However, the incremental contributions of program-level impacts could be cumulatively considerable if construction of a new fish hatchery or major levee work along the river in the Restoration Area would occur and the visual impacts of these actions could not be appropriately mitigated. These impacts are related to scenic resources within the Restoration Area that would not change with the RPAs in place. Overall, Alternatives A1 and A2 would cause a potential cumulatively considerable incremental contribution to the significant cumulative impact on visual resources in the Restoration Area and downstream at the site of any new pumping plant. This cumulative impact is potentially significant and unavoidable. The cumulative impacts and cumulative impact conclusions **would not change** from the Draft PEIS/R.

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Attachment

Representation of U.S. Fish and Wildlife Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM II Planning Studies

Final
CVP/SWP Long-Term Operations Sensitivity Analysis Appendix

Final

July 2012

TECHNICAL MEMORANDUM

Representation of U.S. Fish and Wildlife Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM II Planning Studies – DRAFT

PREPARED FOR: California Department of Water Resources

PREPARED BY: CH2M HILL, revised subsequently by DWR and Reclamation

DATE: February 10, 2010

The U.S. Fish and Wildlife Service's (Service) Delta Smelt Biological Opinion (BO) was released on December 15, 2008, in response to the U.S. Bureau of Reclamation's (Reclamation) request for formal consultation with the Service on the coordinated operations of the Central Valley Project (CVP) and State Water Project (SWP) in California.

To develop CALSIM II modeling assumptions for reasonable and prudent alternative actions (RPA) documented in this BO, the California Department of Water Resources (Department) led a series of meetings that involved members of fisheries and project agencies. The purpose for establishing this group was to prepare the assumptions and CALSIM II implementations to represent the RPAs in Existing and Future Condition CALSIM II simulations for future planning studies.

This memorandum summarizes the approach that resulted from these meetings and the modeling assumptions that were laid out by the group. The scope of this memorandum is limited to the December 15, 2008 BO. Unless otherwise indicated, all descriptive information of the RPAs is taken from Appendix B of the BO.

Table 1 lists the participants that contributed to the meetings and information summarized in this document.

The RPAs in the Service's BO are based on physical and biological phenomena that do not lend themselves to simulations using a monthly time step. Much scientific and modeling judgment has been employed to represent the implementation of the RPAs. The group believes the logic put into CALSIM II represents the RPAs as best as possible at this time, given the scientific understanding of environmental factors enumerated in the BO and the limited historical data for some of these factors.

TABLE 1
Meeting Participants

Aaron Miller/Department	Derek Hilts/Service
Steve Ford/Department	Steve Detwiler/Service
Randi Field/Reclamation	Matt Nobriga/CDFG
Gene Lee/Reclamation	Jim White/CDFG
Lenny Grimaldo/Reclamation	Craig Anderson/NMFS
Parviz Nader-Tehrani/Department	Robert Leaf/CH2M HILL
Erik Reyes/Department	Derya Sumer/CH2M HILL
Sean Sou/Department	

Notes:

CDFG = California Department of Fish and Game

NMFS = National Marine Fisheries Service

The simulated Old and Middle River (OMR) flow conditions and CVP and SWP Delta export operations, resulting from these assumptions, are believed to be a reasonable representation of conditions expected to prevail under the RPAs over large spans of years (refer to CALSIM II modeling results for more details on simulated operations). Actual OMR flow conditions and Delta export operations will differ from simulated operations for numerous reasons, including having near real-time knowledge and/or estimates of turbidity, temperature, and fish spatial distribution that are unavailable for use in CALSIM II over a long period of record. Because these factors and others are believed to be critical for smelt entrainment risk management, the Service adopted an adaptive process in defining the RPAs. Given the relatively generalized representation of the RPAs, assumed for CALSIM II modeling, much caution is required when interpreting outputs from the model.

Action 1: Adult Delta Smelt Migration and Entrainment (RPA Component 1, Action 1 – First Flush)

Action 1 Summary:

Objective: A fixed duration action to protect pre-spawning adult delta smelt from entrainment during the first flush, and to provide advantageous hydrodynamic conditions early in the migration period.

Action: Limit exports so that the average daily Combined OMR flow is no more negative than -2,000 cubic feet per second (cfs) for a total duration of 14 days, with a 5-day running average no more negative than -2,500 cfs (within 25 percent).

Timing:

Part A: December 1 to December 20 – Based upon an examination of turbidity data from Prisoner's Point, Holland Cut, and Victoria Canal and salvage data from CVP/SWP (see below), and other parameters important to the protection of delta smelt including, but not limited to, preceding conditions of X2, the Fall Midwater Trawl Survey (FMWT), and river flows; the SWG may recommend a start date to the Service. The Service will make the final determination.

Part B: After December 20 – The action will begin if the 3-day average turbidity at Prisoner's Point, Holland Cut, and Victoria Canal exceeds 12 nephelometric turbidity units (NTU). However the SWG can recommend a delayed start or interruption based on other conditions such as Delta inflow that may affect vulnerability to entrainment.

Triggers (Part B):

Turbidity: Three-day average of 12 NTU or greater at all three turbidity stations: Prisoner's Point, Holland Cut, and Victoria Canal.

OR

Salvage: Three days of delta smelt salvage after December 20 at either facility or cumulative daily salvage count that is above a risk threshold based upon the "daily salvage index" approach reflected in a daily salvage index value ≥ 0.5 (daily delta smelt salvage > one-half prior year FMWT index value).

The window for triggering Action 1 concludes when either off-ramp condition described below is met. These off-ramp conditions may occur without Action 1 ever being triggered. If this occurs, then Action 3 is triggered, unless the Service concludes on the basis of the totality of available information that Action 2 should be implemented instead.

Off-ramps:

Temperature: Water temperature reaches 12 degrees Celsius (°C) based on a three station daily mean at the temperature stations: Mossdale, Antioch, and Rio Vista

OR

Biological: Onset of spawning (presence of spent females in the Spring Kodiak Trawl Survey [SKT] or at Banks or Jones).

Action 1 Assumptions for CALSIM II Modeling Purposes:

An approach was selected based on hydrologic and assumed turbidity conditions. Under this general assumption, Part A of the action was never assumed because, on the basis of historical salvage data, it was considered unlikely or rarely to occur. Part B of the action was assumed to occur if triggered by turbidity conditions. This approach was believed to tend to a more conservative interpretation of the frequency, timing, and extent of this action. The assumptions used for modeling are as follows:

Action: Limit exports so that the average daily OMR flow is no more negative than -2,000 cfs for a total duration of 14 days, with a 5-day running average no more negative than -2,500 cfs (within 25 percent of the monthly criteria).

Timing: If turbidity-trigger conditions first occur in December, then the action starts on December 21; if turbidity-trigger conditions first occur in January, then the action starts on January 1; if turbidity-trigger conditions first occur in February, then the action starts on February 1; and if turbidity-trigger conditions first occur in March, then the action starts on March 1. It is assumed that once the action is triggered, it continues for 14 days.

Triggers: Only an assumed turbidity trigger that is based on hydrologic outputs was considered. A surrogate salvage trigger or indicator was not included because there was no way to model it.

Turbidity: If the monthly average unimpaired Sacramento River Index (four-river index: sum of Sacramento, Yuba, Feather, and American Rivers) exceeds 20,000 cfs, then it is assumed that an event, in which the 3-day average turbidity at Hood exceeds 12 NTU, has occurred within the month. It is assumed that an event at Sacramento River is a reasonable indicator of this condition occurring, within the month, at all three turbidity stations: Prisoner's Point, Holland Cut, and Victoria Canal.

A chart showing the relationship between turbidity at Hood (number of days with turbidity is greater than 12 NTU) and Sacramento River Index (sum of monthly flow at four stations on the Sacramento, Feather, Yuba and American Rivers, from 2003 to 2006) is shown on Figure 1. For months when average Sacramento River Index is between 20,000 cfs and 25,000 cfs a transition is observed in number of days with Hood turbidity greater than 12 NTU. For months when average Sacramento River Index is above 25,000 cfs, Hood turbidity was always greater than 12 NTU for as many as 5 days or more within the month in which the flow occurred. For a conservative approach, 20,000 cfs is used as the threshold value.

Salvage: It is assumed that salvage would occur when first flush occurs.

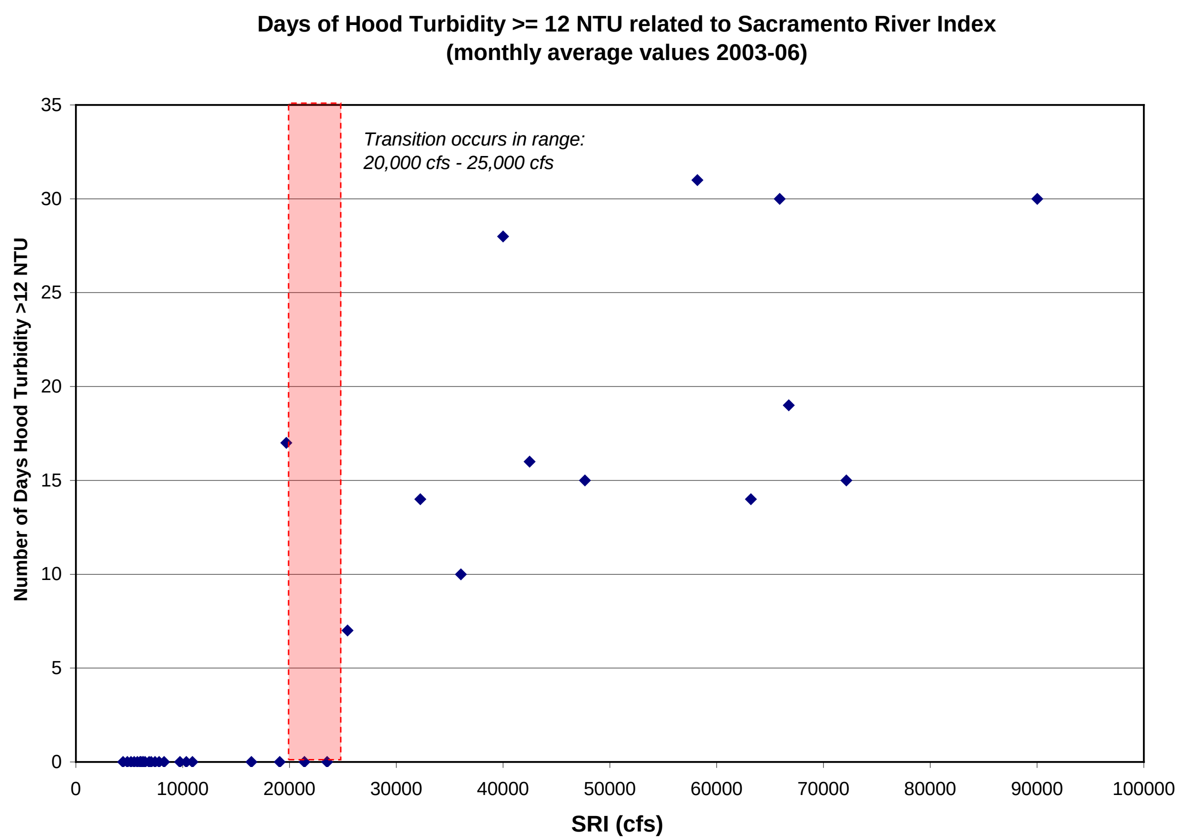

FIGURE 1
RELATIONSHIP BETWEEN TURBIDITY AT HOOD AND SACRAMENTO RIVER INDEX

Off-ramps: Only temperature-based off-ramping is considered. A surrogate biological off-ramp indicator was not included.

Temperature: Because the water temperature data at the three temperature stations (Antioch, Mossdale, and Rio Vista) are only available for years after 1984, another parameter was sought for use as an alternative indicator. It is observed that monthly average air temperature at Sacramento Executive Airport generally trends with the three-station average water temperature (see Figure 2). Using this alternative indicator, monthly average air temperature is assumed to occur in the middle of the month, and values are interpolated on a daily basis to obtain daily average water temperature. Using the correlation between air and water temperature, estimated daily water temperatures are estimated from the 82-year monthly average air temperature. Dates when the three-station average temperature reaches 12°C are recorded and used as input in CALSIM. A 1:1 correlation was used for simplicity instead of using the trend line equation illustrated on Figure 2.

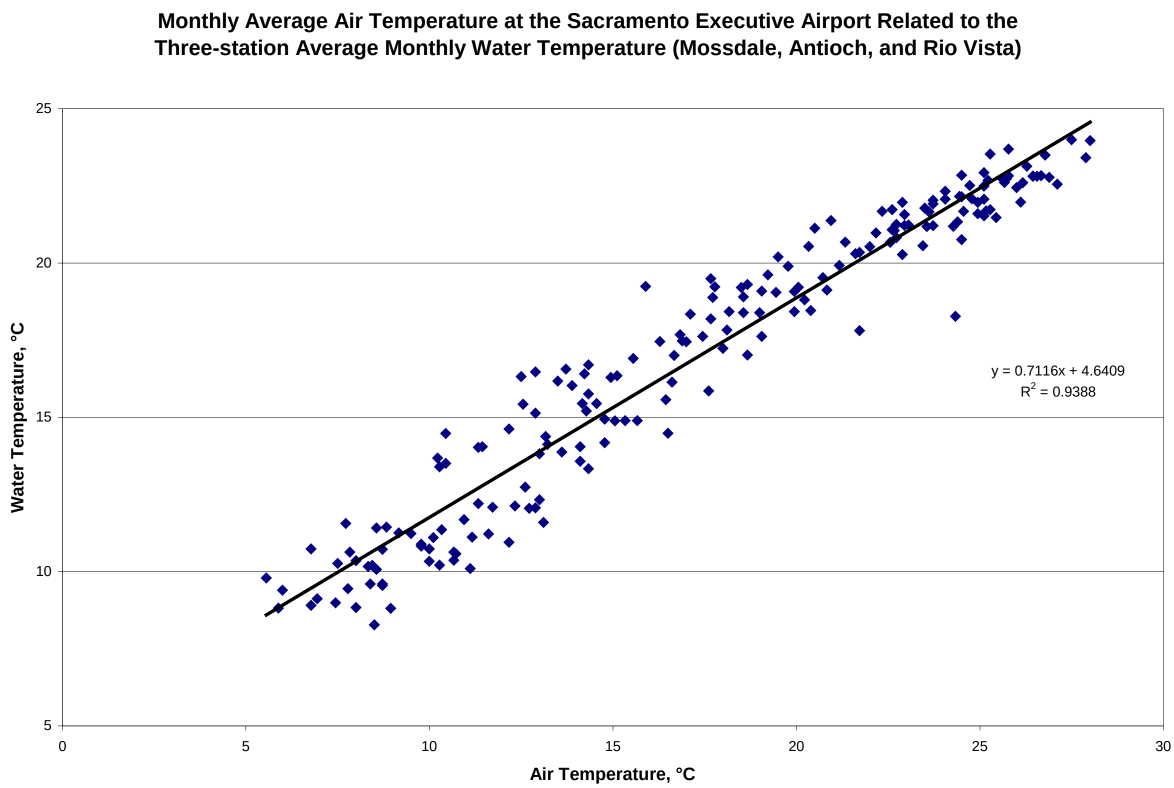

FIGURE 2
RELATIONSHIP BETWEEN MONTHLY AVERAGE AIR TEMPERATURE AT THE SACRAMENTO EXECUTIVE AIRPORT AND THE THREE-STATION AVERAGE MONTHLY WATER TEMPERATURE

Other Modeling Considerations:

In the month of December in which Action 1 does not begin until December 21, for monthly analysis, a background OMR flow must be assumed for the purpose of calculating a day-weighted average for implementing a partial-month action condition. When necessary, the background OMR flow for December was assumed to be -8,000 cfs.

For the additional condition to meet a 5-day running average no more negative than -2,500 cfs (within 25 percent), Paul Hutton's equation[1] is used. Hutton concluded that with stringent OMR standards (1,250 to 2,500 cfs), the 5-day average would control more frequently than the 14-day average, but it is less likely to control at higher flows. Therefore, the CALSIM II implementation includes both a 14-day (approximately monthly average) and a 5-day average flow criteria based on Hutton's methodology (see Attachment 1).

Rationale: The following is an overall summary of the rationale for the preceding interpretation of RPA Action 1.

December 1 to December 20 for initiating Action 1 is not considered because seasonal peaks of delta smelt salvage are rare prior to December 20. Adult delta smelt spawning migrations often begin following large precipitation events that happen after mid-December.

Salvage of adult delta smelt often corresponds with increases in turbidity and exports. On the basis of the above discussion and Figure 1, Sacramento River Index greater than 25,000 cfs is assumed to be an indicator of turbidity trigger being reached at all three turbidity stations: Prisoner's Point, Holland Cut, and Victoria Canal. Most sediment enters the Delta from the Sacramento River during flow pulses; therefore, a flow indicator based on only Sacramento River flow is used.

The 12°C threshold for the off-ramp criterion is a conservative estimate of when delta smelt larvae begin successfully hatching. Once hatched, the larvae move into the water column where they are potentially vulnerable to entrainment.

Results: Using these assumptions, in a typical CALSIM II 82-year simulation (1922 through 2003 hydrologic conditions), Action 1 will occur 29 times in the December 21 to January 3rd period, 14 times in the January 1 to January 14 period, 13 times in the February 1 to February 14 period, and 17 times in the March 1 to March 14 period. In 3 of these 17 occurrences (1934, 1991, and 2001), Action 3 is triggered before Action 1 and therefore Action 1 is bypassed. Action 1 is not triggered in 9 of the 82 years (1924, 1929, 1931, 1955, 1964, 1976, 1977, 1985, and 1994), typically critically dry years. Refer to CALSIM II modeling results for more details on simulated operations of OMR, Delta exports and other parameters of interest.

Action 2: Adult Delta Smelt Migration and Entrainment (RPA Component 1, Action 2)

Action 2 Summary:

Objective: An action implemented using an adaptive process to tailor protection to changing environmental conditions after Action 1. As in Action 1, the intent is to protect

[1] Hutton, Paul/Metropolitan Water District of Southern California (MWDSC). Water Supply Impact Analysis of December 2008 Delta Smelt Biological Opinion, Appendix 5. February.

pre-spawning adults from entrainment and, to the extent possible, from adverse hydrodynamic conditions.

Action: The range of net daily OMR flows will be no more negative than -1,250 to -5,000 cfs. Depending on extant conditions (and the general guidelines below), specific OMR flows within this range are recommended by the Service's Smelt Working Group (SWG) from the onset of Action 2 through its termination (see Adaptive Process description in the BO). The SWG would provide weekly recommendations based upon review of the sampling data, from real-time salvage data at the CVP and SWP, and utilizing most up-to-date technological expertise and knowledge relating population status and predicted distribution to monitored physical variables of flow and turbidity. The Service will make the final determination.

Timing: Beginning immediately after Action 1. Before this date (in time for operators to implement the flow requirement) the SWG will recommend specific requirement OMR flows based on salvage and on physical and biological data on an ongoing basis. If Action 1 is not implemented, the SWG may recommend a start date for the implementation of Action 2 to protect adult delta smelt.

Suspension of Action:

<u>Flow:</u> OMR flow requirements do not apply whenever a 3-day flow average is greater than or equal to 90,000 cfs in Sacramento River at Rio Vista and 10,000 cfs in San Joaquin River at Vernalis. Once such flows have abated, the OMR flow requirements of the Action are again in place.

Off-ramps:

<u>Temperature:</u> Water temperature reaches 12°C based on a three-station daily average at the temperature stations: Rio Vista, Antioch, and Mossdale.

OR

<u>Biological:</u> Onset of spawning (presence of a spent female in SKT or at either facility).

Action 2 Assumptions for CALSIM II Modeling Purposes:

An approach was selected based on the occurrence of Action 1 and X2 salinity conditions. This approach selects from between two OMR flow tiers depending on the previous month's X2 position, and is never more constraining than an OMR criterion of -3,500 cfs. The assumptions used for modeling are as follows:

Action: Limit exports so that the average daily OMR flow is no more negative than -3,500 or -5,000 cfs depending on the previous month's ending X2 location (-3,500 cfs if X2 is east of Roe Island, or -5,000 cfs if X2 is west of Roe Island), with a 5-day running average within 25 percent of the monthly criteria (no more negative than -4,375 cfs if X2 is east of Roe Island, or -6,250 cfs if X2 is west of Roe Island).

Timing: Begins immediately after Action 1 and continues until initiation of Action 3.

In a typical CALSIM II 82-year simulation, Action 1 was not triggered in 9 of the 82 years. In these conditions it is assumed that OMR flow should be maintained no more negative than -5,000 cfs.

Suspension of Action: A flow peaking analysis, developed by Paul Hutton[2], is used to determine the likelihood of a 3-day flow average greater than or equal to 90,000 cfs in Sacramento River at Rio Vista and a 3-day flow average greater than or equal to 10,000 cfs in San Joaquin River at Vernalis occurring within the month. It is assumed that when the likelihood of these conditions occurring exceeds 50 percent, Action 2 is suspended for the full month, and OMR flow requirements do not apply. The likelihood of these conditions occurring is evaluated each month, and Action 2 is suspended for one month at a time whenever both of these conditions occur.

The equations for likelihood (frequency of occurrence) are as follows:

Frequency of Rio Vista 3-day flow average > 90,000 cfs:

> 0% when Freeport monthly flow < 50,000 cfs, OR
>
> (0.00289 x Freeport monthly flow – 146)% when 50,000 cfs ≤ Freeport plus Yolo Bypass monthly flow ≤ 85,000 cfs, OR
>
> 100% when Freeport monthly flow >85,000 cfs

Frequency of Vernalis 3-day flow average > 10,000 cfs:

> 0% when Vernalis monthly flow < 6,000 cfs, OR
>
> (0.00901 x Vernalis monthly flow – 49)% when 6,000 cfs ≤ Vernalis monthly flow ≤ 16,000 cfs, OR
>
> 100% when Vernalis monthly flow >16,000 cfs

Frequency of Rio Vista 3-day flow average > 90,000 cfs equals 50% when Freeport plus Yolo Bypass monthly flow is 67,820 cfs and the frequency of Vernalis 3-day flow average > 10,000 cfs equals 50% Vernalis monthly flow is 10,988 cfs. Therefore these two flow values are used as thresholds in the model.

Off-ramps: Only temperature-based off-ramping is considered. A surrogate biological off-ramp indicator was not included.

<u>Temperature:</u> Because the water temperature data at the three temperature stations (Antioch, Mossdale, and Rio Vista) are only available for years after 1984, another parameter was sought for use as an alternative indicator. It is observed that monthly average air temperature at Sacramento Executive Airport generally trends with the three-station average water temperature (Figure 2). Using this alternative indicator, monthly average air temperature is assumed to occur in the middle of the month, and values are interpolated on a daily basis to obtain daily average water temperature. Using the correlation between air

[2] Hutton, Paul/MWDSC. 2009. Water Supply Impact Analysis of December 2008 Delta Smelt Biological Opinion, Appendix 4. February.

and water temperature, daily water temperatures are estimated from the 82-year monthly average air temperature. Dates when the three-station average temperature reaches 12°C are recorded and used as input in CALSIM. A 1:1 correlation was used for simplicity instead of using the trend line equation illustrated on Figure 2.

Rationale: The following is an overall summary of the rationale for the preceding interpretation of RPA Action 2.

Action 2 requirements are based on X2 location that is dependent on the Delta outflow. If outflows are very high, fewer delta smelt will spawn east of Sherman Lake; therefore, the need for OMR restrictions is lessened.

In the case of Action 1 not being triggered, CDFG suggested OMR > -5,000 cfs, following the actual implementation of the BO in winter 2009, because some adult delta smelt might move into the Central Delta without a turbidity event.

Action 2 is suspended when the likelihood of a 3-day flow average greater than or equal to 90,000 cfs in Sacramento River at Rio Vista and a 3-day flow average greater than or equal to 10,000 cfs in San Joaquin River at Vernalis occurring concurrently within the month exceeds 50 percent, because at extreme high flows the majority of adult delta smelt will be distributed downstream of the Delta, and entrainment concerns will be very low.

The 12°C threshold for the off-ramp criterion is a conservative estimate of when delta smelt larvae begin successfully hatching. Once hatched, the larvae move into the water column where they are potentially vulnerable to entrainment.

Results: Using these assumptions, in a typical CALSIM II 82-year simulation (1922 through 2003 hydrologic conditions), Action 1, and therefore Action 2, does not occur in 11 of the 82 years (1924, 1929, 1931, 1934, 1955, 1964, 1976, 1977, 1985, 1991, 1994, and 2001), typically critically dry years. The criteria for suspension of OMR minimum flow requirements, described above, results in potential suspension of Action 2 (if Action 2 is active) 6 times in January, 11 times in February, 6 times in March (however Action 2 was not active in 3 of these 6 times), and 2 times in April. The result is that Action 2 is in effect 37 times in January (with OMR at -3,500 cfs 29 times, and at -5,000 cfs 8 times), 43 times in February (with OMR at -3,500 cfs 25 times, and at -5,000 cfs 18 times), 31 times in March (with OMR at -3,500 cfs 14 times, and at -5,000 cfs 17 times), and 80 times in April (with OMR at -3,500 cfs 46 times, and at -5,000 cfs 34 times). The frequency each month is a cumulative result of the action being triggered in the current or prior months. Refer to CALSIM II modeling results for more details on simulated operations of OMR, Delta exports and other parameters of interest.

Action 3: Entrainment Protection of Larval and Juvenile Delta Smelt (RPA Component 2)

Action 3 Summary:

Objective: Minimize the number of larval delta smelt entrained at the facilities by managing the hydrodynamics in the Central Delta flow levels pumping rates spanning a time sufficient for protection of larval delta smelt, e.g., by using a VAMP-like action. Because protective OMR flow requirements vary over time (especially between years), the action is adaptive and flexible within appropriate constraints.

Action: Net daily OMR flow will be no more negative than -1,250 to -5,000 cfs based on a 14-day running average with a simultaneous 5-day running average within 25 percent of the applicable requirement for OMR. Depending on extant conditions (and the general guidelines below), specific OMR flows within this range are recommended by the SWG from the onset of Action 3 through its termination (see Adaptive Process in Introduction). The SWG would provide these recommendations based upon weekly review of sampling data, from real-time salvage data at the CVP/SWP, and expertise and knowledge relating population status and predicted distribution to monitored physical variables of flow and turbidity. The Service will make the final determination.

Timing: Initiate the action after reaching the triggers below, which are indicative of spawning activity and the probable presence of larval delta smelt in the South and Central Delta. Based upon daily salvage data, the SWG may recommend an earlier start to Action 3. The Service will make the final determination.

Triggers:

Temperature: When temperature reaches 12°C based on a three-station average at the temperature stations: Mossdale, Antioch, and Rio Vista.

OR

Biological: Onset of spawning (presence of spent females in SKT or at either facility).

Off-ramps:

Temporal: June 30;

OR

Temperature: Water temperature reaches a daily average of 25°C for three consecutive days at Clifton Court Forebay.

Action 3 Assumptions for CALSIM II Modeling Purposes:

An approach was selected based on assumed temperature and X2 salinity conditions. This approach selects from among three OMR flow tiers depending on the previous month's X2 position and ranges from an OMR criteria of -1,250 to -5,000 cfs. Because of to the potential low export conditions that could occur at an OMR criterion of -1,250 cfs, a criterion for minimum exports for health and safety is also assumed. The assumptions used for modeling are as follows:

Action: Limit exports so that the average daily OMR flow is no more negative than -1,250, -3,500, or -5,000 cfs, depending on the previous month's ending X2 location (-1,250 cfs if X2 is east of Chipps Island, -5,000 cfs if X2 is west of Roe Island, or -3,500 cfs if X2 is between Chipps and Roe Island, inclusively), with a 5-day running average within 25 percent of the monthly criteria (no more negative than -1,562 cfs if X2 is east of Chipps Island, -6,250 cfs if X2 is west of Roe Island, or -4,375 cfs if X2 is between Chipps and Roe Island). The more constraining of this OMR requirement or the VAMP requirement will be selected during the

VAMP period (April 15 to May 15). Additionally, in the case of the month of June, the OMR criterion from May is maintained through June (it is assumed that June OMR should not be more constraining than May).

Timing: Begins immediately upon temperature trigger conditions and continues until off-ramp conditions are met.

Triggers: Only temperature trigger conditions are considered. A surrogate biological trigger was included.

Temperature: Because the water temperature data at the three temperature stations (Antioch, Mossdale, and Rio Vista) are only available for years after 1984, another parameter was sought to be used as an alternative indicator. It is observed that monthly average air temperature at Sacramento Executive Airport generally trends with the three-station average water temperature (Figure 2). Using this alternative indicator, monthly average air temperature is assumed to occur in the middle of the month, and values are interpolated on a daily basis to obtain daily average water temperature. Using the correlation between air and water temperature, estimated daily water temperatures are estimated from the 82-year monthly average air temperature. Dates when the three-station average temperature reaches 12°C are recorded and used as input in CALSIM. A 1:1 correlation was used for simplicity instead of using the trend line equation illustrated on Figure 2.

Biological: Onset of spawning is assumed to occur no later than April 30.

Off-ramps:

Temporal: It is assumed that the ending date of the action would be no later than June 30.

OR

Temperature: Only 17 years of data are available for Clifton Court water temperature. A similar approach as used in the temperature trigger was considered. However, because 3 consecutive days of water temperature greater than or equal to 25°C is required, a correlation between air temperature and water temperature did not work well for this off-ramp criterion. Out of the 17 recorded years, in one year the criterion was triggered in May (May 31), and in 3 years it was triggered in June (June 3, 21, and 27). In all other years it was observed in July or later. With only four data points before July, it was not possible to generate a rule based on statistics. Therefore, temporal off-ramp criterion (June 30) is used for all years.

Health and Safety: In CALSIM II, a minimum monthly Delta export criterion of 300 cfs for SWP and 600 cfs (or 800 cfs depending on Shasta storage) for CVP is assumed. This assumption is suitable for dry-year conditions when allocations are low and storage releases are limited; however, minimum monthly exports need to be made for protection of public health and safety (health and safety deliveries upstream of San Luis Reservoir).

In consideration of the severe export restrictions associated with the OMR criteria established in the RPAs, an additional set of health and safety criterion is assumed. These export restrictions could lead to a situation in which supplies are available and allocated; however, exports are curtailed forcing San Luis to have an accelerated drawdown rate. For dam safety at San Luis Reservoir, 2 feet per day is the maximum acceptable drawdown rate.

Drawdown occurs faster in summer months and peaks in June when the agricultural demands increase. To avoid rapid drawdown in San Luis Reservoir, a relaxation of OMR is allowed so that exports can be maintained at 1,500 cfs in all months if needed.

This modeling approach may not fit the real-life circumstances. In summer months, especially in June, the assumed 1,500 cfs for health and safety may not be sufficient to keep San Luis drawdown below a safe 2 ft/day; and under such circumstances the projects would be required to increase pumping in order to maintain dam safety.

Rationale: The following is an overall summary of the rationale for the preceding interpretation of RPA Action 3.

The geographic distribution of larval and juvenile delta smelt is tightly linked to X2 (or Delta outflow). Therefore, the percentage of the population likely to be found east of Sherman Lake is also influenced by the location of X2. The X2-based OMR criteria were intended to model an expected management response to the general increase in delta smelt's risk of entrainment as a function of increasing X2.

The 12°C threshold for the trigger criterion is a conservative estimate of when delta smelt larvae begin successfully hatching. Once hatched, the larvae move into the water column where they are potentially vulnerable to entrainment.

The annual salvage "season" for delta smelt typically ends as South Delta water temperatures warm to lethal levels during summer. This usually occurs in late June or early July. The laboratory-derived upper lethal temperature for delta smelt is 25.4°C.

Results: Action 3 occurs 30 times in February (with OMR at -1,250 cfs 9 times, at -3,500 cfs 11 times, and at -5,000 cfs 10 times), 76 times in March (with OMR at -1,250 cfs 15 times, at -3,500 cfs 27 times, and at -5,000 cfs 34 times), all times (82) in April (with OMR at -1,250 cfs 17 times, at -3,500 cfs 29 times, and at -5,000 cfs 35 times), all times (82) in May (with OMR at -1,250 cfs 19 times, at -3,500 cfs 37 times, and at -5,000 cfs 26 times), and 70 times in June (with OMR at -1,250 cfs 7 times, at -3,500 cfs 37 times, and at -5,000 cfs 26 times). Refer to CALSIM II modeling results for more details on simulated operations of OMR, Delta exports and other parameters of interest. (Note: The above information is based on the August 2009 version of the model and documents the development process, more recent versions of the model may have different results.)

Action 4: Estuarine Habitat During Fall (RPA Component 3)

Action 4 Summary:

Objective: Improve fall habitat for delta smelt by managing of X2 through increasing Delta outflow during fall when the preceding water year was wetter than normal. This will help return ecological conditions of the estuary to that which occurred in the late 1990s when smelt populations were much larger. Flows provided by this action are expected to provide direct and indirect benefits to delta smelt. Both the direct and indirect benefits to delta smelt are considered equally important to minimize adverse effects.

Action: Subject to adaptive management as described below, provide sufficient Delta outflow to maintain average X2 for September and October no greater (more eastward) than

74 kilometers in the fall following wet years and 81 kilometers in the fall following above normal years. The monthly average X2 position is to be maintained at or seaward of these location for each individual month and not averaged over the two month period. In November, the inflow to CVP/SWP reservoirs in the Sacramento Basin will be added to reservoir releases to provide an added increment of Delta inflow and to augment Delta outflow up to the fall X2 target. The action will be evaluated and may be modified or terminated as determined by the Service.

Timing:

September 1 to November 30.

Triggers:

Wet and above normal water-year type classification from the 1995 Water Quality Control Plan that is used to implement D-1641.

Action 4 Assumptions for CALSIM II Modeling Purposes:

Model is modified to increase Delta outflow to meet monthly average X2 requirements for September and October and subsequent November reservoir release actions in Wet and Above Normal years. No off-ramps are considered for reservoir release capacity constraints. Delta exports may or may not be reduced as part of reservoir operations to meet this action. The Action is summarized in Table 2.

Table 2. Summary of Action 4 implementation in CALSIM II.

Fall Months following Wet or Above Normal Years	**Action Implementation**
September	Meet monthly average X2 requirement (74 km in Wet years, 81 km in Above Normal years)
October	Meet monthly average X2 requirement (74 km in Wet years, 81 km in Above Normal years)
November	Make reservoir releases up to natural inflow as needed to continue to meet monthly average X2 requirement (74 km in Wet years, 81 km in Above Normal years)

Rationale: Action 4 requirements are based on determining X2 location. Adjustment and retraining of the ANN was also completed to address numerical sensitivity concerns.

Results: There are 38 September and 37 October months that the Action is triggered over the 82-year simulation period.

Action 5: Temporary Spring Head of Old River Barrier and the Temporary Barrier Project (RPA Component 2)

Action 5 Summary:

Objective: To minimize entrainment of larval and juvenile delta smelt at Banks and Jones or from being transported into the South and Central Delta, where they could later become entrained.

Action: Do not install the Spring Head of Old River Barrier (HORB) if delta smelt entrainment is a concern. If installation of the HORB is not allowed, the agricultural barriers would be installed as described in the Project Description. If installation of the HORB is allowed, the Temporary Barrier Project (TBP) flap gates would be tied in the open position until May 15.

Timing: The timing of the action would vary depending on the conditions. The normal installation of the spring temporary HORB and the TBP is in April.

Triggers: For delta smelt, installation of the HORB will only occur when particle tracking modeling results show that entrainment levels of delta smelt will not increase beyond 1 percent at Station 815 as a result of installing the HORB.

Off-ramps: If Action 3 ends or May 15, whichever comes first.

Action 5 Assumptions for CALSIM II and DSM2 Modeling Purposes:

The South Delta Improvement Program (SDIP) Stage 1 is not included in the Existing and Future Condition assumptions being used for CALSIM II and DSM2 baselines. The TBP is assumed instead. The TBP specifies that HORB be installed and operated during April 1 through May 31 and September 16 through November 30. In response to the FWS BO, Action 5, the HORB is assumed to not be installed during April 1 through May 31.

Attachment

Representation of National Marine Fisheries Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM II Planning Studies

Final

CVP/SWP Long-Term Operations Sensitivity Analysis Appendix

SAN JOAQUIN RIVER RESTORATION PROGRAM

Final

July 2012

TECHNICAL MEMORANDUM

Representation of National Marine Fisheries Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM II Planning Studies

PREPARED FOR: California Department of Water Resources

PREPARED BY: CH2M HILL, revised subsequently by DWR and Reclamation

DATE: February 10, 2010

The National Marine Fisheries Service's (NMFS) Biological Opinion (BO) on the Long-term Operations of the Central Valley Project and State Water Project was released on June 4, 2009.

To develop CALSIM II modeling assumptions to represent the operations related reasonable and prudent alternative actions (RPA) required by this BO, the California Department of Water Resources (Department) led a series of meetings that involved members of fisheries and project agencies. The purpose for establishing this group was to prepare the assumptions and CALSIM II implementations to represent the RPAs in both Existing- and Future-Condition CALSIM II simulations for future planning studies.

This memorandum summarizes the approach that resulted from these meetings and the modeling assumptions that were laid out by the group. The scope of this memorandum is limited to the June 4, 2009 BO. All descriptive information of the RPAs is taken from the BO.

Table 1 lists the participants that contributed to the meetings and information summarized in this document.

The RPAs in NMFS's BO are based on physical and biological processes that do not lend themselves to simulations using a monthly time step. Much scientific and modeling judgment has been employed to represent the implementation of the RPAs. The group believes the logic put into CALSIM II represents the RPAs as best as possible at this time, given the scientific understanding of environmental factors enumerated in the BO and the limited historical data for some of these factors.

Given the relatively generalized representation of the RPAs assumed for CALSIM II modeling, much caution is required when interpreting outputs from the model.

TABLE 1
Meeting Participants

Aaron Miller/Department Randi Field/Reclamation Lenny Grimaldo/Reclamation Henry Wong/Reclamation	Derek Hilts/USFWS Roger Guinee/ USFWS Matt Nobriga/CDFG Bruce Oppenheim/ NMFS
Parviz Nader-Tehrani/ Department Erik Reyes/ Department Sean Sou/ Department Paul A. Marshall/ Department Ming-Yen Tu/ Department Xiaochun Wang/ Department	Robert Leaf/CH2M HILL Derya Sumer/CH2M HILL

Notes:

CDFG = California Department of Fish and Game

NMFS = National Marine Fisheries Service

USFWS = US Fish and Wildlife Service

Action Suite 1.1 Clear Creek

Suite Objective: The RPA actions described below were developed based on a careful review of past flow studies, current operations, and future climate change scenarios. These actions are necessary to address adverse project effects on flow and water temperature that reduce the viability of spring-run and CV steelhead in Clear Creek.

Action 1.1.1 Spring Attraction Flows

Objective: Encourage spring-run movement to upstream Clear Creek habitat for spawning.

Action: Reclamation shall annually conduct at least two pulse flows in Clear Creek in May and June of at least 600 cfs for at least three days for each pulse, to attract adult spring-run holding in the Sacramento River main stem.

Action 1.1.1 Assumptions for CALSIM II Modeling Purposes

Action: Model is modified to meet 600 cfs for 3 days twice in May. In the CALSIM II analysis, Flows sufficient to increase flow up to 600 cfs for a total of 6 days are added to the flows that would have otherwise occurred in Clear Creek.

Rationale: CALSIM II is a monthly model. The monthly flow in Clear Creek is an underestimate of the the actual flows that would occur subject to daily operational constraints at Whiskeytown Reservoir. The additional flow to meet 600 cfs for a total of 6 days was added to the monthly average flow modeled.

Action 1.1.5. Thermal Stress Reduction

Objective: To reduce thermal stress to over-summering steelhead and spring-run during holding, spawning, and embryo incubation.

Action: Reclamation shall manage Whiskeytown releases to meet a daily water temperature of: 1) 60°F at the Igo gage from June 1 through September 15; and 2) 56°F at the Igo gage from September 15 to October 31.

Action 1.1.5 Assumptions for CALSIM II Modeling Purposes

Action: It is assumed that temperature operations can perform reasonably well with flows included in model.

Rationale: A temperature model of Whiskeytown Reservoir has been developed by Reclamation. Further analysis using this or other temperature model is required to verify the statement that temperature operations can perform reasonably well with flows included in model.

Action Suite 1.2 Shasta Operations

Objectives: To address the avoidable and unavoidable adverse effects of Shasta operations on winter-run and spring-run:

1. Ensure a sufficient cold water pool to provide suitable temperatures for winter-run spawning between Balls Ferry and Bend Bridge in most years, without sacrificing the potential for cold water management in a subsequent year. Additional actions to those in the 2004 CVP/SWP operations Opinion are needed, due to increased vulnerability of the population to temperature effects attributable to changes in Trinity River ROD operations, projected climate change hydrology, and increased water demands in the Sacramento River system.
2. Ensure suitable spring-run temperature regimes, especially in September and October. Suitable spring-run temperatures will also partially minimize temperature effects to naturally-spawning, non-listed Sacramento River fall-run, an important prey base for endangered Southern Residents.
3. Establish a second population of winter-run in Battle Creek as soon as possible, to partially compensate for unavoidable project-related effects on the one remaining population.
4. Restore passage at Shasta Reservoir with experimental reintroductions of winter-run to the upper Sacramento and/or McCloud rivers, to partially compensate for unavoidable project-related effects on the remaining population.

Action 1.2.1 Performance Measures

Objective: To establish and operate to a set of performance measures for temperature compliance points and End-of-September (EOS) carryover storage, enabling Reclamation and NMFS to assess the effectiveness of this suite of actions over time. Performance measures will help to ensure that the beneficial variability of the system from changes in hydrology will be measured and maintained.

Action: To ensure a sufficient cold water pool to provide suitable temperatures, long-term performance measures for temperature compliance points and EOS carryover storage at

Shasta Reservoir shall be attained. Performance measures for EOS carryover storage at Shasta Reservoir are as follows:

- 87 percent of years: Minimum EOS storage of 2.2 MAF
- 82 percent of years: Minimum EOS storage of 2.2 MAF and end-of-April storage of 3.8 MAF in following year (to maintain potential to meet Balls Ferry compliance point)
- 40 percent of years: Minimum EOS storage 3.2 MAF (to maintain potential to meet Jelly's Ferry compliance point in following year)

Performance measures (measured as a 10-year running average) for temperature compliance points during summer season are:

- Meet Clear Creek Compliance point 95 percent of time
- Meet Balls Ferry Compliance point 85 percent of time
- Meet Jelly's Ferry Compliance point 40 percent of time
- Meet Bend Bridge Compliance point 15 percent of time

Action 1.2.1 Assumptions for CALSIM II Modeling Purposes

Action: No specific CALSIM II modeling code is implemented to simulate the Performance measures identified. System performance will be assessed and evaluated through post-processing of various model results.

Rationale: Given that the performance criteria are based on the CALSIM II modeling data used in preparation of the Biological Assessment, the system performance after application of the RPAs should be similar as a percentage of years that the end-of-April storage and temperature compliance requirements are met over the simulation period. Post-processing of modeling results will be compared to various new operating scenarios as needed to evaluate performance criteria and appropriateness of the rules developed.

Action 1.2.2 November through February Keswick Release Schedule (Fall Actions)

Objective: Minimize impacts to listed species and naturally spawning non-listed fall-run from high water temperatures by implementing standard procedures for release of cold water from Shasta Reservoir.

Action: Depending on EOS carryover storage and hydrology, Reclamation shall develop and implement a Keswick release schedule, and reduce deliveries and exports as needed to achieve performance measures.

Action 1.2.2 Assumptions for CALSIM II Modeling Purposes

Action: No specific CALSIM II modeling code is implemented to simulate the Performance measures identified. Keswick flows based on operation of 3406(b)(2) releases in OCAP Study 7.1 (for Existing) and Study 8 (for Future) are used in CALSIM II. These flows will be reviewed for appropriateness under this action. A post-process based evaluation similar to what has been explained in Action 1.2.1 will be conducted.

Rationale: Performance measures are set as percentage of years that the end-of-September and temperature compliance requirements are met over the simulation period. Post-processing of modeling results will be compared to various new operating scenarios as needed to evaluate performance criteria and appropriateness of the rules developed.

Action 1.2.3 February Forecast; March – May 14 Keswick Release Schedule (Spring Actions)

Objective: To conserve water in Shasta Reservoir in the spring in order to provide sufficient water to reduce adverse effects of high water temperature in the summer months for winter-run, without sacrificing carryover storage in the fall.

Action: 1) Reclamation shall make its February forecast of deliverable water based on an estimate of precipitation and runoff within the Sacramento River basin at least as conservative as the 90 percent probability of exceedance. Subsequent updates of water delivery commitments must be based on monthly forecasts at least as conservative as the 90 percent probability of exceedance.

2) Reclamation shall make releases to maintain a temperature compliance point not in excess of 56 degrees between Balls Ferry and Bend Bridge from April 15 through May 15.

Action 1.2.3 Assumptions for CALSIM II Modeling Purposes

Action: No specific CALSIM II modeling code is implemented to simulate the Performance measures identified. It is assumed that temperature operations can perform reasonably well with flows included in model.

Rationale: Temperature models of Shasta Lake and the Sacramento River have been developed by Reclamation. This modeling reflects current facilities for temperature controlled releases. Further analysis using this or another temperature model can further verify that temperature operations can perform reasonably well with flows included in model and temperatures are met reliably at each of the compliance points. In the future, it may be that adjusted flow schedules may need to be developed based on development of temperature model runs in conjunction with CALSIM II modeled operations.

Action 1.2.4 May 15 through October Keswick Release Schedule (Summer Action)

Objective: To manage the cold water storage within Shasta Reservoir and make cold water releases from Shasta Reservoir to provide suitable habitat temperatures for winter-run, spring-run, CV steelhead, and Southern DPS of green sturgeon in the Sacramento River between Keswick Dam and Bend Bridge, while retaining sufficient carryover storage to manage for next year's cohorts. To the extent feasible, manage for suitable temperatures for naturally spawning fall-run.

Action: Reclamation shall manage operations to achieve daily average water temperatures in the Sacramento River between Keswick Dam and Bend Bridge as follows:

1) Not in excess of 56°F at compliance locations between Balls Ferry and Bend Bridge from May 15 through September 30 for protection of winter-run, and not in excess of 56°F at the same compliance locations between Balls Ferry and Bend Bridge from October 1 through October 31 for protection of mainstem spring run, whenever possible.

2) Reclamation shall operate to a final Temperature Management Plan starting May 15 and ending October 31.

Action 1.2.4 Assumptions for CALSIM II Modeling Purposes

Action: No specific CALSIM II modeling code is implemented to simulate the Performance measures identified. It is assumed that temperature operations can perform reasonably well with flows included in model. During the detailed effects analysis, temperature modeling and post-processing will be used to verify temperatures are met at the compliance points. In the long-term approach, for a complete interpretation of the action, development of temperature model runs are needed to develop flow schedules if needed for implementation into CALSIM II.

Rationale: Temperature models of Shasta Lake and the Sacramento River have been developed by Reclamation. This modeling reflects current facilities for temperature controlled releases. Further analysis using this or another temperature model is required to verify the statement that temperature operations can perform reasonably well with flows included in model and temperatures are met reliably at each of the compliance points. It may be that alternative flow schedules may need to be developed based on development of temperature model runs in conjunction with CALSIM II modeled operations.

Action Suite 1.3 Red Bluff Diversion Dam (RBDD) Operations

Objectives: Reduce mortality and delay of adult and juvenile migration of winter-run, spring-run, CV steelhead, and Southern DPS of green sturgeon caused by the presence of the diversion dam and the configuration of the operable gates. Reduce adverse modification of the passage element of critical habitat for these species. Provide unimpeded upstream and downstream fish passage in the long term by raising the gates year-round, and minimize adverse effects of continuing dam operations, while pumps are constructed replace the loss of the diversion structure.

Action 1.3.1 Operations after May 14, 2012: Operate RBDD with Gates Out

Action: No later than May 15, 2012, Reclamation shall operate RBDD with gates out all year to allow unimpeded passage for listed anadromous fish.

Action 1.3.1 Assumptions for CALSIM II Modeling Purposes

Action: Adequate permanent facilities for diversion are assumed; therefore no constraint on diversion schedules is included in the Future condition modeling.

Action 1.3.2 Interim Operations

Action: Until May 14, 2012, Reclamation shall operate RBDD according to the following schedule:

•September 1 - June 14: Gates open. No emergency closures of gates are allowed.

•June 15 - August 31: Gates may be closed at Reclamation's discretion, if necessary to deliver water to TCCA.

Action 1.3.2 Assumptions for CALSIM II Modeling Purposes

Action: Adequate interim/temporary facilities for diversion are assumed; therefore no constraint on diversion schedules is included in the Existing condition modeling.

Action 1.4 Wilkins Slough Operations

Objective: Enhance the ability to manage temperatures for anadromous fish below Shasta Dam by operating Wilkins Slough in the manner that best conserves the dam's cold water pool for summer releases.

Action: The SRTTG shall make recommendations for Wilkins Slough minimum flows for anadromous fish in critically dry years, in lieu of the current 5,000 cfs navigation criterion to NMFS by December 1, 2009. In critically dry years, the SRTTG will make a recommendation.

Action 1.4 Assumptions for CALSIM II Modeling Purposes

Action: Current rules for relaxation of NCP in CALSIM II (based on BA models) will be used. In CALSIM II, NCP flows are relaxed depending on allocations for agricultural contractors. Table 2 is used to determine the relaxation.

TABLE 2

NCP FLOW SCHEDULE WITH RELAXATION

CVP AG Allocation (%)	NCP Flow (cfs)
<10	3250
10-25	3500
25-40	4000
40-65	4500
>65	5000

Rationale: The allocation-flow criteria have been used in the CALSIM II model for many years. The low allocation year relaxations were added to improve operations of Shasta Lake subject to 1.9 MAF carryover target storage. These criteria may be reevaluated subject to the requirements of Action 1.2.1

Action 2.1 Lower American River Flow Management

Objective: To provide minimum flows for all steelhead life stages.

Action: Implement the flow schedule specified in the Water Forum's Flow Management Standard (FMS), which is summarized in Appendix 2-D of the NMFS BO.

Action 2.1 Assumptions for CALSIM II Modeling Purposes

Action: The AFRMP Minimum Release Requirements (MRR) range from 800 to 2,000 cfs based on a sequence of seasonal indices and adjustments. The minimum Nimbus Dam release requirement is determined by applying the appropriate water availability index (Index Flow). Three water availability indices (i.e., Four Reservoir Index (FRI), Sacramento River Index (SRI), and the Impaired Folsom Inflow Index (IFII)) are applied during different times of the year, which provides adaptive flexibility in response to changing hydrological and operational conditions.

During some months, Prescriptive Adjustments may be applied to the Index Flow, resulting in the MRR. If there is no Prescriptive Adjustment, the MRR is equal to the Index Flow.

Discretionary Adjustments for water conservation or fish protection may be applied during the period extending from June through October. If Discretionary Adjustments are applied, then the resultant flows are referred to as the Adjusted Minimum Release Requirement (Adjusted MRR).

The MRR and Adjusted MRR may be suspended in the event of extremely dry conditions, represented by “conference years” or “off-ramp criteria”. Conference years are defined when the projected March through November unimpaired inflow into Folsom Reservoir is less than 400,000 acre-feet. Off-ramp criteria are triggered if forecasted Folsom Reservoir storage at any time during the next twelve months is less than 200,000 acre-feet.

Rationale: Minimum instream flow schedule specified in the Water Forum’s Flow Management Standard (FMS) is implemented in the model.

Action 2.2 Lower American River Temperature Management

Objective: Maintain suitable temperatures to support over-summer rearing of juvenile steelhead in the lower American River.

Action: Reclamation shall develop a temperature management plan that contains: (1) forecasts of hydrology and storage; (2) a modeling run or runs, using these forecasts, demonstrating that the temperature compliance point can be attained (see Coldwater Management Pool Model approach in Appendix 2-D); (3) a plan of operation based on this modeling run that demonstrates that all other non-discretionary requirements are met; and (4) allocations for discretionary deliveries that conform to the plan of operation.

Action 2.2 Assumptions for CALSIM II Modeling Purposes

Action: The flows in the model reflect the ARFMP implemented under Action 2.1. It is assumed that temperature operations can perform reasonably well with flows included in model.

Rationale: Temperature models of Folsom Lake and the American River were developed in the 1990’s. Model development for long range planning purposes may be required. Further analysis using a verified long range planning level temperature model is required to verify the statement that temperature operations can perform reasonably well with flows included in model and temperatures are met reliably

Action Suite 3.1 Stanislaus River / Eastside Division Actions

Overall Objectives: (1) Provide sufficient definition of operational criteria for Eastside Division to ensure viability of the steelhead population on the Stanislaus River, including freshwater migration routes to and from the Delta; and (2) halt or reverse adverse modification of steelhead critical habitat.

Action 3.1.2 Provide Cold Water Releases to Maintain Suitable Steelhead Temperatures

Action: Reclamation shall manage the cold water supply within New Melones Reservoir and make cold water releases from New Melones Reservoir to provide suitable temperatures for CV steelhead rearing, spawning, egg incubation smoltification, and adult migration in the Stanislaus River downstream of Goodwin Dam.

Action 3.1.2 Assumptions for CALSIM II Modeling Purposes

Action: No specific CALSIM II modeling code is implemented to simulate the Performance measures identified. It is assumed that temperature operations can perform reasonably well with flow operations resulting from the minimum flow requirements described in action 3.1.3.

Rationale: Temperature models of New Melones Lake and the Stanislaus River have been developed by Reclamation. Further analysis using this or another temperature model can further verify that temperature operations perform reasonably well with flows included in model and temperatures are met reliably. Development of temperature model runs is needed to refine the flow schedules assumed.

Action 3.1.3 Operate the East Side Division Dams to Meet the Minimum Flows, as Measured at Goodwin Dam

Objective: To maintain minimum base flows to optimize CV steelhead habitat for all life history stages and to incorporate habitat maintaining geomorphic flows in a flow pattern that will provide migratory cues to smolts and facilitate out-migrant smolt movement on declining limb of pulse.

Action: Reclamation shall operate releases from the East Side Division reservoirs to achieve a minimum flow schedule as prescribed in NMFS BO Appendix 2-E and generally described in figure 11-1. When operating at higher flows than specified, Reclamation shall implement ramping rates for flow changes that will avoid stranding and other adverse effects on CV steelhead.

Action 3.1.3 Assumptions for CALSIM II Modeling Purposes

Action: Minimum flows based on Appendix 2-E flows (presented in Figure 1) are assumed consistent to what was modeled by NMFS (5/14/09 and 5/15/09 CALSIM II models provided by NMFS; relevant logic merged into baselines models).

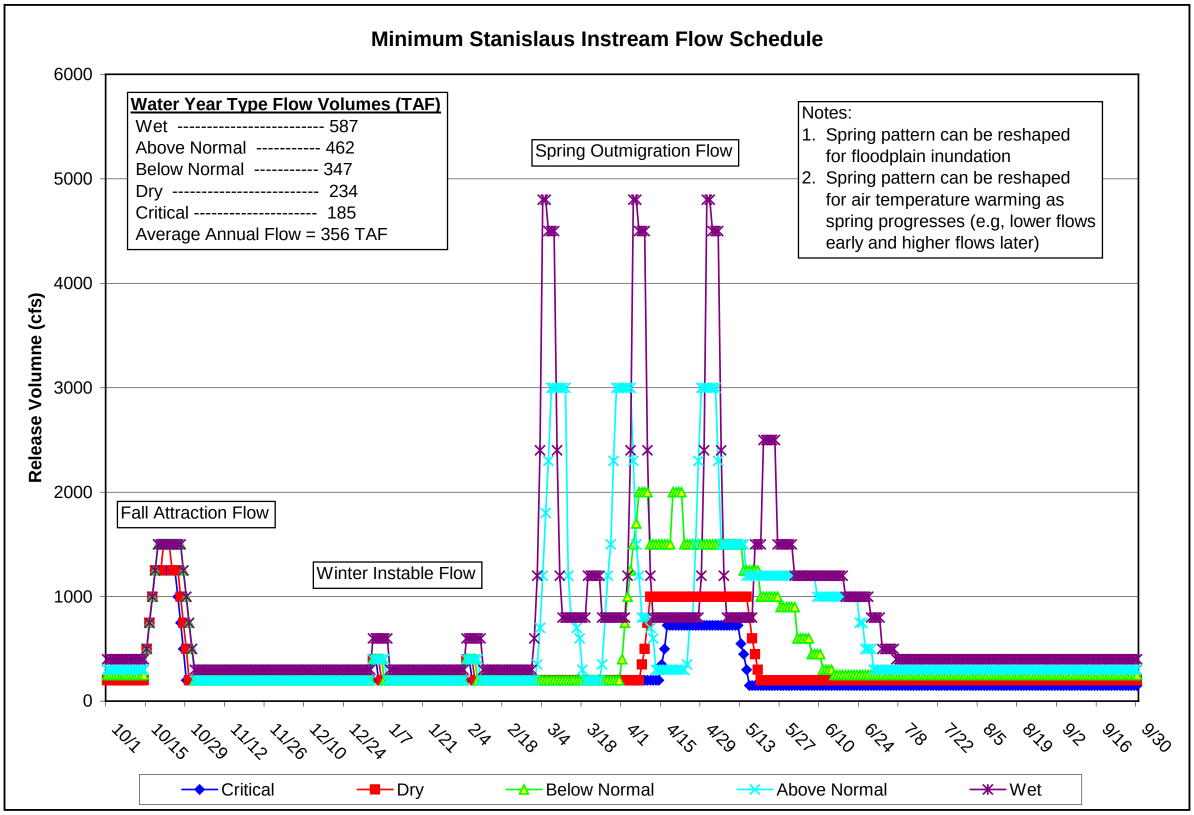

FIGURE 1. MINIMUM STANISLAUS INSTREAM FLOW SCHEDULE AS PRESCRIBED IN APPENDIX 2-E OF THE NMFS BO (06/04/09)

Annual allocation in New Melones is modeled to ensure availability of required instream flows (Table 3) based on a water supply forecast that is comprised of end-of-February New Melones storage (in TAF) plus forecasted inflow to New Melones from March 1 to September 30 (in TAF). The "forecasted inflow" is calculated using perfect foresight in the model. Allocated volume of water is released according to water year type following the monthly flow schedule illustrated in Figure 1.

TABLE 3

NEW MELONES ALLOCATIONS TO MEET MINIMUM INSTREAM FLOW REQUIREMENTS

New Melones index (TAF)	Annual allocation required for instream flows (TAF)
<1000	0-98.9
1,000 - 1,399	98.9
1,400 - 1,724	185.3
1,725 – 2,177	234.1
2,178 - 2,386	346.7
2,387 – 2,761	461.7
2,762 – 6,000	586.9

Rationale: This approach was reviewed by NOAA fisheries and verified that the year typing and New Melones allocation scheme are consistent with the modeling prepared for the BO.

Action Suite 4.1 Delta Cross Channel (DCC) Gate Operation, and Engineering Studies of Methods to Reduce Loss of Salmonids in Georgiana Slough and Interior Delta

Action 4.1.2 DCC Gate Operation

Objective: Modify DCC gate operation to reduce direct and indirect mortality of emigrating juvenile salmonids and green sturgeon in November, December, and January.

Action: During the period between November 1 and June 15, DCC gate operations will be modified from the proposed action to reduce loss of emigrating salmonids and green sturgeon. From December 1 to January 31, the gates will remain closed, except as operations are allowed using the implementation procedures/modified Salmon Decision Tree.

Timing: November 1 through June 15.

Triggers: Action triggers and description of action as defined in NMFS BO are presented in Table 4.

TABLE 4

NMFS BO DCC GATE OPERATION TRIGGERS AND ACTIONS

Date	Action Triggers	Action Responses
October 1 – November 30	Water quality criteria per D-1641 are met and either the Knights Landing Catch Index (KLCI) or the Sacramento Catch Index (SCI) are greater than 3 fish per day but less than or equal to 5 fish per day.	Within 24 hours of trigger, DCC gates are closed. Gates will remain closed for 3 days.
	Water quality criteria per D-1641 are met and either the KLCI or SCI is greater than 5 fish per day	Within 24 hours, close the DCC gates and keep closed until the catch index is less than 3 fish per day at both the Knights Landing and Sacramento monitoring sites.
	The KLCI or SCI triggers are met but water quality criteria are not met per D-1641 criteria.	DOSS reviews monitoring data and makes recommendation to NMFS and WOMT per procedures in Action IV.5.
December 1 – December 14	Water quality criteria are met per D-1641.	DCC gates are closed. If Chinook salmon migration experiments are conducted during this time period (e.g., Delta Action 8 or similar studies), the DCC gates may be opened according to the experimental design, with NMFS' prior approval of the study.
	Water quality criteria are not met but both the KLCI and SCI are less than 3 fish per day.	DCC gates may be opened until the water quality criteria are met. Once water quality criteria are met, the DCC gates will be closed within 24 hours of compliance.
	Water quality criteria are not met but either of the KLCI or SCI is greater than 3 fish per day.	DOSS reviews monitoring data and makes recommendation to NMFS and WOMT per procedures in Action IV.5

TABLE 5 (CONTINUED)

NMFS BO DCC GATE OPERATION TRIGGERS AND ACTIONS

Date	Action Triggers	Action Responses
December 15 – January 31	December 15-January 31	DCC Gates Closed.
	NMFS-approved experiments are being conducted.	Agency sponsoring the experiment may request gate opening for up to five days; NMFS will determine whether opening is consistent with ESA obligations.
	One-time event between December 15 to January 5, when necessary to maintain Delta water quality in response to the astronomical high tide, coupled with low inflow conditions.	Upon concurrence of NMFS, DCC Gates may be opened one hour after sunrise to one hour before sunset, for up to 3 days, then return to full closure. Reclamation and DWR will also reduce Delta exports down to a health and safety level during the period of this action.
February 1 – May 15	D-1641 mandatory gate closure.	Gates closed, per WQCP criteria
May 16 – June 15	D-1641 gate operations criteria	DCC gates may be closed for up to 14 days during this period, per 2006 WQCP, if NMFS determines it is necessary.

Action 4.1.2 Assumptions for CALSIM II Modeling Purposes

Action: The DCC gate operations for October 1 through January 31 were layered on top of the D-1641 gate operations already included in the CALSIM II model. The general assumptions regarding the NMFS DCC operations are summarized in Table 5.

Timing: October 1 through January 31.

TABLE 5

DCC GATE OPERATION TRIGGERS AND ACTIONS AS MODELED IN CALSIM II

Date	Modeled Action Triggers	Modeled Action Responses
October 1-December 14	Sacramento River daily flow at Wilkins Slough exceeding 7,500 cfs; flow assumed to flush salmon into the Delta	Each month, the DCC gates are closed for number of days estimated to exceed the threshold value.
	Water quality conditions at Rock Slough subject to D-1641 standards	Each month, the DCC gates are not closed if it results in violation of the D-1641 standard for Rock Slough; if DCC gates are not closed due to water quality conditions, exports during the days in question are restricted to 2,000 cfs.
December 15 – January 31	December 15-January 31	DCC Gates Closed.

Flow Trigger: It is assumed that during October 1 – December 14, the DCC will be closed if Sacramento River daily flow at Wilkins Slough exceeds 7,500 cfs. Using historical data (1945 through 2003, USGS gauge 11390500 “Sacramento River below Wilkins Slough near Grimes, CA"), a linear relationship is obtained between average monthly flow at Wilkins Slough and the number of days in month where the flow exceeds 7,500 cfs. This relation is then used to estimate the number of days of DCC closure for the October 1 – December 14 time period (Figure 2).

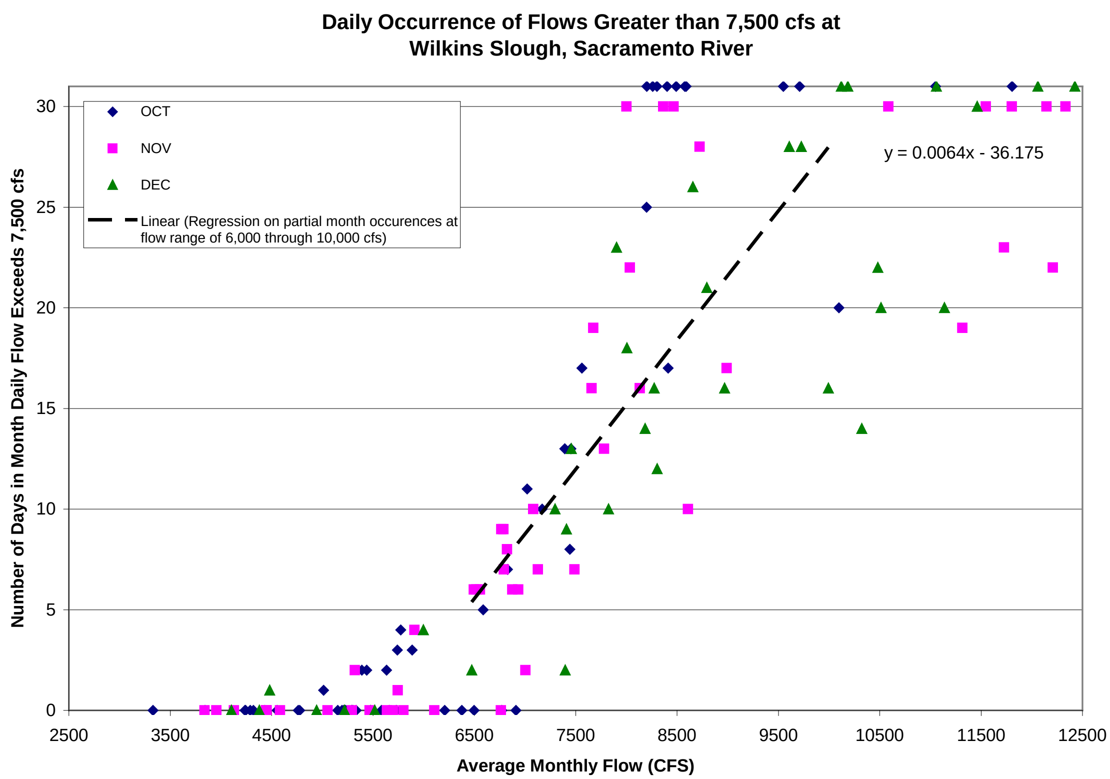

FIGURE 2. RELATIONSHIP BETWEEN MONTHLY AVERAGES OF SACRAMENTO RIVER FLOWS AND NUMBER OF DAYS THAT DAILY FLOW EXCEEDS 7,500 CFS IN A MONTH AT WILKINS SLOUGH

It is assumed that during December 15 through January 31 that the DCC gates are closed under all flow conditions.

Water Quality: It is assumed that during October 1 – December 14 the DCC gates may remain open if water quality is a concern. Using the CALSIM II-ANN flow-salinity model for Rock Slough, current month's chloride level at Rock Slough is estimated assuming DCC closure per NMFS BO. The estimated chloride level is compared against the Rock Slough chloride standard (monthly average). If estimated chloride level exceeds the standard, the gate closure is modeled per D1641 schedule (for the entire month).

It is assumed that during December 15 through January 31 that the DCC gates are closed under all water quality conditions.

Export Restriction: During October 1 – December 14 period, if the flow trigger condition is such that additional days of DCC gates closed is called for, however water quality conditions are a concern and the DCC gates remain open, then Delta exports are limited to 2,000 cfs for each day in question. A monthly Delta export restriction is calculated based on the trigger and water quality conditions described above.

Rationale: The proposed representation in CALSIM II should adequately represent the limited water quality concerns were Sacramento River flows are low during the extreme high tides of December.

Action Suite 4.2 Delta Flow Management

Action 4.2.1 San Joaquin River Inflow to Export Ratio

Objectives: To reduce the vulnerability of emigrating CV steelhead within the lower San Joaquin River to entrainment into the channels of the South Delta and at the pumps due to the diversion of water by the export facilities in the South Delta, by increasing the inflow to export ratio. To enhance the likelihood of salmonids successfully exiting the Delta at Chipps Island by creating more suitable hydraulic conditions in the main stem of the San Joaquin River for emigrating fish, including greater net downstream flows.

Action: For CVP and SWP operations under this action, “The Phase II: Operations beginning is 2012” is assumed. From April 1 through May 31, 1) Reclamation shall continue to implement the Goodwin flow schedule for the Stanislaus River prescribed in Action 3.1.3 and Appendix 2-E of the NMFS BO); and 2) Combined CVP and SWP exports shall be restricted to the ratio depicted in table 6 below based on the applicable San Joaquin River Index, but will be no less than 1,500 cfs (consistent with the health and safety provision governing this action.)

Action 4.2.1 Assumptions for CALSIM II Modeling Purposes

Action: Flows at Vernalis during April and May will be based on the Stanislaus River flow prescribed in Action 3.1.3 and the flow contributions from the rest of the San Joaquin River basin consistent with the representation of VAMP contained in the BA modeling. In many years this flow may be less than the minimum Vernalis flow identified in the NOAA BO.

Exports are restricted as illustrated in Table 6.

TABLE 6

MAXIMUM COMBINED CVP AND SWP EXPORT DURING APRIL AND MAY

San Joaquin River Index	Combined CVP and SWP Export Ratio
Critically dry	1:1
Dry	2:1
Below normal	3:1
Above normal	4:1
Wet	4:1

Rationale: Although the described model representation does not produce the full Vernalis flow objective outlined in the NOAA BO, it does include the elements that are within the control of the CVP and SWP, and that are reasonably certain to occur for the purpose of the EIS/EIR modeling.

In the long-term, a future SWRCB flow standard at Vernalis may potentially incorporate the full flow objective identified in the BO; and the Merced and Tuolumne flows would be based on the outcome of the current SWRCB and FERC processes that are underway.

Action 4.2.3 Old and Middle River Flow Management

Objective: Reduce the vulnerability of emigrating juvenile winter-run, yearling spring-run, and CV steelhead within the lower Sacramento and San Joaquin rivers to entrainment into the channels of the South Delta and at the pumps due to the diversion of water by the export facilities in the South Delta. Enhance the likelihood of salmonids successfully exiting the Delta at Chipps Island by creating more suitable hydraulic conditions in the mainstem of the San Joaquin River for emigrating fish, including greater net downstream flows.

Action: From January 1 through June 15, reduce exports, as necessary, to limit negative flows to -2,500 to -5,000 cfs in Old and Middle Rivers, depending on the presence of salmonids. The reverse flow will be managed within this range to reduce flows toward the pumps during periods of increased salmonid presence. Refer to NMFS BO document for the negative flow objective decision tree.

Action 4.2.3 Assumptions for CALSIM II Modeling Purposes

Action: Old and Middle River flows required in this BO are assumed to be covered by OMR flow requirements developed for actions 1 through 3 of the FWS BO Most Likely scenario (Representation of U.S. Fish and Wildlife Service Biological Opinion Reasonable and Prudent Alternative Actions for CALSIM II Planning Studies – DRAFT, 6/10/09).

Rationale: Based on a review of available data, it appears that implementation of actions 1 through 3 of the FWS RPA, and action 4.2.1 of the NOAA RPA will adequately cover this action within the CALSIM II simulation. If necessary, additional post-processing of results could be conducted to verify this assumption.

Attachment

Draft Potential Fishery Impacts of San Joaquin River Restoration Sensitivity Analysis

Final
Program Environmental Impact Statement/Report

SAN JOAQUIN RIVER RESTORATION PROGRAM

Final
July 2012

Draft

Potential Fishery Impacts of San Joaquin River Restoration Sensitivity Analysis

CalSim Code Implementation

September 3, 2010

Introduction

This Technical Memorandum documents the development of 12 CalSim simulations in support of the Potential Fishery Impacts of San Joaquin River Restoration Sensitivity Analysis.

The sensitivity analysis was developed to investigate the potential for San Joaquin River and Delta fishery impacts of the San Joaquin River Restoration Project (SJRRP) under various implementations of the RPAs to be different than the impacts described in the Draft PEIS/R. The CalSim simulations were developed in an attempt to capture the range of potential operations, and subsequent fishery impacts that could occur under any implementation scheme. As such these simulations were not refined in an attempt to develop "viable" or "reasonable" operations, potentially "unviable" or "unreasonable" operations were left in the simulations if they occurred. The final set of simulations is assumed to define an outer boundary of potential SJRRP impacts given the uncertainty in any final implementation of the RPA's or definition of "viable" or "reasonable" operations. These simulations were then used to attempt to define an outer boundary of potential fishery impacts from any RPA implementation and operational response to the implementation.

These CalSim simulations are intended to represent extremes of operation for fishery analysis purposes; they are not intended to represent Reclamation suggested implementations or Reclamation policy in any form. Use of these simulations for any purpose outside the context of this sensitivity study must be done with a full understanding of the potential that conclusions drawn from such use do not represent Reclamation policy, and may be misleading or factually incorrect.

Baseline Provided by Reclamation

A baseline study labeled "CALSIM_040110_FINAL" was provided by Reclamation. The baseline was an Existing LOD two-step TXFR study. Several global modifications were required to adapt the model for use in the sensitivity analysis.

Single-Step CONV Baseline

To simplify the sensitivity analysis and shorten model runtime, the baseline was condensed into a single-step CONV study. Within the existing structure of CALSIM, the San Joaquin River and tributary operations are completely simulated within the CONV step. Three components of the TXFR step were implemented in the CONV step. This included CVP Cross Valley Canal wheeling through Banks Pumping Plant, CVP Joint Point wheeling through Banks Pumping Plant, and Sacramento County Water Agency diversions of Delta surplus at Freeport. Stage 2 transfers were not included in the CONV step since Stage 2 transfers were turned off in the CALSIM_040110_FINAL TXFR step.

In the baseline provided by Reclamation, Contra Costa Water District Delta diversions were dependent on ANN calculations of salinity at CCWD intakes. ANN calculations of salinity varied from cycle to cycle within the same time-step. This occasionally caused instability in modeling Delta operations from one cycle to the next. In the single-step CONV baseline, CCWD diversions are based on static time-series input from DSM2. This eliminated the cyclical instability.

Comparisons were made between the two-step TXFR and single-step CONV baselines and no significant change in simulated operations was observed. There were occasional small differences in results due to the change in CCWD intake water quality or other modeling noise, but no changes were observed that would affect the conclusions of the sensitivity analysis.

Other Baseline Changes

Missing in the model provided by Reclamation was the implementation of the 2009 BO Vernalis flow RPA (April-May flow requirement at Vernalis). The Vernalis April-May flow RPA was "turned on" by making the following changes to VERNALIS_MIN.WRESL (~~red~~ = deleted text, **blue** = inserted text):

```
define NOAAVernMin_req {!value     0. }
!     case AprORMay {
!          condition month == apr .or. month == may
!          select NOAAmin from NOAAVern60dayMin where WYT = wyt_SJR
}
!     case otherwise {
!          condition always
!          value     0. }
!          }
```

To correct an existing table error, the lookup table NOAAVern60dayMin was edited as follows:

```
! NOAA Phase II RPA flow reqt at Vernalis for Apr1-May31.
NoaaVern60dayMin
WYT    NOAAmin
1      6000
2      6000
3      4500
4      3000
5      601500
```

In VERNALIS_MIN.WRESL, logic for disaggregating April and May Vernalis minimum flow releases was added. Before, with the Vernalis flow RPA "turned off," there was no need to disaggregate the release requirements into April and May pulse and non-pulse periods because the Vernalis minimum flow requirements only applied in the non-pulse period. Now, with the Vernalis flow RPA "turned on," Vernalis flow requirements cover all of April and May. With differing base releases in the pulse and non-pulse periods, the required releases needed to be calculated separately. The added disaggregation logic, where 'np' stands for non-pulse and 'p' stands for pulse, is as follows:

```
define VernMin_def_np {
   case AprilorMay {
      condition range(month,apr,may)
      value     max(0., max(NOAAVernMin_req, X2VernMin_req) -
C639[SJR_WQ1])
   }
   case otherwise {
      condition always
      value     max (0., VernMin_req - C639[SJR_WQ1] -
C10DO[VAMP_AND_DO])
   }
}

define VernMin_def_p {
   case AprilorMay {
      condition range(month,apr,may)
      value     max(0., NOAAVernMin_req - C639[VAMP_AND_DO])
   }
   case otherwise {
      condition always
      value     0.
   }
}


define VernMinRemGood_np {
   case AprilMay {
      condition range(month,apr,may)
      value     max(0.,maxGoodwin - C520[SJR_WQ1] + C520F[SJR_WQ1])
   }
   case otherwise {
      condition always
      value     max(0.,maxGoodwin - C520[VAMP_AND_DO] +
C520F[VAMP_AND_DO])
   }
}
define VernMinRemGood_p {
   case AprilMay {
      condition range(month,apr,may)
      value     max(0.,maxGoodwin - C520[VAMP_AND_DO] +
C520F[VAMP_AND_DO])
   }
   case otherwise {
      condition always
      value     0.
```

```
   }
}

define VernMinRel1_np {value min(VernMin_def_np,VernMinRemGood_np)}
define VernMinRel1_p {value min(VernMin_def_p,VernMinRemGood_p)}

define Rel1_np_frac {
   case April {
      condition month == apr .and. VernMinRel1_np + VernMinRel1_p >
0.1
      value
   VernMinRel1_np*cfs_taf*14./30./(VernMinRel1_np*cfs_taf*14./30. +
VernMinRel1_p*cfs_taf*16./30.)
   }
   case May {
      condition month == may .and. VernMinRel1_np + VernMinRel1_p >
0.1
      value
   VernMinRel1_np*cfs_taf*16./31./(VernMinRel1_np*cfs_taf*16./31. +
VernMinRel1_p*cfs_taf*15./31.)
   }
   case otherwise {
      condition always
      value     1.
   }
}


define VernMinCaprem_np {
   case April {
      condition month == apr
      value     Rel1_np_frac*VernMinCapRem*30./14.
   }
   case May {
      condition month == may
      value     Rel1_np_frac*VernMinCapRem*31./16.
   }
   case otherwise {
      condition always
      value     VernMinCapRem
   }
}

define VernMinCaprem_p {
   case April {
      condition month == apr
      value     max(0.,1. - Rel1_np_frac)*VernMinCapRem*30./16.
   }
   case May {
      condition month == may
      value     max(0.,1. - Rel1_np_frac)*VernMinCapRem*31./15.
   }
   case otherwise {
      condition always
```

```
        value     0.
    }
}

define VernMinRel_np {value min(VernMinRel1_np,VernMinCaprem_np)}
define VernMinRel_p {value min(VernMinRel1_p,VernMinCaprem_p)}

!define VernMin_reqtobemet { value min(VernMinRemGoodRipon,
VernMin_def, VernMinCapRem)}
define VernMin_reqtobemet {
        condition month == apr
        value     (14.*VernMinRel_np + 16.*VernMinRel_p)/30.
    }
    case May {
        condition month == may
        value     (16.*VernMinRel_np + 15.*VernMinRel_p)/31.
    }
    case otherwise {
        condition always
        value     VernMinRel_np
    }
}
```

In VERNALIS_MIN.WRESL, calculation of the annual allocation release cap for Vernalis minimum flows was edited so that in February the cap depends on a forward looking New Melones forecast rather than the previous year’s New Melones forecast for the ending contract year. The modification provides better consistency with actual operating practice of making releases based on the upcoming year’s water supply rather than being bound by the previous year’s contract year allocations. The code changes are as follows:

~~define VernMinCap { select VernMinCap from stan_yr given NMF=NMforecast1 use minimum }~~

```
define sumI10_part_feb {
     case February{
          condition   month==FEB
          sum     (i=mar-month,mar-month+6,1) I10(i) * cfs_TAF(i)
     }
     case otherwise {
          condition     always
          value      0.
     }
}

define NMfore_feb_est {
    case February {
        condition month == feb
        value     S10[SJR_WQ1] + sumI10_part_feb
    }
    case otherwise {
        condition always
        value     0.
```

```
   }
}
define NMfore_feb_est_ {alias NMfore_feb_est kind 'forecast' units
'taf'}

define VernMinCap {
   case February {
      condition month == feb
      select       VernMinCap from stan_yr given NMF=NMfore_feb_est
use minimum
   }
   case otherwise {
      condition always
      select       VernMinCap from stan_yr given NMF=NMforecast1 use
minimum
   }
}
```

In WQ_BOUND_DISAG.WRESL, the disaggregated pulse and non-pulse release requirements generated in VERNALIS_MIN.WRESL were inserted into the water quality calculations. The intent was to properly represent the water quality effects of the Vernalis flow RPA during the April and May pulse and non-pulse periods. Furthermore, two decision variables are created in WQ_BOUND_DISAG.WRESL – C10MIN_P and C10MIN_NP – to provide pulse and non-pulse New Melones release output for Vernalis minimum flow requirements.

San Joaquin River Restoration

The sensitivity analysis required each set of assumptions to be tested both with and without SJR Restoration. In the baseline, Restoration is turned off. Turning Restoration on requires several line changes in the study main wresl file: MAINCONV_SA.WRESL. These changes are as follows:

In Cycle 1, change:

```
INCLUDE '..\..\common\sanjoaquin\Friant\SJRR_Rest_off.wresl'
```

To:

```
INCLUDE '..\..\common\sanjoaquin\Friant\SJRR_Rest.wresl'
```

In Cycles 1 and 2, change:

```
INCLUDE[LOCAL]
'..\..\common\sanjoaquin\Friant\SJR_Rest_Req_Off_Local.wresl'
```

To:

```
INCLUDE[LOCAL]
'..\..\common\sanjoaquin\Friant\SJR_Rest_Req_Local.wresl'
```

In Cycles 3, 4, and 5, change:

```
INCLUDE[LOCAL]
'..\..\common\sanjoaquin\Friant\SJR_Rest_Req_Off_Local.wresl'
```

To:

```
INCLUDE[LOCAL]
'..\..\common\sanjoaquin\Friant\SJR_Rest_Pulse_Local.wresl'
```

In Cycles 6, 7, 8, and 9, change:

```
INCLUDE[LOCAL]
'..\..\common\sanjoaquin\Friant\SJR_Rest_Req_Off_Local.wresl'
```

To:

```
INCLUDE[LOCAL] '..\..\common\sanjoaquin\Friant\SJR_Rest_Full.wresl'
```

In addition to the wresl code changes, Friant release requirements are entered as timeseries data in the CalSim SV DSS file. The B-Part names of the timeseries are REST_REQ_P and REST_REQ_NP. P and NP stand for pulse and non-pulse periods respectively.

CalSim Alternative Simulations

Six different alternatives, or sets of assumptions, were identified by Reclamation to be included in the analysis. Each of the alternatives were modeled both with and without the SJRRP included in order to see the impacts of the SJRRP on operations and flows. These alternatives are characterized in the following table with a brief description of each alternatives's intent and salient assumptions following.

Alternative	VAMP	Stanislaus RPA with reference to VAMP	Stockton East Allocations
1	OFF	First	Variable (90 TAF)
2	OFF	First	100% (155 TAF)
3	ON	First	Variable (90 TAF)
4	ON	Last	Variable (90 TAF)
5	ON	First	100% (155 TAF)
6	ON	Last	100% (155 TAF)

Alternative 1

This setting tests a Basin operation that does not include the VAMP component of the SJRA. The underlying operation of the Stanislaus River includes the Baselines model's operation to the 2009 BO, inclusive of releases for the river flow RPA, Vernalis RPA, D1641 flow and water quality objectives, and Stanislaus River dissolved oxygen objectives. The alternative includes SJRA fall releases in the Stanislaus River and Merced River, but does not include an operation for VAMP during April and May. CVP Stanislaus River contractors are provided allocations ranging from zero (0) up to 90 TAF per year based on water supply availability (based on the New Melones Index – "NMI") and is consistent with the EIR/S studies.

VAMP was "turned off" by setting the values in the CalSim lookup table VAMP_REQ.table to zero.

VAMP_REQ
Base requirement DoubleStep

0	0	0
1999	0	0
3199	0	0
4449	0	0
5699	0	0
99999	0	0

The assumption “Stanislaus RPA with reference to VAMP” relates to how VAMP tributary flow contributions are determined. When established as “first”, means basing the VAMP flow target and tributary contributions on an operation (“VAMP existing flow”) that assumes the Stanislaus River flow RPA exists absent VAMP. When established as “last”, the calculation of VAMP existing flow and tributary contributions assumes the Stanisluas River IPO flow exists absent the VAMP, but the RPA flow will be ultimately released subsequent to the VAMP calculation.

To set the Stanislaus RPA “first” in both the pulse and non-pulse periods, the lookup tables that implemented the Goodwin IPO release were replaced with the tables developed by Derek Hilts to implement the pulse and non-pulse RPA. Calls to the non-pulse RPA table are made in Cycles 1 and 2 in STAN_FW_MIN.WRESL. This required the following edits to the baseline (~~red~~ = deleted text, **blue** = inserted text):

```
define stanmin {
    case AprilMay {
        condition month==APR
        select ~~stanfish ~~**flow** from Stan_~~monfish~~**rpa** given
stanyr=stanfish_yr use linear where month=month}
    case notAprMay {
        condition always
        select flow from stan_rpa given stanyr=stanfish_yr use
linear where month=month}
}
```

(Note that while a conditional statement is applied to maintain consistency with the baseline code, there is no need for a conditional statement since the table call is the same whether the month is April or not.)

Calls to the pulse RPA table are made in Cycles 3, 4 and 5 in Stan_FW_pulse.wresl. The following edit was made to the baseline:

```
define stanpulse {
    case April {
        condition       month == apr
        select          pulse from stan_pulse**_rpa** given stanyr =
stanfish_yr use linear }
    case May {
        condition       month == may
        select          pulse from stan_pulse_rpa given stanyr =
stanfish_yr use linear }
    case otherwise {
```

```
condition        always
value            0. }
}
```

The variables stanmin and stanpulse form the upper bound of C520_MIF in the non-pulse and pulse periods respectively. The C520_MIF variable is typically associated with Goodwin releases supporting the IPO. For this study it is used for the Stanislaus RPA flow requirements. A variable C10RPA is included in the model for Stanislaus RPA releases when they occur “last.” The wresl file that implements the Stanislaus RPA last is STAN_NMFS_RPA.WRESL. As such, the “include” statement for this file is commented out in SANJOAQUINADDCYC6.WRESL, and the variable C10RPA is set to zero.

```
!    INCLUDE 'Stanislaus\Stan_NMFS_RPA.wresl'
goal setC10RPAcycle6 { C10RPA = 0. }
```

From the baseline, the cap on Stockton East’s CVP Stanislaus River allocations was reduced from 155 TAF to 90 TAF (SEWD 10 TAF, CSJSEWD 80 TAF). This was done using the stan_yr.table from pre 2009 BO studies and renaming it stan_yr_90.table. The file stan_year_90.table was referenced in STANISLAUS_DEMS.WRESL when retrieving annual allocations for SEWD and CSJWCD. For Sensitivity 1, allocations remained variably dependent on the NMI water supply forecast.

In VERNALIS_MIN.WRESL, the baseline reduced Stanislaus releases necessary to meet Vernalis minimum flow requirements by the amount calculated for release for the Stanislaus RPA. When the Stanislaus RPA is “first,” this release is already included in the base flow. So the Vernalis release corrections were removed as follows:

define VernMin_def {value max(0., VernMin_def1~~ - StanNMFSdef~~)}

define VernMinRemGoodRipon {value max(0., VernMinRemGoodRipon1~~ - StanNMFSdef~~)}

Sensitivity 2

The differences between Sensitivity 2 and Sensitivity 1 are CVP Stanislaus River contractor demands and allocations. In Sensitivity 1, contractor allocations of Stanislaus River water were capped at 90 TAF and the allocations varied with the NMI. Whereas in Sensitivity 2, the contractors’ demand and allocations for Stanislaus River water were raised to 155 TAF, and an allocation of 100% of demand was provided every year. The stan_yr.table developed for the 2009 BO studies was modified so that SEWD and CSJWCD receive75 TAF and 80 TAF CVP allocations, respectively, with no conditioning by the state of the NMI. Furthermore, the lookup table URBAN_DEMAND3.TABLE was modified so that the monthly M&I demands for arc D510 summed up to 75 TAF annually.

In STANISLAUS_DEMS.WRESL, the demand constraint for D520_SEWD_PMI was removed allowing the SEWD M&I demands to be entirely controlled at the point of delivery (D510). Furthermore, losses in the SEWD canal (estimated in CalSim as 5% of flow) were assumed to be part of the increased SEWD demand. Therefore, 5% SEWD demand is assumed channel loss and the remaining 95% is assumed to be actual use. This logic was already established for the SEWD agricultural deliveries. The following change to CALAVERAS_DEMS.WRESL was made for the M&I deliveries.

```
! Set City of Stockton/SEWD M&I delivery to meet delivery requirment
goal meet_D510_MI {D510_MI < max(0., demand_D510_MI*taf_cfs)*0.95}
```

In the above statement, demand_D510_MI is the monthly M&I demand for SEWD retrieved from URBAN_DEMAND3.TABLE. As stated previously, the table was updated so that the monthly M&I demands summed up to 75 TAF annually. The 0.95 correction factor recognizes that 5% of the demand ends up lost in arc L509 and the remainder is delivered to the service area.

While SEWD was allocated 100% of demand every year, a trigger was placed in STANISLAUS_DEMS.WRESL to reduce deliveries when there is encroachment on the New Melones minimum power pool. Reclamation provided the assumption for the minimum power pool capacity of 300 TAF. The following additional wresl code incorporated:

```
!No deliveries to SEWD/CSJID if encroaching on power pool.
goal maxdelivD520_PMI { D520_SEWD_PMI + D520_CSJSEWD_PAG < max(0.,
S10(-1) - 300.)*taf_cfs }
```

Sensitivity 3

Sensitivity 3 is the same as Sensitivity 1 except that the VAMP component of the SJRA is “turned on.” In this sensitivity VAMP is based upon a calculation assuming the Stanislaus River flow RPA at Goodwin, and the CVP Stanislaus River contractors are allocated a varying 0-90 TAF water supply.

The lookup table VAMP_REQ.TABLE was returned to the original found in the Reclamation provided baseline.

VAMP_REQ

Base	requirement	DoubleStep
0	2000	3200
1999	2000	3200
3199	3200	4450
4449	4450	5700
5699	5700	7000
99999	7000	7000

Sensitivity 4

Sensitivity 4 is like Sensitivity 3 given that the CVP Stanislaus River contractors’ allocations vary with the NMI and are capped at 90 TAF, and the VAMP flow requirements are turned on. However, the difference of this setting is that the Stanislaus

RPA is applied before VAMP operations (first) in Sensitivity 3 and after VAMP operations (last) in Sensitivity 4. In result, this protocol can produce Vernalis flows that vary from VAMP flow targets. In summary, the VAMP flow target and tributary contributions are based on a calculation that assumes Goodwin releases are consistent with the IPO. The tributary contributions are “frozen” to this calculation. Then, Goodwin releases will be operated to the 2009 BO Stanislaus River flow RPA which may be higher or lower in flow than the IPO. In the end, the tributary contribution and flow during the VAMP period will approximate the flow that would have occurred under IPO operations; however, the flow at Vernalis may differ from the VAMP flow target by the amount of difference between Goodwin releases under the IPO and the RPA. There were many code changes to accomplish this operation.

For the April non-pulse period (April 1 to April 14), the Cycle 1 and 2 Goodwin minimum flows were set according to the IPO rather than the BO RPA in STAN_FW_MIN.WRESL:

```
define stanmin {
    case AprilMay {
        condition month==APR
        select ~~flow ~~stanfish from Stan_~~rpa~~monfish given
stanyr=stanfish_yr use linear where month=month}
    case notAprMay {
        condition always
        select flow from stan_rpa given stanyr=stanfish_yr use
linear where month=month}
}
```

For the April and May pulse period (April 15 – May 15), the Cycle 3, 4, and 5 Goodwin minimum flows were set according to the IPO rather than the BO RPA in STAN_FW_PULSE.WRESL:

```
define stanpulse {
    case April {
        condition       month == apr
        select          pulse from stan_pulse~~_rpa~~ given stanyr =
stanfish_yr use linear }
    case May {
        condition       month == may
        select          pulse from stan_pulse~~_rpa~~ given stanyr =
stanfish_yr use linear }
    case otherwise {
        condition       always
        value           0. }
        }
```

In Cycle 6, the file SANJOAQUINADDCYC6.WRESL was edited so that STAN_NMFS_RPA.WRESL was included and C10RPA was not set to zero:

```
~~!~~    INCLUDE 'Stanislaus\Stan_NMFS_RPA.wresl'
~~goal setC10RPAcycle6 { C10RPA = 0. }~~
```

Changes were made to STAN_NMFS_RPA.WRESL to calculate any flow deficit or surplus when measured against the Stanislaus RPA. The calculated deficit indicates the quantity of release still necessary to meet the Stanislaus RPA. Any calculated surplus indicates that the IPO release could be reduced to the level of the RPA as long as there are no violations of other downstream flow or water quality standards. The deficit and surplus flow calculations were disaggregated into pulse and non-pulse periods to allow for proper accounting of flow and water quality changes.

VERNALIS_MIN.WRESL determines the increase in releases from New Melones to meet minimum flow requirements at Vernalis. For Sensitivity 4, the calculation had to be edited in several locations to properly account for an increase or decrease in release due to applying the RPA last.

In VERNALIS_BOUND.WRESL, a calculation of monthly average Vernalis flow without including the Cycle 6 Vernalis minimum flow requirements is made. If flow at Goodwin as directed by the IPO is in surplus to that specified by the RPA, this term needs to be reduced by the surplus flow calculated in VERNALIS_MIN.WRESL. This modification was applied as follows:

```
define Vern_nomincycle6 {
    case NonPulseNonDO {
        condition   month <= mar
        value       C639[SJR_WQ1] }
    case April {
        condition   month == apr
        value       14.*C639[SJR_WQ1]/30. + 16.*(C639[VAMP_AND_DO] -
StanNMFSsrp_p)/30. }
    case Mayonly {
        condition   month == may
        value       15.*(C639[VAMP_AND_DO] - StanNMFSsrp_p)/31. +
16.*C639[SJR_WQ1]/31. }
    case NonPulsePlusDO {
        condition   always
        value       C639[VAMP_AND_DO] }
        }
```

Likewise, in INSTREAM_BOUND.WRESL, modifications are made to the calculation of average April and May flows for the IPO requirements by reducing the value by the surplus reduction.

WQ_BOUND_DISAG.WRESL was modified for the pulse and non-pulse changes in release from New Melones. Also, two decision variables were created – C10RPA_P and C10RPA_NP – to provide pulse and non-pulse New Melones release output for Stanislaus RPA flows.

Sensitivity 5

Sensitivity 5 is the same as Sensitivity 2 except that VAMP is turned on. The lookup table VAMP_REQ.TABLE was returned to the original settings found in the Reclamation provided baseline.

VAMP_REQ

Base	requirement	DoubleStep
0	2000	3200
1999	2000	3200
3199	3200	4450
4449	4450	5700
5699	5700	7000
99999	7000	7000

Sensitivity 6

The changes from Sensitivity 5 to Sensitivity 6 are the same as those made from Sensitivity 3 to Sensitivity 4. The only difference between Sensitivity 4 and 6 is the CVP Stanislaus River contractor demand and allocation, which is discussed in detail under Sensitivity 2.