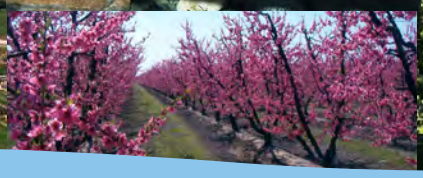
SAN JOAQUIN RIVER
RESTORATION PROGRAM

Draft

Program Environmental Impact Statement/ Environmental Impact Report





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The San Joaquin River Restoration Program is a comprehensive long-term effort to restore flows to the San Joaquin River from Friant Dam to the confluence of Merced River and restore a self-sustaining Chinook salmon fishery in the river while reducing or avoiding adverse water supply impacts from Interim and Restoration flows.

Mission Statements

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

The mission of the California Department of Water Resources is to manage the water resources of California in cooperation with other agencies, to benefit the State's people, and to protect, restore, and enhance the natural and human environments.

Draft

Program Environmental Impact Statement/Report

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List of Abbreviations and Acronyms

µg/L	microgram per liter
µin/sec	microinch per second
µmhos/cm	micromhos per centimeter
µS/cm	microSiemen per centimeter
ºF	degree Fahrenheit
AB	Assembly Bill
Act	San Joaquin River Restoration Settlement Act
ALUC	Airport Land Use Commission
APCO	Air Pollution Control Officer
APE	area of potential effects
ARB	California Air Resources Board
AT&T	American Telephone and Telegraph
B.P.	Before Present
BA	Biological Assessment
BAAQMD	Bay Area Air Quality Management District
BACT	best available control technology
Banks Pumping Plant	Harvey O. Banks Pumping Plant
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin River Basins
Bay Area	San Francisco Bay Area
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta
BDCP	Bay‑Delta Conservation Plan
BLM	U.S. Department of the Interior, Bureau of Land Management
BMP	best management practice
BNSF	Burlington Northern and Santa Fe Railway
BO	Biological Opinion
BPS	Best Performance Standards
Business Plan Act	California Hazardous Materials Release Response Plans and Inventory Law of 1985
C2VSIM	California Central Valley Groundwater-Surface Water Simulation Model
CAA	Federal Clean Air Act
CAAA	Federal Clean Air Act Amendments of 1990
CAAQS	California Ambient Air Quality Standards

CAL FIRE	California Department of Forestry and Fire Protection
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CALFED	CALFED Bay-Delta Program
CalIPC	California Invasive Plant Council
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CAT	Climate Action Team
CBSC	California Building Standards Code
CCAA	California Clean Air Act
CCAR	California Climate Action Registry
CCC	Columbia Canal Company
CCP	Comprehensive Conservation Plan
CCR	California Code of Regulations
CCSP	Climate Change Scoping Plan
CCWD	Contra Costa Water District
CDC	U.S. Centers for Disease Control and Prevention
CDFA	California Department of Food and Agriculture
CDPH	California Department of Public Health
CEC	Categorical Exclusion Checklist
CEQ	Council on Environmental Quality
CEQ Regulations	Council on Environmental Quality Regulations for Implementing NEPA
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFCP	California Farmland Conservancy Program
CFGC	California Fish and Game Commission
CFR	Code of Federal Regulations
cfs	cubic foot per second
CH_4	methane
CHABA	Committee of Hearing, Bioacoustics, and Biomechanics
Charter Group	Suisun Marsh Charter Group Principal Agencies
CHP	California Highway Patrol
CIWMA	California Integrated Waste Management Act
CLUP	Comprehensive Land Use Plan
cm	centimeter
CMP	congestion management program

CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPPA	California Native Plant Protection Act
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	CO_2 equivalent
COA	Coordinated Operation Agreement
COSMA	City of Stockton Metropolitan Area
Court	U.S. Eastern District Court of California
CPUC	California Public Utilities Commission
CT	census tract
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
CVHM	Central Valley Hydrologic Model
CVJV	Central Valley Joint Venture
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CVPM	Central Valley Production Model
CWA	Clean Water Act
CWC	California Water Code
dB	decibel
dBA	decibel on the A-weighted scale
DBCP	dibromochloropropane
DBW	California Department of Boating and Waterways
DDT	1,1,1-trichloro-2, 2-bis(4-chlorophenyl)ethane
DEET	diethyl(meta)toulamide
Delta	Sacramento-San Joaquin Delta
DFG	California Department of Fish and Game
DHS	California Department of Health Services
diesel PM	particulate matter from diesel-fueled engines
DMC	Delta-Mendota Canal
DO	dissolved oxygen
DOC	California Department of Conservation
DOF	California Department of Finance
DOGGR	California Department of Conservation, Division of Oil, Gas, and Geothermal Resources
DOT	U.S. Department of Transportation
DPS	distinct population segment
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources

E/I	export/inflow
EA	Environmental Assessment
EAD	expected annual damages
Eagle Act	Bald and Golden Eagle Protection Act
EC	electrical conductivity
EDD	California Employment Development Department
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Federal Endangered Species Act of 1973
ESRI	Environmental Systems Research Institute, Inc.
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FCDPH	Fresno County Department of Public Health, Environmental Health Division
FCWD	Fresno County Waterworks District
FDHGM	Friant Dam Hydropower Generation Model
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FloodSAFE	California FloodSAFE Initiative
FMFCD	Fresno Metropolitan Flood Control District
FMMP	California Farmland Mapping and Monitoring Program
FMWG	Fisheries Management Work Group
FONSI	Finding of No Significant Impact
FPA	Friant Power Authority
FPP	Friant Power Project
FR	Federal Register
FRA	Federal Railroad Administration
Fresno COG	Council of Fresno County Governments
FSZ	Farmland Security Zone
FTA	Federal Transit Administration
FWA	Friant Water Authority
FWCA	Fish and Wildlife Coordination Act
FY	fiscal year
GAMA	Groundwater Ambient Monitoring Assessment
GCM	Global Circulation Model
GHG	greenhouse gas

GIS	geographic information system
GMP	groundwater management plan
GSM	Central Valley Ground-Surface Water Model
Guidance	SJVAPCD Guidance for Valley Land-Use Agencies in Addressing GHG Emission Impacts for New Projects Under CEQA
GWh	gigawatt-hour
GWP	Global Warming Potential
H_2SO_3	sulfuric acid
HAP	hazardous air pollutant
HFC	hydrofluorocarbons
hp	horsepower
Hz	hertz
I	Interstate
ID	irrigation district
IEP	USFWS Interagency Ecological Program
in/sec	inch per second
in/year	inch per year
INSAR	Interferometric Synthetic Aperture Radar
IPAR	Initial Program Alternatives Report
IPCC	Intergovernmental Panel on Climate Change
IS	Initial Study
ISR	Indirect Source Review
ITA	Indian Trust Assets
IWM	instream woody material
Jones Pumping Plant	C.W. “Bill” Jones Pumping Plant
JPOD	joint point of diversion
KingIGSM	Kings Groundwater Basin Model
km	kilometer
L_{dn}	day-night noise level
L_{eq}	equivalent noise level
LESA	Land Evaluation and Site Assessment
LIM	Land Inventory and Monitoring
L_{max}	maximum noise level
L_{min}	minimum noise level
LOD	level of development
LOS	level of service
LRA	Local Responsibility Area
LSJLD	Lower San Joaquin Levee District
LSZ	low salinity zone

LUST	leaking underground storage tank
M&I	municipal and industrial
MAA	may adversely affect
MAF	million acre-feet
MBTA	Migratory Bird Treaty Act
MCDEH	Merced County Department of Environmental Health
MCEH	Madera County Department of Environmental Health
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MCTC	Madera County Transportation Commission
MCWPA	Madera-Chowchilla Water and Power Authority
mg/L	milligram per liter
mm	millimeter
MMRP	Mitigation Monitoring and Reporting Program
MND	Mitigated Negative Declaration
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
mph	mile per hour
msl	mean sea level
MT	metric ton
Multi-Hazard Mitigation Plan	State of California Multi-Hazard Mitigation Plan
MW	megawatt
MWC	Mutual Water Company
MWD	Metropolitan Water District of Southern California
MWh	megawatt-hour
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
NAVD	North American Vertical Datum
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NL	California Department of Public Health notification limit
NLAA	not likely to adversely affect
NMFS	National Marine Fisheries Service

NO	nitric oxide
NO_2	nitrogen dioxide
NOE	Notice of Exemption
NOI	Notice of Intent
NOP	Notice of Preparation
NO_X	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resource Conservation Service
NRDC	Natural Resources Defense Council
NRHP	National Register of Historic Places
NTU	nephelometric turbidity unit
NULE	Non-Urban Levee Evaluation
NWR	National Wildlife Refuge
O&M	operations and maintenance
OES	Governor's Office of Emergency Services
ONC	California Office of Noise Control
OPR	Office of Planning and Research
OSHA	U.S. Department of Labor, Occupational Safety and Health Administration
PA	Programmatic Agreement
PARCS	Fresno Department of Parks, After School, Recreation and Community services
PCB	polychlorinated biphenyl
pCi/L	picocurie per liter
PEIS/R	Program Environmental Impact Statement/Report
PFC	perfluorocarbons
PG&E	Pacific Gas and Electric Company
PM_{10}	particulate matter with an aerodynamic resistance diameter of 10 micrometers or less
$PM_{2.5}$	fine particulate matter with an aerodynamic resistance diameter of 2.5 micrometers or less
POU	place of use
ppm	part per million
ppt	part per thousand
PPV	peak particle velocity
PRC	Public Resources Code
PRI	Port Railroad, Inc.
RA	Restoration Administrator
RBDD	Red Bluff Diversion Dam
RCRA	Resource Conservation and Recovery Act
RD	reclamation district

Reclamation	U.S. Department of the Interior, Bureau of Reclamation
Reporting Rule	EPA Greenhouse Gas Reporting Rule
RHA	Rivers and Harbors Act
RHJV	Riparian Habitat Joint Venture
RHMMP	Riparian Habitat Mitigation and Monitoring Plan
RMP/GP	Resource Management Plan and General Plan
RMS	root mean square
ROG	reactive organic gas
RP	recreation policy
RPF	recreation policy-facility
rpm	revolution per minute
RPS	recreation policy siting
RTP	Regional Transportation Plan
RWA	Recovered Water Account
RWD	report of waste discharge
RWQCB	Regional Water Quality Control Board
SAFETEA-LU	Safe, Accountable, Flexible, and Efficient Transportation Equity Act: A Legacy for Users
SB	Senate Bill
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCWA	Solano County Water Agency
SDIP	South Delta Improvements Program
SDWA	South Delta Water Agency
SDWSC	Stockton Deep Water Ship Channel
SEC	section
Secretary	Secretary of the Interior
SEL	sound exposure level
Settlement	Stipulation of Settlement in *NRDC, et al., v. Kirk Rodgers, et al.*
SF_6	sulfur hexafluoride
SFHA	Special Flood Hazard Areas
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJAPCD	San Joaquin Air Pollution Control District
SJRA	San Joaquin River Agreement
SJRC	San Joaquin River Conservancy
SJRECWA	San Joaquin River Exchange Contractors Water Authority
SJRGA	San Joaquin River Group Authority

SJRGMA	San Joaquin River Gorge Management Area
SJRMP	San Joaquin River Management Program
SJRPCT	San Joaquin River Parkway and Conservation Trust
SJRRP	San Joaquin River Restoration Program
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SJVDP	San Joaquin Valley Drainage Program
SLCC	San Luis Canal Company
SMARA	State Surface Mining and Reclamation Act
SO_2	sulfur dioxide
Southern San Joaquin MUD	Southern San Joaquin Municipal Utilities District
SR	State Route
SRA	State Recreation Area
SRTTG	Sacramento River Temperature Task Group
State	State of California
STC	Sound Transmission Class
SVP	Society of Vertebrate Paleontology
SWAT	Special Weapons and Tactics
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
TAF	thousand acre-feet
TCD	temperature control device
TDS	total dissolved solids
TMDL	total maximum daily load
tpd	ton per day
TPY	ton per year
TSCA	Toxic Substances Control Act
UBC	Uniform Building Code
UCMP	University of California, Museum of Paleontology
UPRR	Union Pacific Railroad
USC	United States Code
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USJRBSI	Upper San Joaquin River Storage Basin Investigation
VAMP	Vernalis Adaptive Management Program

VdB	vibration decibel
VDE	visible dust emissions
VMT	vehicle miles traveled
WD	water district
WDL	DWR Water Data Library
WDR	waste discharge requirement
WESTSIM	Westside Simulation Model
WG	Work Group
WMA	Wildlife Management Area
WMA	Water Management Area
WNV	West Nile virus
WQCP	Water Quality Control Plan
WRDA	Water Resources Development Act
WSD	water storage district
WY	water year
X2	distance upstream from the Golden Gate Bridge where tidally averaged salinity is equal to 2 parts per thousand

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Chapter 1.0
Introduction

The San Joaquin River Restoration Program (SJRRP) was established in late 2006 to implement a Stipulation of Settlement (Settlement) in *NRDC, et al., v. Kirk Rodgers, et al*. (Appendix A). The U.S. Department of the Interior, Bureau of Reclamation (Reclamation), as the Federal lead agency under the National Environmental Policy Act (NEPA), and the California Department of Water Resources (DWR), as the State lead agency under the California Environmental Quality Act (CEQA), have prepared this joint Draft Program Environmental Impact Statement/Report (PEIS/R) to implement the Settlement. Federal authorization for implementing the Settlement is provided in the San Joaquin River Restoration Settlement Act (Act) (Public Law 111-11) (Appendix B).

Authority for combined Federal and State documents is provided in Title 40, Code of Federal Regulations (CFR), Sections 1502.25, 1506.2, and 1506.4 (Council on Environmental Quality's Regulations for Implementing NEPA (CEQ Regulations)) and California Code of Regulations (CCR) Title 14, Division 6, Chapter 3 (State CEQA Guidelines), Section 15222 (Preparation of Joint Documents). This document also was prepared consistent with U.S. Department of the Interior regulations specified in 43 CFR, Part 46 (U.S Department of the Interior Implementation of NEPA, Final Rule). This Draft PEIS/R evaluates potential direct, indirect, and cumulative impacts on the environment at a program level that could result from implementing the Settlement consistent with the Act. This Draft PEIS/R also analyzes, at a project level of detail, the potential direct, indirect, and cumulative impacts that could result from implementing certain aspects of the Settlement, including release, conveyance, and recapture of Interim and Restoration flows. In addition, this Draft PEIS/R includes feasible mitigation measures to avoid, minimize, rectify, reduce, or compensate for significant adverse impacts.

1.1 Background

Originating high in the Sierra Nevada Mountains, the San Joaquin River carries snowmelt from mountain meadows to the valley floor before turning north and becoming the backbone of tributaries draining into the San Joaquin Valley. The San Joaquin River is California's second longest river and discharges to the Sacramento-San Joaquin Delta (Delta) and, ultimately, to the Pacific Ocean through San Francisco Bay.

Historically, the San Joaquin River supported a rich and diverse ecosystem influenced by seasonal runoff patterns. During winter and spring months, runoff from Sierra Nevada streams would spread over the valley floor and slowly drain to the Delta, providing rich habitat supporting numerous aquatic and wildlife species, including Chinook salmon.

Over the past two centuries, development of water resources transformed the San Joaquin River. In the late 1880s, settlers in the Central Valley drained large areas of valley floor lands and put these lands into agricultural production, supported by small and seasonal diversion dams on the river and a series of water conveyance and drainage canals. Hydroelectric project development in the upper portions of the San Joaquin River watershed harnessed power from the river and modified the natural flow patterns.

In 1944, Reclamation completed construction of Friant Dam on the San Joaquin River. With the completion of Friant-Kern Canal in 1951 and Madera Canal in 1945, Friant Dam diverted San Joaquin River water supplies to over 1 million acres of highly productive farmland along the eastern portion of the San Joaquin Valley. Operation of the dam ceased flow in some portions of the river and extirpated salmon runs in the San Joaquin River upstream from its confluence with the Merced River.

1.1.1 Stipulation of Settlement

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit, known as *NRDC, et al., v. Kirk Rodgers, et al.*, challenging the renewal of long-term water service contracts between the United States and Central Valley Project (CVP) Friant Division contractors (Appendix A). On September 13, 2006, after more than 18 years of litigation, the Settling Parties, including NRDC, Friant Water Authority (FWA), and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of a Settlement (see Appendix A) subsequently approved by the U.S. Eastern District Court of California (Court) on October 23, 2006. The Act, included in Public Law 111-11 (see Appendix B) and signed into law on March 30, 2009, authorizes and directs the Secretary of the Interior (Secretary) to implement the Settlement. The Settlement establishes two primary goals:

- **Restoration Goal** – To restore and maintain fish populations in "good condition" in the main stem 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.

- **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 and Restoration flows provided for in the Settlement.

To achieve the Restoration Goal, the Settlement calls for releases of water from Friant Dam to the confluence of the Merced River (referred to as Interim and Restoration flows), a combination of channel and structural modifications along the San Joaquin River below Friant Dam, and reintroduction of Chinook salmon. Restoration Flows are specific volumes of water to be released from Friant Dam during different year types, according to Exhibit B of the Settlement; Interim Flows are experimental flows that began in 2009 and will continue until full Restoration Flows are initiated, with the purpose of collecting relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse. To achieve the Water Management Goal, the Settlement calls for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows to reduce or avoid impacts to water deliveries to all of the Friant

Division long-term contractors caused by the Interim and Restoration flows. In addition, the Settlement establishes a Recovered Water Account (RWA) and recovered water program to make water available to all of the Friant Division long-term contractors who provide water to meet Interim or Restoration flows, to reduce or avoid the impact of the Interim and Restoration flows on such contractors. Interim and Restoration flows are described in greater detail in Chapter 2.0, "Description of Alternatives."

The Settlement and the Act authorize and direct specific physical and operational actions that could potentially directly or indirectly affect environmental conditions in the Central Valley. Areas potentially affected by Settlement actions include the San Joaquin River and associated flood bypass system, tributaries to the San Joaquin River, the Delta, and water service areas of the CVP and State Water Project (SWP), including the Friant Division. Settlement Paragraphs 11 through 16 describe the physical and operational actions. Table 1-1 summarizes the level of analysis provided in this Draft PEIS/R for actions identified in key Settlement paragraphs.

Table 1-1.
Restoration and Water Management Actions in Key Settlement Paragraphs

Settlement Paragraph	Description	Level of NEPA/CEQA Compliance Supported by Draft PEIS/R
11	Identifies specific channel and structural improvements considered necessary to achieve the Restoration Goal. Includes a list of improvements.	Program Level
12	Acknowledges that additional channel or structural improvements not identified in Paragraph 11 may be needed to achieve the Restoration Goal.	Program Level
13	Identifies specific volumes of water to be released from Friant Dam during different year types (Restoration Flows), and provisional water supplies to meet the Restoration Flow targets, as provided in Exhibit B of the Settlement. Stipulates the release of full Restoration Flows no later than January 1, 2014, subject to then-existing channel capacities.	Project Level
14	Stipulates that spring-run and fall-run Chinook salmon be reintroduced to the San Joaquin River between Friant Dam and the confluence of the San Joaquin River with the Merced River no later than December 31, 2012. Assigns priority to self-sustaining spring-run Chinook salmon over fall-run Chinook salmon.	Program Level
15	Specifies that a program of Interim Flows begins no later than October 1, 2009, and continues until full Restoration Flows can begin, to collect relevant data concerning flows, temperatures, fish needs, seepage losses, recirculation, recapture, and reuse.	Project Level for release of Interim Flows and related actions Program Level for some data collection activities
16	Requires that the Secretary develop and implement a plan for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows to reduce or avoid impacts to water deliveries for all Friant Division long-term contractors. This paragraph also calls for establishment of an RWA and program to make water available to the Friant Division long-term contractors who provide water to meet Interim or Restoration flows.	Project Level for recapture in the Restoration Area and in the Delta Program Level for all other Water Management actions

Key:
CEQA = California Environmental Quality Act
NEPA = National Environmental Policy Act
PEIS/R = Program Environmental Impact Statement/Report
RWA = Recovered Water Account
Secretary = Secretary of the Interior

1.1.2 San Joaquin River Restoration Program

The SJRRP comprises several Federal and State of California (State) agencies responsible for implementing the Settlement. Implementing Agencies include Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Water Resources; and California Department of Fish and Game. Table 1-2 shows milestone dates recommended in the Settlement. The Implementing Agencies are committed to attaining these milestones, as demonstrated by the release of Interim Flows beginning in October 2009; however, these dates may change, pending completion of compliance, coordination, consultation, data collection,

and related efforts. Reclamation and DWR initiated the NEPA and CEQA processes in August 2007 to analyze implementation of the Settlement. As mentioned, Reclamation is the lead NEPA agency and DWR is the lead CEQA agency in preparing this Draft PEIS/R.

Table 1-2.
Key Settlement Milestones

Date	Milestone[1]	Status
October 2009	• Initiate Interim Flows and Monitoring Program	Completed
September 2010	• USFWS submits a completed permit application to NMFS for reintroduction of spring-run Chinook salmon	Completed
April 2012	• NMFS issues a decision on the permit application for reintroduction of spring-run Chinook salmon	Future
December 2012	• Reintroduce spring-run and fall-run Chinook salmon, if permitted by NMFS	Future
December 2013	• Complete Phase 1 improvements identified in the Settlement • Secretary of the Interior, in consultation with NRDC and FWA, develops operational guidelines	Future
January 2014	• Initiate full Restoration Flows	Future
December 2016	• Complete Phase 2 improvements identified in the Settlement	Future
December 2024	• Secretary of Commerce reports to Congress on the progress made in reintroducing spring-run and fall-run Chinook salmon and discusses plans for future implementation of the Settlement	Future
December 2025	• Review and revise Restoration Flows, if necessary	Future
January – July 2026	• Any party to the Settlement may file a motion to request an increase, decrease, or material change in the quantity and/or timing of Restoration Flows	Future

Note:
[1] These milestones are set forth in the Settlement.

Key:
FWA = Friant Water Authority
NMFS = National Marine Fisheries Service
NRDC = Natural Resources Defense Council
Settlement = Stipulation of Settlement
USFWS = U.S. Fish and Wildlife Service

In addition to the Implementing Agencies, the Settlement stipulates that a Technical Advisory Committee be established, comprising six members appointed by NRDC and FWA. The Settlement also calls for a Restoration Administrator (RA) to be appointed by NRDC and FWA, to facilitate the Technical Advisory Committee and provide specific recommendations to the Secretary in coordination with the Technical Advisory Committee. The RA's duties are defined in the Settlement, and include making recommendations to the Secretary on the release of Interim and Restoration flows. The RA is also responsible for consulting with the Secretary on implementing actions under Paragraph 11 of the Settlement, and for identifying and recommending additional actions under Paragraph 12 of the Settlement. In addition, the RA is responsible for consulting with the Secretary on the reintroduction of Chinook salmon under Paragraph 14 of the Settlement. The RA's recommendations would be taken into consideration by the

Secretary in making decisions or taking specific actions to be implemented under the Settlement.

1.1.3 Scoping and Public Involvement Process

The Implementing Agencies conducted extensive public and stakeholder outreach activities to engage and inform all interested parties of SJRRP activities, including development of this Draft PEIS/R. Reclamation initiated the NEPA process by issuing a Notice of Intent (NOI) on August 2, 2007, and DWR initiated the CEQA process by issuing a Notice of Preparation (NOP) on August 22, 2007, to prepare this Draft PEIS/R and hold public scoping meetings. The PEIS/R scoping comment period began the date the NOI was issued and ended on September 26, 2007. The Implementing Agencies convened four public meetings, one each in Tulare (August 28, 2007), Fresno (August 29, 2007), Los Banos (August 30, 2007), and Sacramento (September 10, 2007), to inform the public and interested stakeholders about the SJRRP, and to solicit comments and input on the scope of the PEIS/R. Reclamation and DWR received comments from 85 entities, including Federal and State agencies, local interest groups, local residents, farmers, landowners, environmental groups, public advocacy groups, Native American community groups, and individuals. The comments received were summarized in a *Public Scoping Report* released December 14, 2007 (SJRRP).

Public involvement and outreach activities have enabled the Implementing Agencies to successfully involve stakeholders and incorporate public and stakeholder input into the development of major SJRRP documents, including this Draft PEIS/R. These activities seek to create an open and transparent process through which the general public, stakeholders, affected Third Parties, and other interested parties can track and participate in SJRRP activities, including the formulation of alternatives for this Draft PEIS/R. Ongoing public outreach activities conducted in support of the SJRRP include the following:

- Preparing for and hosting Technical Feedback Meetings with subject-matter experts, Settling Parties, affected stakeholders, and the general public to obtain information and viewpoints from individual attendees; provide updates on the status of SJRRP work products; keep the Technical Feedback Group up-to-date with the current status of the SJRRP; gather feedback on SJRRP documents; and discuss potential opportunities and constraints that may arise. The format of obtaining and disseminating information through Technical Feedback Group meetings is intended to be flexible to address the issues and documents at hand and to accommodate the needs of the SJRRP, Settling Parties, stakeholders, and the general public.

- Maintaining a publicly accessible, SJRRP-specific Web site that offers timely information and updates, a document repository that includes technical memoranda, a calendar of events, and contact information (www.restoresjr.net).

- Making available technical memoranda and other milestone SJRRP documents to the general public, stakeholders, affected Third Parties, and other interested parties on the SJRRP Web site.

- Developing and distributing a wide variety of SJRRP information, including quarterly SJRRP updates, news releases, fact sheets, and brochures to keep the public informed.

The lead agency must, whenever practicable, use a consensus-based management approach to the NEPA process, as required by 43 CFR 46.110. Consensus-based management "…involves outreach to persons, organizations or communities who may be interested in or affected by a proposed action with an assurance that their input will be given consideration by the Responsible Official in selecting a course of action" (43 CFR 46.110(a)). The Draft PEIS/R was developed with a consensus-based management approach. The completed and ongoing activities conducted in support of the SJRRP, as described above, constitute outreach performed in support of this approach.

1.2 Purpose and Uses of PEIS/R

The purpose of this Draft PEIS/R is to disclose the potential direct, indirect, and cumulative impacts of implementing the Settlement, as directed by the Act, consistent with NEPA/CEQA requirements. This Draft PEIS/R serves as an informational document for decision makers, public agencies, nongovernmental organizations, and the general public regarding the potential direct, indirect, and cumulative environmental consequences of implementing any of the alternatives. It is anticipated that future site-specific environmental analysis would be developed based on information from the PEIS/R.

This Draft PEIS/R does not identify a preferred alternative for implementation. Consistent with CEQ Regulations, 40 CFR Part 46.425, and State CEQA Guidelines, the Final PEIS/R will identify a preferred alternative for implementation (or alternatives, if more than one exists). The preferred alternative will be identified in the Final PEIS/R based on the information presented in this Draft PEIS/R, in light of any potential revisions made in response to comments received on this Draft PEIS/R. After the Final PEIS/R is published, Reclamation will prepare and adopt a Record of Decision, and DWR will prepare and adopt a Notice of Determination, to implement a preferred alternative.

1.2.1 National Environmental Policy Act

NEPA provides an interdisciplinary framework for Federal agencies to take environmental factors into account during a decision making process (42 United States Code (USC) 4321, 40 CFR 1500.1). NEPA requires an Environmental Impact Statement (EIS) whenever a proposed major Federal action (e.g., a proposal for legislation or an activity financed, assisted, conducted, or approved by a Federal agency with Federal agency control) significantly affects the quality of the human environment. Section 1508.14 of the CEQ Regulations defines the human environment to include "the natural and physical environment and the relationship of people with that environment."

The EIS, in conjunction with other relevant material, is used by the Federal Government to plan actions and make decisions. Section 1502.1 of the CEQ Regulations states that an

EIS primarily serves as an action-forcing device to infuse the policies and goals defined in NEPA into ongoing programs and actions of the Federal Government. As an informational document, an EIS provides a rigorous and objective evaluation of all reasonable alternatives; full and open disclosure of environmental consequences before agency action; an interdisciplinary approach to project evaluation; identification of measures to mitigate impacts; and an avenue for public and agency participation in decision making (40 CFR 1502.1). NEPA defines mitigation as avoiding, minimizing, rectifying, reducing, or compensating for significant effects of a proposed action (40 CFR 1508.20). NEPA also requires evaluating a proposed action and alternatives at an equal level of detail.

NEPA requires that a lead agency "include [in an EIS] appropriate mitigation measures not already included in the proposed action or alternatives" (40 CFR 1502.14(f)). An EIS must also include discussions of "means to mitigate adverse environmental impacts (if not fully covered under Section 1502.14(f))." In preparing a Record of Decision under 40 CFR 1505.2, a lead agency must "[s]tate whether all practicable means to avoid or minimize environmental harm from the alternative selected have been adopted, and if not, why they were not. A monitoring and enforcement program shall be adopted and summarized where applicable for any mitigation."

1.2.2 California Environmental Quality Act

The State CEQA Guidelines (14 CCR Section 15064(f)(1)) require that an Environmental Impact Report (EIR) be prepared whenever a project may result in a significant environmental impact. Section 15064(d) states that "in evaluating the significance of the environmental effect of a project, the lead agency shall consider direct physical changes in the environment which may be caused by the project and reasonably foreseeable indirect physical changes in the environment which may be caused by the project." An EIR is an informational document used to inform public agency decision makers and the general public of the significant environmental effects of a project, identify possible ways to mitigate or avoid the significant effects, and describe a range of reasonable alternatives to the project that could feasibly attain most of the basic objectives of the project while substantially lessening or avoiding any of the significant environmental impacts. When determining whether to approve a project, State and local public agencies are required by CEQA to consider the information presented in the EIR.

CEQA requires that State and local government agencies consider the potential environmental effects of projects over which they have discretionary authority before taking action on those projects (Public Resources Code (PRC) Section 21000 et seq.). CEQA also requires that each public agency avoid or mitigate to less-than-significant levels, wherever feasible, the significant environmental effects of projects it approves or implements. If a project would result in significant and unavoidable environmental impacts that cannot be feasibly mitigated to less-than-significant levels, the project can still be approved, but the lead agency's decision makers must issue a "statement of overriding considerations" explaining in writing the specific economic, social, or other considerations that they conclude, based on substantial evidence, make those significant effects acceptable.

Section 15126.6(a) of the State CEQA Guidelines also requires that an EIR describe and evaluate a reasonable range of alternatives that would feasibly attain most of the basic project objectives, and would avoid or substantially lessen any significant impact of the project, as proposed. A range of reasonable alternatives is analyzed to define issues and provide a clear basis for choice among options. CEQA requires that the lead agency consider alternatives that would avoid or reduce one or more of the significant impacts identified for a project in an EIR. The State CEQA Guidelines state that the range of alternatives required to be evaluated in an EIR is governed by the "rule of reason"; the EIR needs to describe and evaluate only those alternatives necessary to permit a reasonable choice and to foster informed decision making and informed public participation (Section 15126.6(f)). Consideration of alternatives focuses on those that can either eliminate significant adverse environmental impacts, or reduce them to less-than-significant levels; alternatives considered in this context may include those that are more costly and those that could impede to some degree the attainment of all project objectives (Section 15126(b)). CEQA does not require alternatives to be evaluated in the same level of detail as the proposed project.

1.2.3 Type of Environmental Document

This Draft PEIS/R presents two levels of analyses, program-level and project level analyses. The program-level, or first-tier, analysis of the alternatives is performed in accordance with CEQ Regulations (40 CFR 1502.20), and consistent with California PRC Sections 21093 and 21094; Title 14 CCR Sections 15152 and 15168; and 40 CFR 1500.4(i), 1502.4(b), and 1502.20, among others. The program-level analysis evaluates the actions identified in the Settlement. (See Chapter 2.0, "Description of Alternatives," for further detail on Settlement actions.) For actions evaluated at a program level of detail, a potential range of future construction and management actions is included in the alternatives to bracket the probable range of effects. This bracketed range of potential effects also will allow for an informed analysis of system-wide and cumulative impacts resulting from implementing the entirety of the Settlement. This Draft PEIS/R also includes more detailed project-level analysis of certain actions fully described in each alternative. Table 1-1 summarizes the level of analysis (program or project) provided in this Draft PEIS/R for Settlement actions. Actions considered for evaluation but not included in the action alternatives (described in Appendix G, "Plan Formulation") are not prohibited from future implementation, but would require separate analysis pursuant to NEPA and/or CEQA at a project level of detail.

Program-Level Analysis

The program-level analysis considers the broad environmental effects of implementing the Settlement, and addresses the entire suite of effects of implementing the Settlement, including the project-level actions evaluated in detail in this Draft PEIS/R, as well as cumulative impacts. Based on the program-level analysis, this Draft PEIS/R also identifies mitigation measures and performance standards that would apply to subsequent, future project components implemented as part of the Settlement (as conditions of approval). The Implementing Agencies would incorporate these performance standards into the implementation of Settlement actions to avoid or reduce impacts. In addition, the program-level analysis addresses a reasonable range of alternatives at an equal level of detail. A No-Action Alternative (which also constitutes

the No-Project alternative under CEQA) is also analyzed, as required by NEPA and CEQA.

The Implementing Agencies acknowledge that additional analysis pursuant to NEPA and/or CEQA will be required in the future for activities addressed at a program level in this Draft PEIS/R, after specific project details are identified. At that time, the Implementing Agencies would require compliance with the mitigation measures and performance standards set forth in this PEIS/R as conditions for approval of subsequent actions. The extent of environmental review for future actions will depend on a number of factors, including the extent to which the programmatic analysis, mitigation measures, and performance standards have anticipated and accounted for the project-specific impacts of the future action. All actions evaluated only at a program level in this Draft PEIS/R must complete additional analysis pursuant to NEPA and/or CEQA at a project level of detail.

This Draft PEIS/R provides broad direction for a wide range of possible future actions while allowing the opportunity for flexibility to respond to changing needs and conditions. Future project-level NEPA/CEQA documents may incorporate the findings of the PEIS/R by reference through "tiering," or incorporating by reference general discussions from the PEIS/R. It is anticipated that later documents will focus solely on issues specific to the later project. A PEIS/R can be used in this way to simplify the task of preparing environmental documents for later parts of a program.

Incorporation of previous analysis by reference is encouraged for NEPA analysis under the CEQ Regulations (40 CFR 1500.4, 1502.21):

> *Agencies shall incorporate material into an environmental impact statement by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material shall be cited in the statement and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment. Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference.*

The State CEQA Guidelines allow for incorporation by reference when project-specific analysis is tiered from previous analysis (Sections 15150 and 15152). Under Section 15152 of the State CEQA Guidelines, when CEQA documentation has been prepared for a program of projects, project-specific studies for subsequent projects within the program should be limited to effects which:

- Were not examined as significant effects on the environment in the program EIR because appropriate mitigation (when available) would be identified for significant effects identified in the program EIR.

- Were examined as significant effects on the environment in the program EIR, but which could be reduced or avoided through specific revisions in the project (State CEQA Guidelines Section 15152(d)).

Project-Level Analysis

In addition to the program-level analysis described above, this Draft PEIS/R also includes a more detailed project-level analysis of the following actions:

- Reoperate Friant Dam and downstream flow-control structures to release Interim and Restoration flows, as constrained by then-existing channel capacities, to the San Joaquin River, and make water supplies available to Friant Division long-term contractors at a preestablished rate (Reclamation action).

- Provide additional funding to support additional maintenance activities, including patrolling to assess levee conditions when increased potential for seepage is identified through monitoring, as described in the Physical Monitoring and Management Plan (Appendix D); performing any additional operations and maintenance needed on flap gates in the Eastside and Mariposa bypasses, at the Chowchilla Bypass Bifurcation Structure, at the Eastside Bypass Bifurcation Structure, or at the Mariposa Bypass Bifurcation Structure to facilitate routing Interim and Restoration flows; and removing vegetation and sediment by mechanical or chemical means that would cause Interim or Restoration flows to exceed channel capacity (Reclamation action).

- Recapture Interim and Restoration flows at existing facilities within the Restoration Area and the Delta (Reclamation action).

- Reduce, redirect, or redivert Interim or Restoration flows to reduce flow in downstream reaches to address any issues identified through implementation of the Physical Monitoring and Management Plan (Reclamation action).

- Modify releases from Friant Dam to adjust flows to flush or mobilize spawning gravel based on monitoring reports and recommendations on spawning gravel conditions (Reclamation action).

- Grant an order by the State Water Resources Control Board (SWRCB) for the downstream protection and rediversion of Interim and Restoration flows (SWRCB action, serving as CEQA Responsible Agency).

Compliance and Permits Supported by PEIS/R

Table 1-1 summarizes the level of analysis provided in this Draft PEIS/R for Settlement actions. This Draft PEIS/R supports the needed permits, petitions, and similar compliance, coordination, and consultation efforts for program- and project-level actions, as shown in Table 1-3 and described in Chapter 28.0, “Consultation, Coordination, and Compliance.”

Table 1-3.
Compliance, Consultation, and Coordination Supported By This Draft PEIS/R

Resource	Applicable Laws/Regulations/Permits	Regulating Agency/Agencies	Level of Compliance of Applicable Actions
All	San Joaquin River Restoration Settlement Act	Secretary of the Interior	Program and Project
Wetlands, Waters of the United States, and Federal Levees	Section 404 of the Clean Water Act – Individual or General Permit	U.S. Army Corps of Engineers	Program
	Section 10 of the Clean Water Act – Individual or General Permit	U.S. Army Corps of Engineers	Program
	Section 14 of the Clean Water Act ("Section 408") – Permission	U.S. Army Corps of Engineers	Program
	Section 401 of the Clean Water Act – Water Quality Certification or Waiver	Regional Water Quality Control Board	Program
	Section 402 of the Clean Water Act – National Pollutant Discharge Elimination System permit(s)	State Water Resources Control Board and Regional Water Quality Control Board	Program
	Sections 1600 through 1607 of the California Fish and Game Code – Streambed Alteration Agreement	California Department of Fish and Game	Program
Federally Listed Species	Section 7 of the Federal Endangered Species Act – Section 7 Consultation	U.S. Fish and Wildlife Service and National Marine Fisheries Service	Program and Project
	Section 10(j) of the Federal Endangered Species Act – Section 10 permit	National Marine Fisheries Service	Program
Essential Fish Habitat	Magnuson-Stevens Fishery Conservation and Management Act	National Marine Fisheries Service	Program and Project
Fish and Wildlife Resources	Fish and Wildlife Coordination Act report	U.S. Fish and Wildlife Service	Program and Project
Cultural Resources	National Historic Preservation Act – Section 106 Consultation	State Historic Preservation Officer	Program and Project
State-Listed Species/State Special-Status Species	Section 2081 of the California Endangered Species Act – Incidental Take Permit/Consistency Determination	California Department of Fish and Game	Program and Project
	California Native Plant Protection Act	California Department of Fish and Game	Program and Project
Levees and Floodways	Central Valley Flood Protection Board Encroachment Permit and 33 Code of Federal Regulations 208.10 (U.S. Army Corps of Engineers review)	Central Valley Flood Protection Board and U.S. Army Corps of Engineers	Program
Water Rights	California Water Code – Water Right Petitions (including petitions for changes to Water Right Permits 11885, 11886, and 11887)	State Water Resources Control Board	Program and Project
State Lands	Land Use Lease	State Lands Commission	Program
Air Quality	Authority to Construct, Permit to Operate	San Joaquin Valley Air Pollution Control District	Program
State-Owned Roadways	Encroachment Permit	California Department of Transportation	Program
Surface Mining	California Surface Mining and Reclamation Act permit	California Surface Mining and Reclamation Act lead agencies and California Department of Conservation	Program

1.3 Relationship to Other SJRRP NEPA and CEQA Documents

Several environmental documents have been prepared previously to facilitate early actions needed to implement the Settlement. These documents are described further in Chapter 2.0, "Description of Alternatives," and include the following:

- *San Joaquin River Restoration Program Water Level Recorder Installation and Data Collection Notice of Exemption* (NOE). DWR. February 2009.
- *San Joaquin River Restoration Program Scour Chain Installation and Data Collection NOE*. DWR. February 2009.
- *Installation and Rehabilitation of Stream Gages on the San Joaquin River, Fresno, Madera, and Merced Counties, California Environmental Assessment* (EA)*/Finding of No Significant Impact* (FONSI). Reclamation. December 2008.
- *Stream Gage Installation and Operation and Maintenance Project Initial Study* (IS)*/Mitigated Negative Declaration* (MND). DWR. March 2009.
- *San Joaquin River Restoration Program Stream Bed and Sand Sampling NOE*. DWR. April 2009.
- *Chowchilla Bifurcation Structure Gate Seal Installation NOE*. DWR. August 2009.
- *Water Year 2010 Interim Flows Project EA/FONSI and IS/MND*. Reclamation and DWR. September 2009.
- *Draft San Joaquin River Restoration Program Geotechnical Investigation and Seepage Well Installation Project IS/MND*. DWR. October 2009
- *Water Year 2011 Interim Flows Project Supplemental EA/FONSI*. Reclamation. September 2010.

1.4 Purpose and Need for Action and Project Objectives

NEPA regulations require a statement of "the underlying purpose and need to which the agency is responding in proposing the alternatives, including the Proposed Action" (40 CFR 1502.13). The State CEQA Guidelines require a clearly written statement of objectives, including the underlying purpose of a project (Section 15124(b)).

The purpose of the proposed action is to implement the Settlement consistent with the Act. The Act authorizes and directs the Secretary to implement the Settlement.

The Settlement specifies the need, which requires changes to the operation of Friant Dam in support of achieving the Restoration Goal while reducing or avoiding adverse impacts to Friant Division long-term contractors' water deliveries caused by releasing Interim or Restoration flows in support of achieving the Water Management Goal. The Implementing Agencies identified several objectives of the proposed action:

- Release Interim Flows from Friant Dam in accordance with Settlement Paragraph 15.
- Release Restoration Flows from Friant Dam in accordance with Settlement Paragraph 13.
- Implement channel and structure modifications in accordance with Settlement Paragraph 11.
- Implement additional modifications to meet the Restoration Goal, in accordance with Settlement Paragraph 12.
- Reintroduce spring-run and fall-run Chinook salmon to the San Joaquin River below Friant Dam, in accordance with Settlement Paragraph 14.
- Develop and implement a plan to recirculate, recapture, reuse, exchange, or transfer water released for Restoration Flows in accordance with criteria identified in Settlement Paragraph 16(a).
- Establish an RWA that would account for reductions in water supply deliveries to Friant Division long-term contractors resulting from the release of Interim and Restoration flows, and make water available, at $10 an acre-foot, to Friant Division long-term contractors who have experienced water supply reductions resulting from the release of Interim or Restoration flows, in accordance with Settlement Paragraph 16(b).
- Develop and implement monitoring and management plans to guide implementation of the Settlement, including the actions listed in the preceding bullets, in accordance with the Settlement and the Act.

The purpose and objectives respond to a need to increase water releases from Friant Dam to support achieving the Restoration Goal while implementing a plan for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows for the purpose of reducing or avoiding adverse impacts to water deliveries to the Friant Division long-term contractors caused by releasing Interim and Restoration flows.

1.5 Responsibilities of Lead Agencies, Responsible Agency, and Implementing Agencies

As previously described, Reclamation is the lead NEPA agency and DWR is the lead CEQA agency in preparing this Draft PEIS/R. The project-level actions addressed in the PEIS/R include actions to be undertaken by Reclamation, and the effects of these actions are the sole responsibility of Reclamation. DWR serves as the CEQA lead agency for the entire SJRRP, although DWR is not taking any discretionary action for the project-level actions analyzed in this Draft PEIS/R. SWRCB is the only State agency expected to take a discretionary action, in the form of a water rights approval related to the release and conveyance of Interim and Restoration flows. It is anticipated that SWRCB would use this PEIS/R in support of that decision as a CEQA Responsible Agency. In the future, it is expected that DWR, and other State agencies, will complete project-level CEQA review in support of discretionary actions to implement some of the actions addressed at a program level in the Final PEIS/R.

To implement the project-level actions, Reclamation would require a modified water rights permit from SWRCB. Under CEQA, SWRCB is a Responsible Agency insofar as it has a limited role related to the project-level actions analyzed in this Draft PEIS/R. To allow SWRCB to take its action as a Responsible Agency, which involves making findings that the agency has "considered" the EIR (see State CEQA Guidelines Section 15096(f)), DWR, as the CEQA Lead Agency, will be required to certify the PEIS/R as meeting CEQA requirements; adopt Findings of Fact, a Statement of Overriding Considerations, if needed, and a Mitigation Monitoring and Reporting Program; approve the program; and file a Notice of Determination. As the CEQA Lead Agency for the PEIS/R, DWR has prepared an EIR that provides sufficient project-level information to allow SWRCB, as a Responsible Agency, to (1) consider the environmental effects of the project-level actions, (2) mitigate or avoid environmental effects of those parts of the project over which those agencies have discretionary authority, and (3) make findings, required by CEQA Guidelines Section 15091, that its decision making body reviewed and considered the project-level environmental effects presented in the PEIS/R. As a Responsible Agency, if SWRCB decides to take action to approve its portion of the project, SWRCB must approve feasible mitigation measures that would reduce the magnitude of, or avoid any, significant impacts.

The Implementing Agencies, as previously mentioned, include Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Water Resources, and California Department of Fish and Game. The Settlement identifies the need for the involvement of the Secretary through Reclamation as the lead Federal agency responsible for implementation, and through U.S. Fish and Wildlife Service (USFWS) as the lead Federal agency responsible for reintroduction of spring-run and fall-run Chinook salmon. The Settlement also identifies the Secretary of the U.S. Department of Commerce, through National Marine Fisheries Service (NMFS), as a necessary participant to allow for permitting the reintroduction of spring-run Chinook salmon. The Act authorizes and directs the Secretary to implement the Settlement and appropriates funds for implementation. Implementation of the Settlement also requires

involvement of the State's Natural Resources Agency through DWR and California Department of Fish and Game (DFG). Consistent with a Memorandum of Understanding (MOU) between the Settling Parties and the State, the California Natural Resources Agency will play a major role in funding and implementing actions called for in the Settlement and in the Act. DWR will assist in planning, designing, and constructing the physical improvements identified in the Settlement, including projects related to flood protection, levee relocation, and modifications to and maintenance of channel facilities. DFG will provide technical assistance on actions related to the release of Interim and Restoration flows and the reintroduction and monitoring of fish, and planning, designing, and constructing facilities to provide fish passage.

1.6 Study Area

The study area for this Draft PEIS/R, shown in Figure 1-1, has been 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

These geographic areas are described in greater detail in Chapter 3.0, "Considerations for Describing Affected Environment and Environmental Consequences." Interim and Restoration flows would contribute a relatively small amount of water to the Delta compared to contributions of the San Joaquin and Sacramento rivers and other tributaries. Therefore, effects of the SJRRP would be negligible downstream from the Delta (in Suisun, San Pablo, or San Francisco bays, or in the Pacific Ocean). For this reason, the Delta was identified as the downstream extent of the study area.

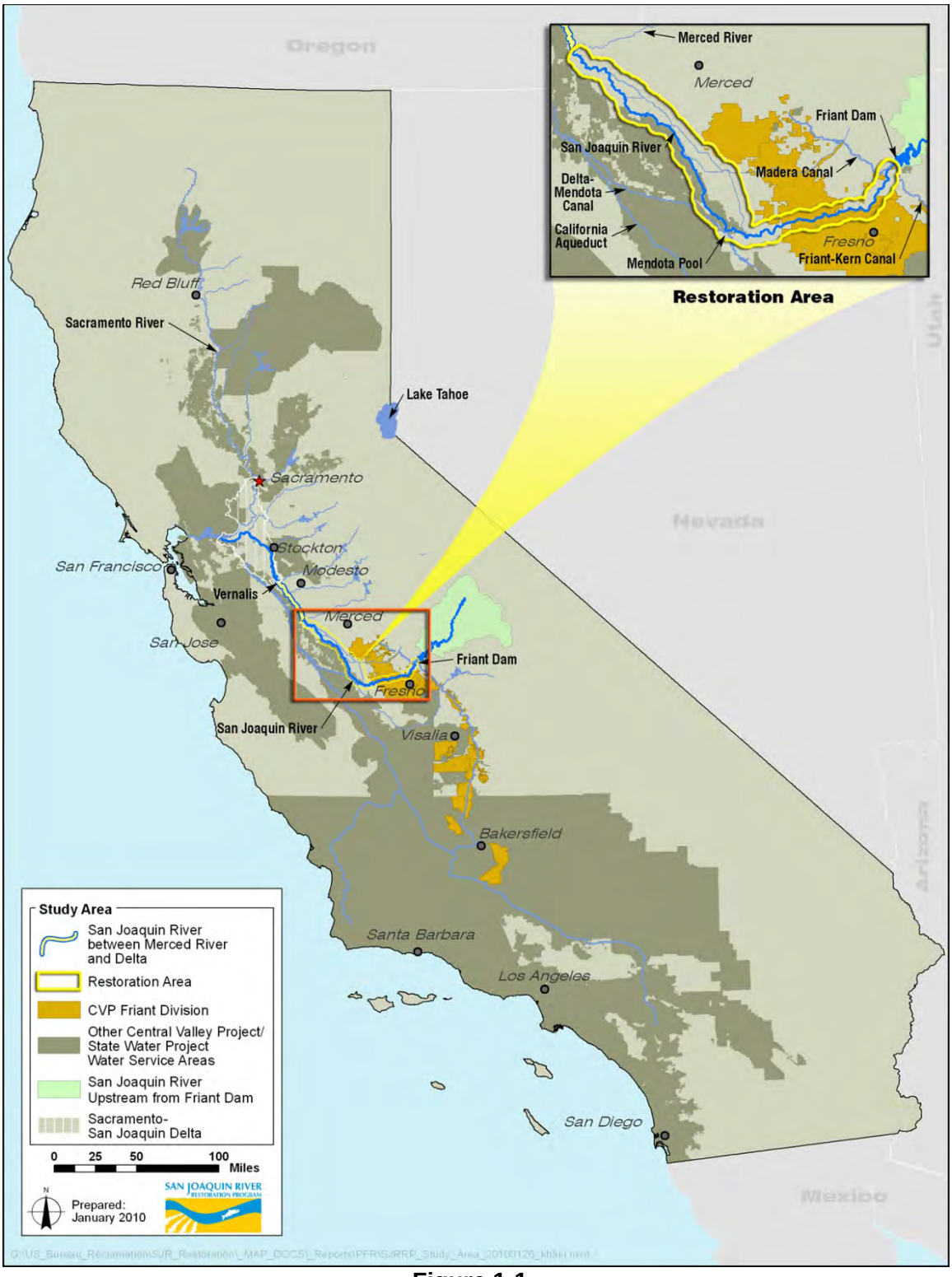


Figure 1-1.
Study Area for This Program Environmental Impact Statement/Report

Figure 1-2.
San Joaquin River Reaches and Flood Bypass System in Restoration Area

1.7 Organization of PEIS/R

This Draft PEIS/R is organized as shown below.

Executive Summary presents the purpose and intended uses of this Draft PEIS/R, and describes lead agencies, project location, project background and future actions, need for action, and project purpose/objectives; provides an overview of the alternatives under consideration, and major conclusions of the environmental analysis; documents the known areas of controversy and issues to be resolved; and summarizes in a table the environmental impacts, mitigation measures, and significance conclusions for the alternatives under consideration.

Chapter 1.0, "Introduction," summarizes project background and context, PEIS/R purpose and uses, relationship to other SJRRP NEPA and CEQA documents, purpose and need for action and objectives, responsibilities of lead/responsible/Implementing agencies, study area, and PEIS/R organization.

Chapter 2.0, "Description of Alternatives," summarizes the methods used for selecting the program alternatives, describes the program alternatives under consideration, and discusses alternatives that have been eliminated from further discussion.

Chapter 3.0, "Considerations for Describing the Affected Environment and Environmental Consequences," describes the study area, and the approach and terms used to describe the environmental and regulatory setting and environmental consequences for the resource topics presented in Chapters 4.0 through 25.0.

Chapters 4.0 through **25.0** include the environmental and regulatory settings for 22 resource topics, and discussions of methods, significance criteria, environmental impacts, and mitigation measures for potential direct and indirect impacts.

Chapter 26.0, "Cumulative Impacts," provides an analysis of overall cumulative effects of the program alternatives, including the No-Action Alternative, together with other past, present, and reasonably foreseeable future projects.

Chapter 27.0, "Other NEPA and CEQA Considerations," describes potential significant and unavoidable impacts, the relationship of short-term uses and long-term productivity, irreversible and irretrievable commitments of resources, and growth-inducing impacts of implementing the Settlement.

Chapter 28.0, "Consultation, Coordination, and Compliance," summarizes public involvement activities under NEPA and CEQA; Native American consultation and consultation and coordination with other Federal, State, regional, and local agencies; agencies and organizations consulted; and areas of controversy and unresolved issues. This chapter also describes Federal laws and regulations that apply to program- and project-level compliance. In addition, this chapter lists potential permits, regulatory approvals, and needed authorizations.

Chapter 29.0, "References," provides a bibliography of sources cited throughout this Draft PEIS/R.

Chapter 30.0, "List of Preparers," lists individuals who participated in preparing this Draft PEIS/R and provides qualifications for those individuals, shown by organization and agency.

Chapter 31.0, "Index," lists key terms and topics discussed throughout this Draft PEIS/R, and the location of the most relevant discussion or definition of the terms and topics.

Appendices contain background information that supports this Draft PEIS/R. The appendices include the Settlement; the Act; a glossary and reader's guide; the Fish Management Plan; the Physical Monitoring and Management Plan; discussion of plan formulation; discussion of modeling methodology, assumptions, and interpretation; and technical information relevant to the resource topics described in Chapters 4.0 through 25.0.

Chapter 2.0
Description of Alternatives

This chapter describes alternatives considered and evaluated in this Draft PEIS/R, consistent with the objectives identified in Chapter 1.0, "Introduction." The chapter begins with an overview of the alternatives formulation process, and describes alternatives that were evaluated: the No-Action Alternative, which also constitutes the "no-project" alternative under CEQA, and six action alternatives considered to implement the Restoration and Water Management goals of the Settlement and the purpose, need, and objectives of the proposed action. Although the alternatives have advantages and disadvantages, each is considered feasible for the purpose of analysis based on relevant economic, environmental, social, technological, and legal factors.

As described in Chapter 1.0, "Introduction," this Draft PEIS/R provides program-level NEPA/CEQA analysis for required actions identified in the Settlement, and project-level NEPA/CEQA analysis for the reoperation of Friant Dam and other actions associated with the release and recapture of Interim and Restoration flows using existing facilities. Additional project-level NEPA/CEQA compliance will be required in the future for actions analyzed at a program level in this Draft PEIS/R. Both the program- and project-level actions described in this Draft PEIS/R reflect a range of potential implementation actions to identify and disclose potential environmental effects. All action alternatives analyzed in this Draft PEIS/R include the reoperation of Friant Dam, actions that contribute to the Restoration Goal, and actions that contribute to the Water Management Goal.

2.1 Alternatives Development

Development of program alternatives began on two parallel tracks. Figure 2-1 illustrates the approach for formulating alternatives. One track focused on actions to address reoperation of Friant Dam, and was developed in coordination with the Settling Parties through preparation of Restoration Flow guidelines, as stipulated by the Settlement. The other focused on defining the range of potential implementation of physical actions to achieve the Restoration and Water Management goals. To accomplish the second track, a broad range of actions to achieve the Restoration and Water Management goals was packaged into initial program alternatives, as described in the *Initial Program Alternatives Report* (IPAR) (SJRRP 2008), and in Appendix G, "Plan Formulation."

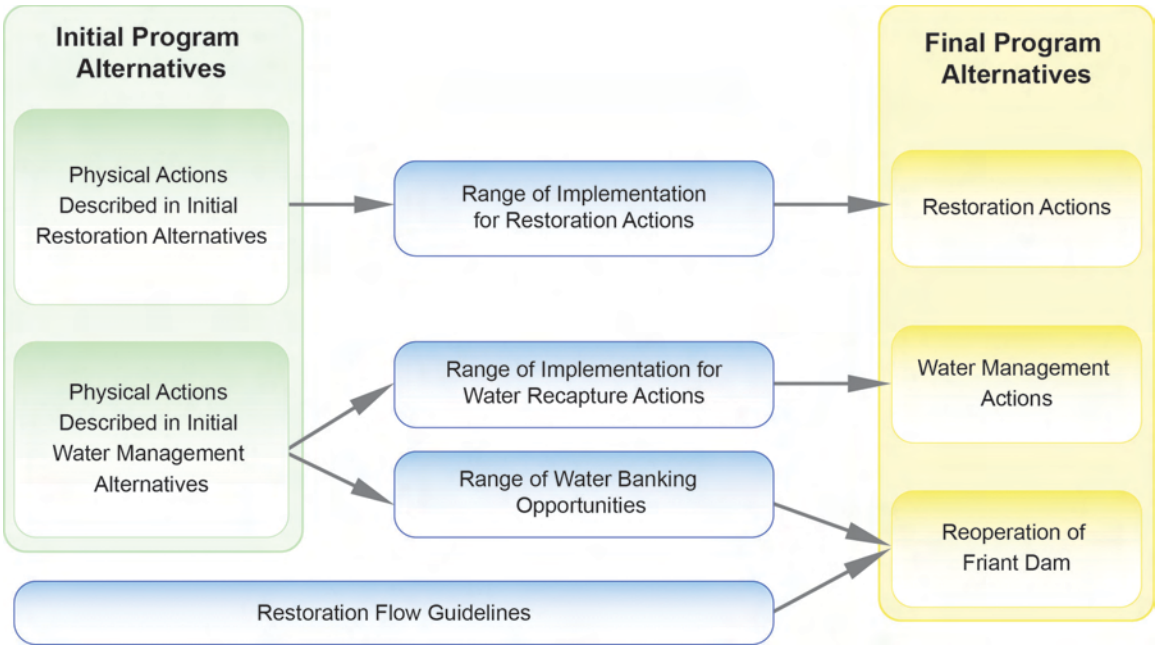


Figure 2-1.
Approach for Formulating Program Alternatives

The IPAR evaluated numerous actions, and ultimately described eight initial alternatives for the Restoration Goal and eight initial alternatives for the Water Management Goal, all with a primary emphasis on ranges of physical actions. This approach was chosen to identify the possible range of physical actions that could be implemented through subsequent site-specific projects. Initial Restoration Alternatives were formulated by grouping potential Restoration actions based on various themes for river restoration. Initial Water Management Alternatives were formulated by grouping potential projects to recapture Interim and Restoration flows with facilities to convey or store water in the Friant Division water service areas. The potential range for each Restoration and Water Management action was represented within the range of Initial Restoration and Water Management alternatives presented in the IPAR. The initial physical actions presented in the IPAR provided a starting point for formulating a range of program alternatives that would achieve the purpose, need, and objectives of the proposed action. Actions to address reoperating Friant Dam for the release of Interim and Restoration flows and actions to address reintroducing Chinook salmon were not described in the IPAR (SJRRP 2008).

A review of initial program alternatives presented in the IPAR revealed that the level of project specificity in the alternatives was greater than the level of certainty that can be determined at this time with limited available information. Because land access has not been granted to the Implementing Agencies for many key locations in the Restoration Area, despite continued efforts to obtain access, the Implementing Agencies could not initiate studies needed to collect more detailed information about site conditions for developing project-specific plans concurrent with preparation of this Draft PEIS/R. The Implementing Agencies recognize the need for a robust monitoring program to collect

information on physical and ecological responses to actions to guide site-specific project requirements.

In recognition of the data limitations, and reliance on future monitoring data, final program alternatives are defined more broadly and include provisions for flexibility in implementation. Accordingly, program alternatives evaluated in this Draft PEIS/R address large-scale system-wide variations, with flexibility for different methods of implementation. The different methods of implementation represent key decision points, including the ultimate extent of channel modifications and flow routing within the Restoration Area, and the extent and location of long-term water recapture opportunities. This approach is appropriate for identifying ranges of potential impacts that could result from implementing the Settlement, and for developing appropriate mitigation strategies at a program level of detail. This process is described in greater detail in Appendix G, "Plan Formulation."

The program alternatives evaluated in this Draft PEIS/R represent a range of reasonable alternatives, consistent with the requirements of NEPA and CEQA. The action alternatives under consideration were formulated to feasibly accomplish the primary objectives of the Settlement, as discussed in Chapter 1.0, "Introduction" of this Draft PEIS/R. The action alternatives include features that could avoid or substantially lessen one or more significant effects. Alternatives considered but eliminated from further consideration are described in Section 2.10 of this chapter.

CEQ Regulations and State CEQA Guidelines describe what is required for an alternatives evaluation in an EIS and EIR, respectively. These requirements are summarized below.

2.1.1 NEPA Requirements

CEQ Regulations (40 CFR 1502.14) require that an EIS include the following:

- Objective evaluation of reasonable alternatives
- Identification of alternatives considered but eliminated from detailed study, along with a brief discussion of the reasons that these alternatives were eliminated
- Information that would allow reviewers to evaluate the comparative merits of the proposed action (i.e., proposed project) and alternatives
- Consideration of the No-Action Alternative
- Identification of the agency's preferred alternative, if any
- Appropriate mitigation measures not already included in a proposed action or alternatives

NEPA requires analysis of the proposed action, and all alternatives considered, at a substantial level of detail. CEQ Regulations (40 CFR 1502.14) require agencies to rigorously explore and objectively evaluate all reasonable alternatives, and to devote

substantial treatment to each alternative considered, including the proposed action. All alternatives considered must be evaluated compared to the No-Action Alternative (future without project). As defined in 43 CFR Part 46.110, to be selected for implementation, a consensus-based alternative must be fully consistent with the CEQ Regulations, and applicable statutory and regulatory provisions.

2.1.2 CEQA Requirements

Section 15126.6(a) of the State CEQA Guidelines requires that an EIR includes the following:

- Description of a range of reasonable alternatives to a proposed project, or to the location of the project, that would feasibly attain most of the basic project objectives but would avoid or substantially lessen any of the significant effects of the project

- Evaluation of the comparative merits of the alternatives

An EIR need not consider every conceivable alternative to a proposed project but must consider a range of reasonable potentially feasible alternatives that would foster informed decision making and public participation.

The range of alternatives required to be evaluated in an EIR is governed by a "rule of reason" that requires an EIR to set forth only those alternatives necessary to permit a reasoned choice. The EIR needs to examine in detail only those alternatives that the lead agency determines could feasibly attain the basic project objectives, taking into account factors such as site suitability, economic viability, availability of infrastructure, general plan consistency, other plans or regulatory limitations, jurisdictional boundaries, and whether the proponent can reasonably acquire, control, or otherwise have access to the alternative site (State CEQA Guidelines Section 15126.6(f)). CEQA does not require alternatives to be evaluated at the same level of detail as the proposed project.

The State CEQA Guidelines recommend that an EIR should briefly describe the rationale for selecting the alternatives to be discussed, identify any alternatives that were considered by the lead agency but were eliminated as infeasible, and briefly explain the reasons underlying the lead agency's determination (State CEQA Guidelines Section 15126.6(c)).

An EIR must also evaluate a "no-project" alternative, which represents "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services" (State CEQA Guidelines Section 15126.6(e)(2)).

2.2 Overview of Alternatives Evaluated

This Draft PEIS/R evaluates a No-Action Alternative and six action alternatives to implement the Settlement. Each action alternative includes the actions called for in the Settlement. The action alternatives differ in two program-level ways:

- **Additional Restoration Actions –** The maximum peak Restoration Flow that would be routed through Reach 4B1 (at least 475 cubic feet per second (cfs) or at least 4,500 cfs), as shown in Table 2-1 and Figure 2-2.

- **Additional Water Management Actions on the San Joaquin River –** How Restoration Flows would be recaptured (Delta only, or Delta plus existing San Joaquin River diversions with or without new infrastructure to increase pumping capacity below the Merced River), as shown in Table 2-1 and in Figure 2-3.

Table 2-1.
Actions Included Under Action Alternatives

Level of NEPA/CEQA Compliance	Actions[1]		Action Alternative					
			A1	A2	B1	B2	C1	C2
Project-Level	Reoperate Friant Dam and downstream flow control structures to route Interim and Restoration flows		✓	✓	✓	✓	✓	✓
	Recapture Interim and Restoration flows in the Restoration Area		✓	✓	✓	✓	✓	✓
	Recapture Interim and Restoration flows at existing CVP and SWP facilities in the Delta		✓	✓	✓	✓	✓	✓
Program-Level	Common Restoration actions[2]		✓	✓	✓	✓	✓	✓
	Actions in Reach 4B1 to provide at least:	475 cfs capacity	✓	✓	✓	✓	✓	✓
		4,500 cfs capacity with integrated floodplain habitat		✓		✓		✓
	Recapture Interim and Restoration flows on the San Joaquin River downstream from the Merced River at:	Existing facilities on the San Joaquin River			✓	✓	✓	✓
		New pumping infrastructure on the San Joaquin River					✓	✓
	Recirculation of recaptured Interim and Restoration flows		✓	✓	✓	✓	✓	✓

Notes:
[1] All alternatives also include the Physical Monitoring and Management Plan and the Conservation Strategy, which include both project- and program-level actions intended to guide implementation of the Settlement.
[2] Common Restoration actions are physical actions to achieve the Restoration Goal that are common to all action alternatives and are addressed at a program level of detail.

Key:
CEQA = California Environmental Quality Act
cfs = cubic feet per second
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
NEPA = National Environmental Policy Act
PEIS/R = Program Environmental Impact Statement/Report
SWP = State Water Project

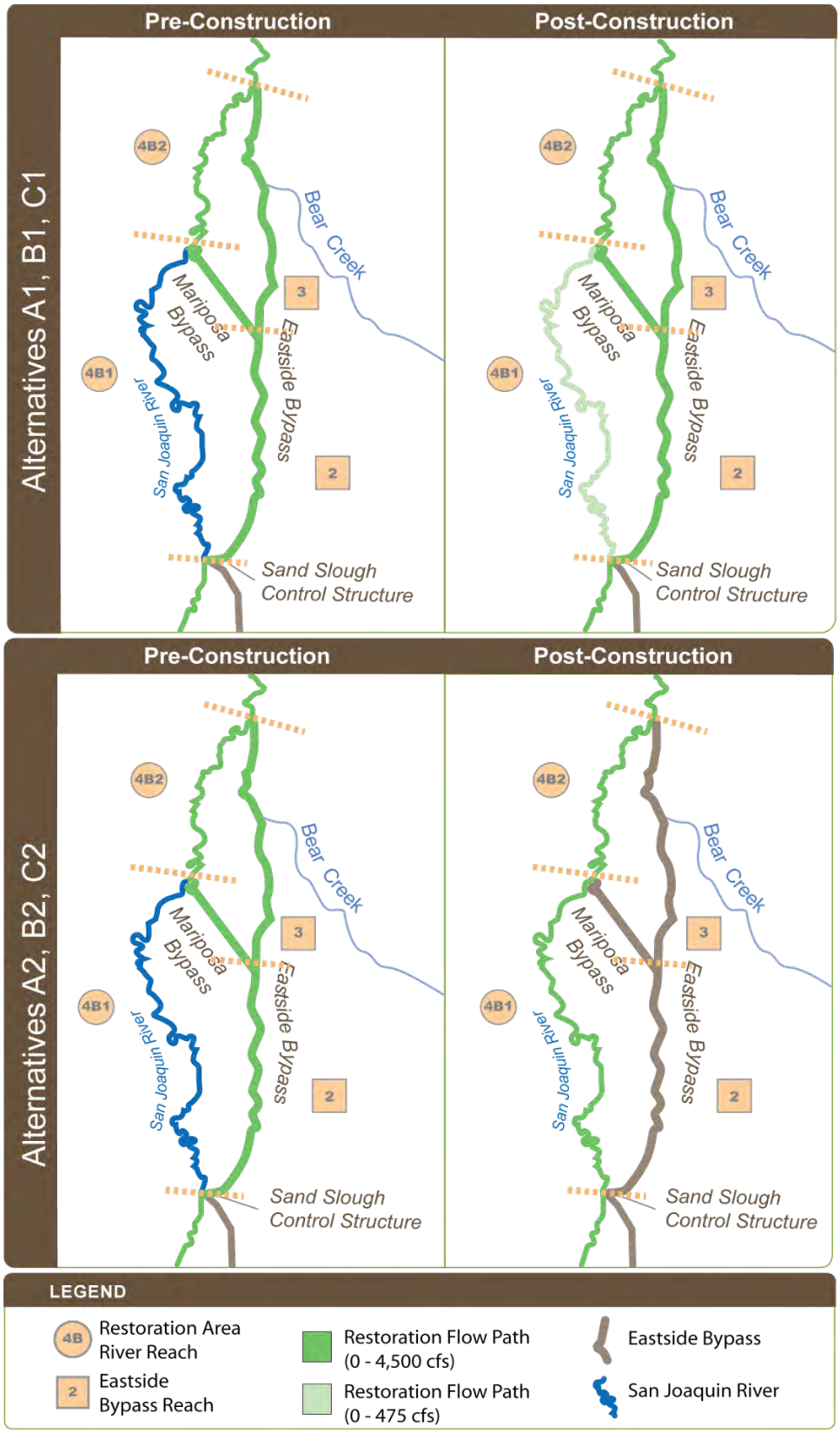
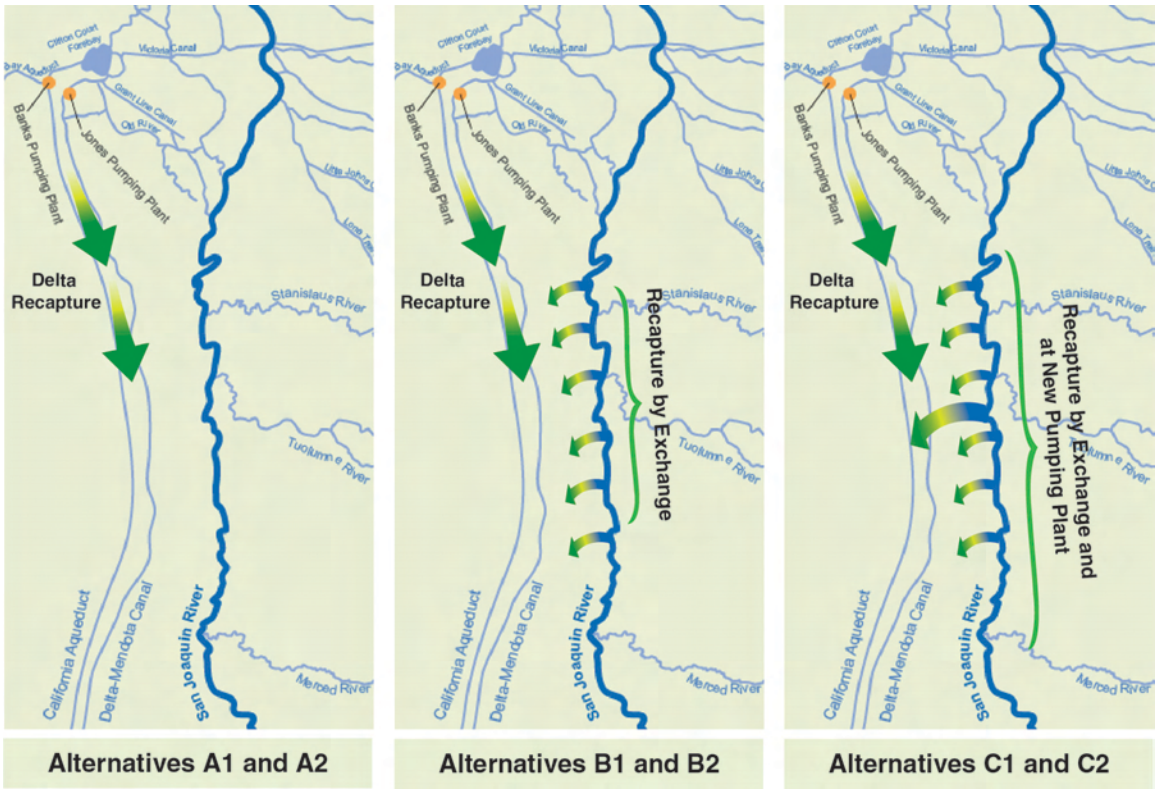


Figure 2-2.
Flow Routing in Reach 4B and Bypass System Under Action Alternatives



Note: Water recapture approaches shown do not encompass potential recapture of Interim and Restoration flows at existing facilities within the Restoration Area.

Figure 2-3.
Water Recapture Approaches Downstream from Restoration Area Included in Action Alternatives

Program alternatives include the following:

- **No-Action Alternative –** Under the No-Action Alternative (No-Project Alternative under CEQA), the Settlement would not be implemented. The No-Action Alternative includes projected conditions as they would exist in the study area at the end of the PEIS/R planning horizon (2030), including those projects and programs considered reasonably foreseeable by that time.

- **Alternative A1: Reach 4B1 at 475 cfs, Delta Recapture –** Alternative A1 includes reoperation of Friant Dam, and a range of actions to achieve the Restoration and Water Management goals. Under Alternative A1, Reach 4B1 would convey at least 475 cfs, and the Eastside and Mariposa bypasses would convey any remaining Interim and Restoration flows. Alternative A1 includes the potential for recapture of Interim and Restoration flows in the Restoration Area and Interim and Restoration flows in the Delta using existing diversion facilities, and the potential for recirculation of all recaptured Interim and Restoration flows. A Physical Monitoring and Management Plan is included in Alternative A1 to provide guidelines for observing and adjusting to changes in conditions regarding flow, seepage, channel capacity, propagation of native vegetation, and suitability of spawning gravel. Alternative A1 also includes a conservation strategy

consisting of management actions necessary to provide a net increase in the extent and quality of riparian and wetland habitats in the Restoration Area, to avoid reducing the long-term viability of sensitive species, and to be consistent with adopted conservation plans.

- **Alternative A2: Reach 4B1 at 4,500 cfs, Delta Recapture** – Alternative A2 includes the same Restoration and Water Management actions as Alternative A1, plus additional Restoration actions to increase Reach 4B1 channel capacity to at least 4,500 cfs, with integrated floodplain habitat. Under this alternative, the Eastside Bypass would not convey Interim or Restoration flows after completion of Reach 4B1 channel modifications.

- **Alternative B1: Reach 4B1 at 475 cfs, San Joaquin River Recapture –** Alternative B1 includes the same Restoration and Water Management actions as Alternative A1, plus additional Water Management actions for the recapture of Interim and Restoration flows in the San Joaquin River below the confluence of the Merced River, using existing facilities with potential in-district modifications.

- **Alternative B2: Reach 4B1 at 4,500 cfs, San Joaquin River Recapture** – Alternative B2 includes the same Restoration and Water Management actions as Alternative B1, plus the additional Restoration actions included in Alternative A2 to increase Reach 4B1 channel capacity to at least 4,500 cfs, with integrated floodplain habitat. Under this alternative, the Eastside Bypass would not convey Interim or Restoration flows after completion of Reach 4B1 channel modifications.

- **Alternative C1: Reach 4B1 at 475 cfs, New Pumping Plant Recapture –** Alternative C1 includes the same Restoration and Water Management actions as Alternative B1, plus additional Water Management actions for recapture of Interim and Restoration flows, through new infrastructure, to increase pumping capacity on the San Joaquin River below the confluence of the Merced River.

- **Alternative C2: Reach 4B1 at 4,500 cfs, New Pumping Plant Recapture –** Alternative C2 includes the same Restoration and Water Management actions as Alternative C1, plus the additional Restoration actions included in Alternative A2 to increase Reach 4B1 channel capacity to at least 4,500 cfs, with integrated floodplain habitat. Under this alternative, the Eastside Bypass would not convey Interim or Restoration flows after completion of Reach 4B1 channel modifications.

The NEPA/CEQA level of compliance supported by this Draft PEIS/R for individual actions included in the action alternatives is shown in Table 2-2.

Table 2-2.
NEPA/CEQA Level of Compliance for Actions Included Under Action Alternatives

Category	Action	Action Alternative						Level of NEPA/CEQA Compliance
		A1	A2	B1	B2	C1	C2	
Reoperate Friant Dam and Downstream Flow Control Structures	Release Interim and Restoration flows from Friant Dam up to full Restoration Flows stipulated by Settlement, as constrained by then-existing channel capacities	✓	✓	✓	✓	✓	✓	Project
	Minimize increases in flood risk in the Restoration Area as a result of Interim and Restoration flows	✓	✓	✓	✓	✓	✓	
	Reoperate downstream flow control structures	✓	✓	✓	✓	✓	✓	
	Establish an RWA and manage Friant Dam to make water supplies available to Friant Division long-term contractors at a preestablished rate	✓	✓	✓	✓	✓	✓	
Recapture Interim and Restoration Flows	Recapture Interim and Restoration flows in Restoration Area at Mendota Pool and wildlife refuge	✓	✓	✓	✓	✓	✓	
	Recapture Interim and Restoration flows in Delta at existing CVP/SWP facilities	✓	✓	✓	✓	✓	✓	
	Recapture Interim and Restoration flows at existing facilities on San Joaquin River with potential in-district modifications to existing facilities			✓	✓	✓	✓	Program
	Construct and operate new pumping infrastructure on San Joaquin River					✓	✓	
Recirculate Recaptured Interim and Restoration Flows	Recirculate recaptured Interim and Restoration flows	✓	✓	✓	✓	✓	✓	
Common Restoration Actions	Construct Mendota Pool Bypass and modify Reach 2B to convey at least 4,500 cfs	✓	✓	✓	✓	✓	✓	
	Modify Reach 4B1 to convey at least 475 cfs	✓	✓	✓	✓	✓	✓	
	Modify San Joaquin River Headgate Structure to enable fish passage and flow routing	✓	✓	✓	✓	✓	✓	
	Modify Sand Slough Control Structure to enable fish passage	✓	✓	✓	✓	✓	✓	
	Screen Arroyo Canal and provide fish passage at Sack Dam	✓	✓	✓	✓	✓	✓	
	Modify Eastside and Mariposa Bypasses for fish passage	✓	✓	✓	✓	✓	✓	
	Enable deployment of seasonal barriers at Mud and Salt sloughs	✓	✓	✓	✓	✓	✓	
	Modify Chowchilla Bypass Bifurcation Structure	✓	✓	✓	✓	✓	✓	
	Fill or isolate gravel pits	✓	✓	✓	✓	✓	✓	
	Reintroduce salmon	✓	✓	✓	✓	✓	✓	
	Enhance spawning gravel	✓	✓	✓	✓	✓	✓	
	Reduce potential for redd superimposition and/or hybridization	✓	✓	✓	✓	✓	✓	
	Supplement the salmon population	✓	✓	✓	✓	✓	✓	
	Modify floodplain and side-channel habitat	✓	✓	✓	✓	✓	✓	
	Enhance in-channel habitat	✓	✓	✓	✓	✓	✓	
	Reduce potential for aquatic predation of juvenile salmonids	✓	✓	✓	✓	✓	✓	
	Reduce potential for fish entrainment	✓	✓	✓	✓	✓	✓	
	Enable fish passage	✓	✓	✓	✓	✓	✓	
	Modify flood flow control structures	✓	✓	✓	✓	✓	✓	

Table 2-2.
NEPA/CEQA Level of Compliance for Actions Included Under Action Alternatives (contd.)

Category	Action	Action Alternative						Level of NEPA/CEQA Compliance
		A1	A2	B1	B2	C1	C2	
Actions in Reach 4B1 to Provide at Least 4,500 cfs Capacity	Modify Reach 4B1 to convey at least 4,500 cfs		✓		✓		✓	Program
Physical Monitoring and Management Plan	Monitoring actions[1]	✓	✓	✓	✓	✓	✓	
	Immediate management actions	✓	✓	✓	✓	✓	✓	Project
	Long-term management actions	✓	✓	✓	✓	✓	✓	Program
Conservation Strategy	Various conservation measures, applied to actions above	✓	✓	✓	✓	✓	✓	Project and Program

Note:
[1] Site-specific documentation has been prepared for monitoring actions completed or currently underway, and would be prepared, as necessary, for actions described at a program-level of detail in this Draft PEIS/R.

Key:
CEQA = California Environmental Quality Act
cfs = cubic feet per second
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
NEPA = National Environmental Policy Act
PEIS/R = Program Environmental Impact Statement/Report
Restoration Area = San Joaquin River from Friant Dam to the Merced river confluence
RWA = Recovered Water Account
Settlement = Stipulation of Settlement, *NRDC et al., v. Kirk Rodgers, et al*.
SWP = State Water Project

2.3 No-Action and No-Project Alternatives

This Draft PEIS/R evaluates a No-Action Alternative in compliance with NEPA no-action and CEQA no-project requirements. The No-Action Alternative reflects projected conditions in 2030 if the Settlement is not implemented. The No-Action Alternative includes existing facilities, conditions, land uses, and reasonably foreseeable actions expected to occur in the study area by 2030. Reasonably foreseeable actions include actions with current authorization, complete funding for design and construction, and complete environmental permitting and compliance (see Table 2-3) when the NOP for the PEIS/R was published (August 22, 2007 (Reclamation)). Under the No-Action Alternative, Reclamation would continue to release a base flow from Friant Dam to meet existing holding contract obligations to maintain a 5 cfs flow at Gravelly Ford. The No-Action Alternative and existing conditions serve as the basis of comparison for determining potential effects of the action alternatives on the affected environment, consistent with NEPA and CEQA requirements (for the purposes of this document, existing conditions are defined as the conditions in place when the NOP was published in August 2007).

The No-Action Alternative would not include implementing the Settlement. Although the specific actions regarding *NRDC, et al., v. Kirk Rodgers, et al.* that would be taken under the No-Action Alternative are too speculative for meaningful consideration, and cannot be defined at this time, it is reasonable to assume that the Settlement would be voided and litigation would resume.

Additional simulation is being prepared to assess projected conditions under the No-Action Alternative with implementation of the USFWS 2008 *Biological Opinion (BO) on the Coordinated Operations of the CVP and SWP* (2008 USFWS CVP/SWP Operations BO) and the NMFS 2009 *Final Biological and Conference Opinion on the Long-Term Operations of the CVP and SWP* (2009 NMFS CVP/SWP Operations BO). Results of this assessment will change the anticipated effects of the No-Action Alternative; however, relative impacts and overall impact mechanisms are not anticipated to change with the results of this assessment. Results of this assessment will be provided in the Final PEIS/R.

Table 2-3.
Projects Included Under No-Action Alternative

Project	Description	Reason for Inclusion in No-Action Alternative
City of Stockton Delta Water Supply Project	Develops a new supplemental water supply for the Stockton metropolitan area by diverting Delta water from a new intake. A raw water pipeline along Eight Mile Road would be built to convey Delta water to a new drinking water treatment plant.	Project is currently authorized, funded, and permitted for implementation
San Joaquin River Exchange Contractors Water Authority Water Transfer Program (2005 – 2014)	Allows the transfer of up to 130,000 acre-feet of substitute water from conservation actions (groundwater pumping and temporary land fallowing from the Exchange Contractors to other CVP contractors) to Reclamation for delivery to San Joaquin Valley wildlife refuges, and to Reclamation and/or DWR for use by the CALFED Environmental Water Account as replacement water for CVP contractors.	Project is currently authorized, funded, and permitted for implementation
Corps Policy on Levee Vegetation	Limits uncontrolled vegetation growth (brush, weeds, or trees) to smaller than 2 inches in diameter to reduce the risk of flood damage.	Flood system improvements are currently underway or will be initiated under this policy (USACE 2007)
Westside Regional Drainage Plan	Implementing the Westside Regional Drainage Plan is assumed to result in the elimination of salt discharges to the San Joaquin River from the Grassland Drainage Area. The Westside Regional Drainage Plan seeks to manage subsurface drainage and achieve a salt balance on productive lands through several mechanisms, including the application of drainage to salt-tolerant crops at a regional reuse facility to reduce the volume of water discharged into Mud Slough (North) and improve the water quality of that discharge.	Plan is currently being implemented
Grassland Bypass Project Extension (2010 – 2019)	Extends the San Luis Drain Use Agreement to allow time to acquire funds and develop feasible drainwater treatment technology to meet revised Basin Plan objectives and waste discharge requirements by December 30, 2019 (consistent with the Westside Regional Drainage Plan and San Luis Drainage Feature Reevaluation plan for drainage service); continues the separation of unusable agricultural drainage water discharged from the Grassland Drainage Area from wetland water supply conveyance channels for 2010 – 2019; facilitates drainage management that maintains the viability of agriculture in the Grassland Bypass Project Area and promotes continuous improvement of water quality in the San Joaquin River.	Final EIS/EIR issued August 2009 extending the project from 2009 to 2019 (Reclamation and SLDMWA 2009)

Table 2-3.
Projects Included Under the No-Action Alternative (contd.)

Project	Description	Reason for Inclusion in No-Action Alternative
Semitropic Water Storage District Groundwater Banking Project	Expands current groundwater banking facilities.	Project is currently authorized, funded, and permitted for implementation
Contra Costa Water District Alternative Intake Project	Seeks to reduce effects to Contra Costa WD customers from seasonal fluctuations and changing conditions in the Delta by altering diversion timing and location. The total amount of diversions will not change and no significant impacts to other Delta water users are anticipated.	Project was constructed in 2010; included in Future No-Action Condition of CalSim v.9
San Joaquin River Agreement and Vernalis Adaptive Management Program 1999 – 2011	Implements the SWRCB 1995 *Water Quality Control Plan* for the lower San Joaquin River and the Delta. VAMP, officially initiated in 2000 as part of SWRCB Water Right Decision 1641, is a large-scale, long-term experimental/management program designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Delta. VAMP is also a scientific experiment to determine how salmon survival rates change in response to alterations in San Joaquin River flows and CVP/SWP exports with installation of the Head of Old River Barrier. Although VAMP expires in 2011, the No-Action Alternative includes the continued operation of VAMP or a program with similar conditions.	Project is currently authorized, funded, and permitted for implementation; included in Existing Condition and Future No-Action Condition of CalSim v.9
Arvin-Edison Canal Expansion	Increases the capacity of Arvin-Edison WSD South Canal, giving Metropolitan WD of Southern California the ability to withdraw up to 75 TAF of water from Arvin-Edison WSD during dry years and to store up to a total of 350 TAF of SWP water.	Project is currently authorized, funded, and permitted for implementation
Sea level rise of 1 foot because of global warming[1]	Assumption incorporated into a 2006 DWR climate change study that was originally based on an IPCC (2001) investigation.	Included in Future No-Action Condition of CalSim v.9

Note:
[1] Potential future changes due to climate change are reflected in the No-Action Alternative through a sea level rise of 1 foot; other potential changes, such as changes in precipitation and temperature, are explored in the *Sensitivity of Future Central Valley Project and State Water Project Operations to Potential Climate Change and Associated Sea Level Rise* Attachment to Appendix I, "Supplemental Hydrologic and Water Operations Analyses."

Key:
CALFED = California Bay-Delta Program
Corps = U.S. Army Corps of Engineers
CVP = Central Valley Project
Delta = Sacramento-San Joaquin Delta
DWR = California Department of Water Resources
EIR = Environmental Impact Report
EIS = Environmental Impact Statement
IPCC = International Panel on Climate Change
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
SWP = State Water Project
SWRCB = State Water Resources Control Board
TAF = thousand acre-feet
VAMP = Vernalis Adaptive Management Program
WD = Water District
WSD = Water Storage District

2.4 Alternative A1 Reach 4B1 at 475 cfs, Delta Recapture

Alternative A1 includes actions analyzed at both a project and program level. The following discussion includes a subsection describing the project-level actions included in Alternative A1, and a subsection describing program-level actions included in Alternative A1 (see Table 2-2). Two additional subsections describe the Physical Monitoring and Management Plan and the Conservation Strategy, which include both project- and program-level actions intended to guide implementation of the Settlement (see Table 2-2).

2.4.1 Project-Level Actions

Alternative A1 actions analyzed at a project level are described in greater detail below. The Physical Monitoring and Management Plan (Appendix D) and the Conservation Strategy, which include both project- and program-level actions, are described in separate subsections (see Table 2-2).

Alternative A1 actions analyzed at a **project level** and described in more detail below are as follows:

- **Reoperate Friant Dam and Downstream Flow Control Structures –** Actions for reoperating Friant Dam and downstream flow control structures for the release and conveyance of Interim and Restoration flows include the following:
  - Releasing Interim and Restoration flows from Friant Dam up to the Restoration Flows stipulated by the Settlement, as constrained by then-existing channel capacities
  - Minimizing increases in flood risk in the Restoration Area as a result of Interim and Restoration flows
  - Reoperating downstream flow control structures, which includes modifying operations of the San Joaquin River Flood Control Project (flood management system) and other structures to convey Interim and Restoration flows
  - Establishing an RWA and managing Friant Dam to make water supplies available to Friant Division long-term contractors at a preestablished rate

- **Recapture Interim and Restoration Flows –** Alternative A1 includes actions to recapture Interim and Restoration flows within the Restoration Area and/or the Delta using existing facilities, as shown in Figure 2-4 and in Table 2-2. Actions to recapture Interim and Restoration flows in the Restoration Area, and Interim and Restoration Flows in the Delta, are constrained by established regulatory and institutional conditions, with no new facility construction, facility modifications, or agreements. Recaptured water available for transfer to Friant Division long-term contractors under all action alternatives would range from zero to 556 thousand acre-feet (TAF), as shown in Table 2-4. Actions to recapture Interim and Restoration flows under Alternative A1 include the following:

  – Recapture of Interim and Restoration flows in the Restoration Area at Mendota Pool and the East Bear Creek Unit of the San Luis National Wildlife Refuge (NWR) (East Bear Creek Unit)

  – Recapture of Interim and Restoration flows in the Delta at existing CVP/SWP facilities

The following sections describe these project-level actions in greater detail.

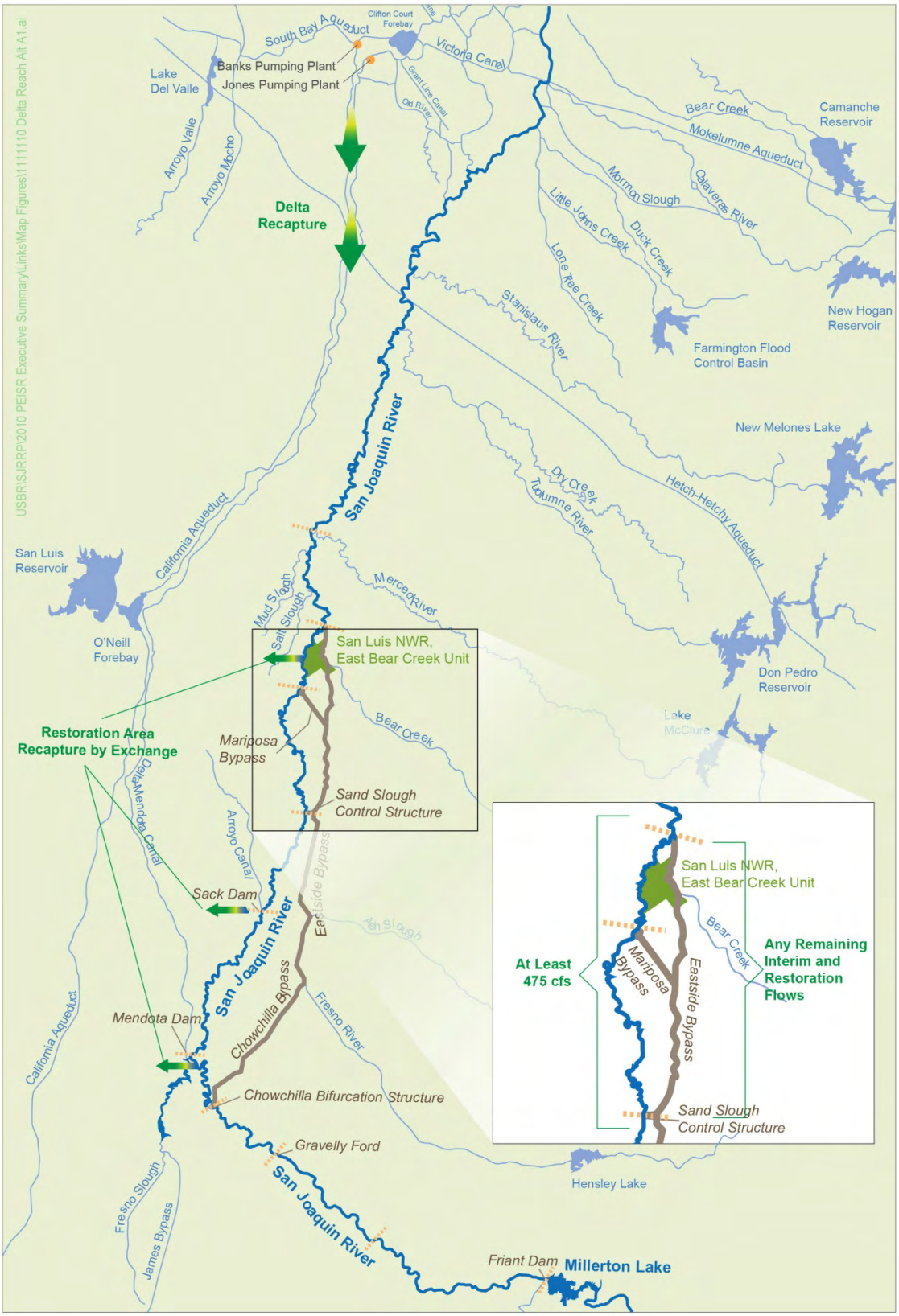


Figure 2-4.
Flow Routing and Water Recapture Under Alternative A1

Table 2-4.
Estimated Maximum Water Available for Transfer Under Action Alternatives

Begin Date	End Date	Friant Dam Releases According to Settlement		Reach 1 Holding Contract Diversions Estimated as in Exhibit B1	Friant Dam Releases Eligible for Recapture[1]	
		(cfs)	(TAF)	(cfs)	(cfs)	(TAF)
10/1	10/31	350	22	160	190	12
11/1	11/10	700	14	130	570	11
11/11	12/31	350	35	120	230	23
1/1	2/28	350	41	100	250	29
3/1	3/15	500	14	130	370	10
3/16	3/31	1,500	48	130	1,370	43
4/1	4/15	2,500	74	150	2,350	70
4/16	4/30	4,000	119	150	3,850	115
5/1	6/30	2,000	242	190	1,810	219
7/1	8/31	350	43	230	120	15
9/1	9/30	350	21	210	140	8
Total flows released (TAF)			**673**	**Total available for transfer[2] (TAF)**		**556**
Potential buffer flows (TAF)			67	Potential buffer flows (TAF)		67
Potential additional releases pursuant to Paragraph 13(c)			100	Potential additional releases pursuant to Paragraph 13(c), minus seepage[3]		0
Maximum total volume released (TAF)			**840**	**Maximum total volume available for transfer (TAF)**		**623**

Notes:
[1] Under existing conditions, Reclamation makes deliveries to riparian water right holders in Reach 1 under "holding contracts." The amounts in the table are approximate based on recent historical deliveries, as provided in Exhibit B of the Settlement. Water delivered to riparian water right holders would not be eligible for recapture.
[2] Total eligible for recapture is a maximum potential total, and does not account for anticipated losses to seepage or other unanticipated losses.
[3] Paragraph 13(c) requires the acquisition of purchased water to overcome seepage losses not anticipated in Exhibit B. Because these potential releases would only be made to overcome seepage, this water would not be available for transfer.

Key:
cfs = cubic feet per second
TAF = thousand acre-feet

Reoperate Friant Dam and Downstream Flow Control Structures

Reoperation of Friant Dam and downstream control structures includes the release of Interim and Restoration flows, reoperating downstream flow control structures, and establishing a RWA, as stipulated by the Settlement and described in the following sections.

Release Interim and Restoration Flows. The release of Interim and Restoration flows from Friant Dam, an action common to all action alternatives, is analyzed at a project level in this Draft PEIS/R because enough project specificity is available. Operations at Friant Dam would change to release Interim and Restoration flows to the San Joaquin River, according to the six flow schedules specified in Exhibit B of the Settlement, as shown in Figure 2-5. The flow schedules are specified in Exhibit B of the Settlement according to six year types: Critical-Low, Critical-High, Dry, Normal-Dry, Normal-Wet, and Wet. The total annual unimpaired runoff at Friant Dam for a water year is the index by which the water year type is determined (based on water years 1922 through 2004).

The Settlement includes an annual allocation of Interim and Restoration flows using either the Restoration Flow schedules included in Exhibit B of the Settlement, or a more continuous hydrograph, as shown in Figure 2-6, in consideration of recommendations to be made by the RA. Potential alternate pathways for the transformation of allocated Restoration Flows between flow schedules are described in Appendix G, "Plan Formulation." Table 2-5 contains the Settlement-recommended release schedule for Interim and Restoration flows.

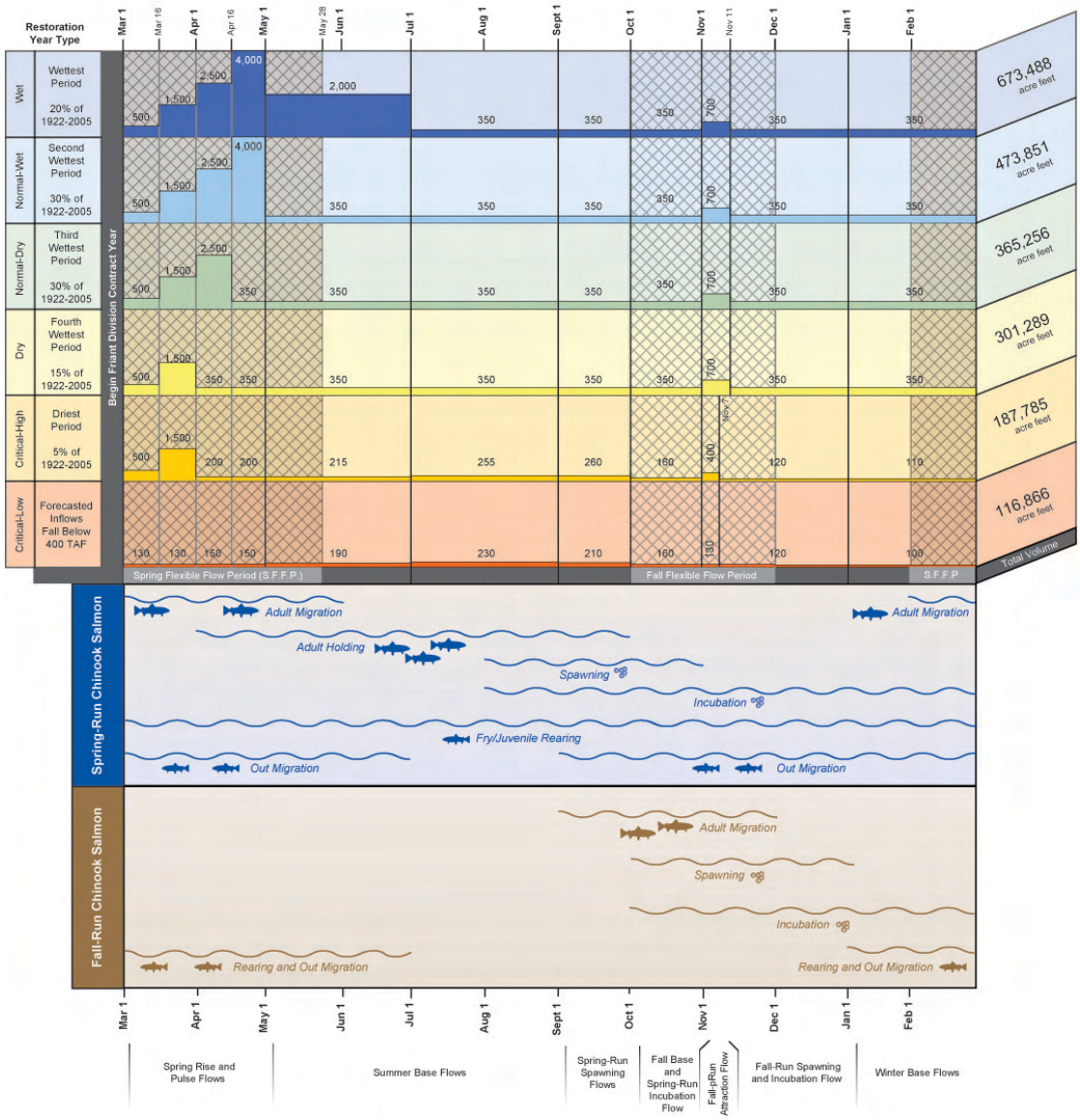
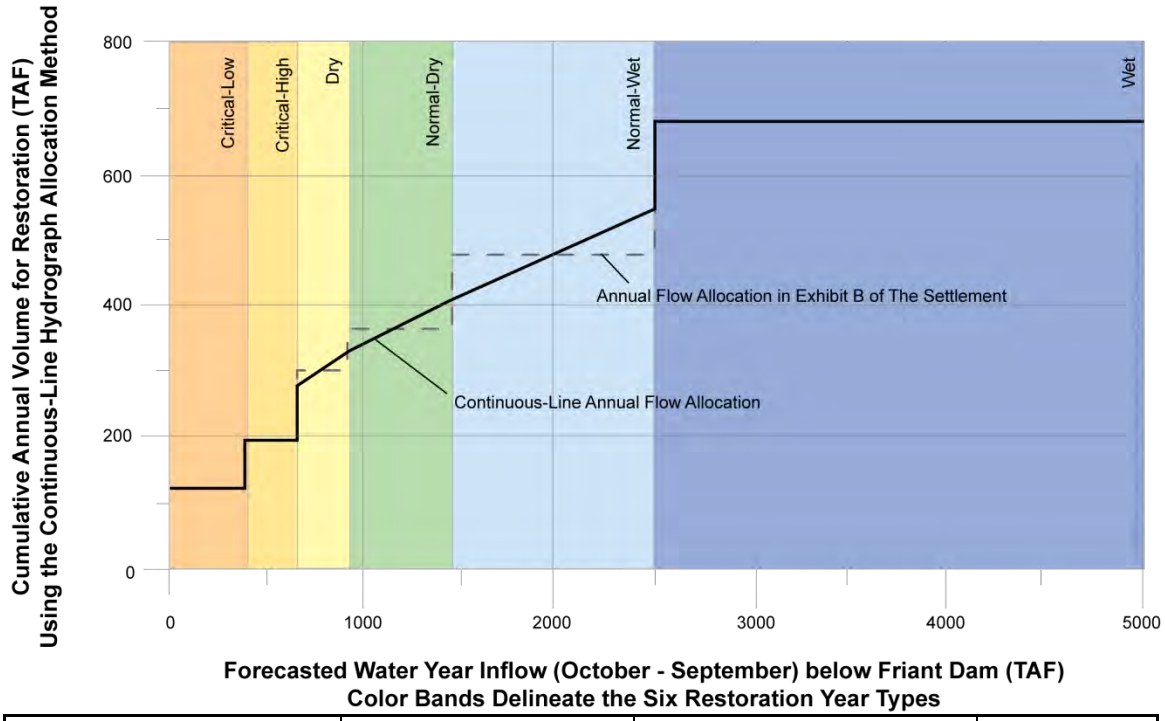


Figure 2-5.
Restoration Flow Schedules Specified in Exhibit B of Settlement



Forecasted Water Year Inflow (October – September) Below Friant Dam (TAF)	Annual Flow Allocation in Exhibit B of Settlement[1] (TAF)	Continuous-Line Annual Flow Allocation (TAF)	Restoration Year Type
Less than 400	116.7	116.9	Critical-Low
Greater than 400 to 670	187.5	187.8	Critical-High
Greater than 670 to 930	300.8	272.3 to 330.3	Dry
Greater than 930 to 1,450	364.6	Greater than 330.3 to 400.3	Normal-Dry
Greater than 1,450 to 2,500	473.0	Greater than 400.3 to 574.4	Normal-Wet
Greater than 2,500	672.3	673.5	Wet

Note:
[1] Friant Dam releases include deliveries to riparian water right holders in Reach 1 under "holding contracts," and releases for the Restoration Goal.

Key:
TAF = thousand acre-feet

Figure 2-6.
Continuous Annual Restoration Flow Allocation in Alternatives

Table 2-5.
Schedule for Release of Interim and Restoration Flows

Year(s)	Days	Release Flows
2009	October 1 through November 20	Of a timing and magnitude, as defined in the appropriate year type release schedule specified in Exhibit B of the Settlement, and without exceeding then-existing channel capacities[1]
2010	February 1 through December 1	Of a timing and magnitude, as defined in the appropriate year type release schedule specified in Exhibit B of the Settlement, and without exceeding then-existing channel capacities[1]
2011 – 2012	February 1 through May 1	Of a timing and magnitude, as defined in the appropriate year type release schedule specified in Exhibit B of the Settlement, and without exceeding then-existing channel capacities
	May 1 through December 1	To wet the channel down to the Chowchilla Bypass Bifurcation Structure to collect information regarding seepage losses[2]
2012 – 2014	January 1 through December 31	Of a timing and magnitude, as defined in the appropriate year type release schedule specified in Exhibit B of the Settlement, and without exceeding then-existing channel capacities or interfering with any remaining in-channel construction activities; continues until modifications identified in Paragraph 11(a) of the Settlement are completed and full Restoration Flows begin
2014 and later	January 1 through December 31	Of a timing and magnitude, as defined in the appropriate year type release schedule specified in Exhibit B of the Settlement, and without exceeding then-existing channel capacities or interfering with any remaining in-channel construction activities

Notes:
[1] Interim Flows during Water Year 2010 (October 1, 2009, through September 30, 2010) are described in the *Water Year 2010 Interim Flows Project Environmental Assessment/Initial Study* released by Reclamation and DWR in September 2009. Interim Flows during Water Year 2011 (October 1, 2010, through September 30, 2011) are described in the *Water Year 2011 Interim Flows Project Supplemental Environmental Assessment* released by Reclamation in September 2010.
[2] This period is intended to correspond to construction activities in Paragraph 11(a). Actual time period of these releases would be coincident with these activities.

Paragraph 15 of the Settlement describes an interim research program that includes the release of Interim Flows beginning in October 2009 and continuing until full Restoration Flows begin (anticipated January 1, 2014), as constrained by then-existing channel capacities). The RA, in consultation with the Technical Advisory Committee, the Secretary, and other appropriate Federal, State, and local agencies, will develop and recommend to the Secretary implementation of a program of Interim Flows. The Interim Flows are intended to allow collection of relevant data concerning flows, temperatures, fish needs, seepage losses, and water recirculation, recapture, and reuse. The Interim Flows include flow releases identified in Exhibit B of the Settlement for the appropriate water year type, including the flexible flow provisions of Exhibit B, to the extent that such releases would not impede or delay completion of actions specified in Paragraph 11(a) of the Settlement, or exceed downstream channel capacities.

The Settlement states that the "Secretary shall commence the Restoration Flows at the earliest possible date…provided, however, that the full Restoration Flows shall commence on a date certain no later than January 1, 2014. If, for any reason, full

Restoration Flows are not released in any year beginning January 1, 2014, the Secretary, in consultation with the RA, shall release as much of the Restoration Flows as possible in light of then-existing channel capacity and without delaying completion of the Phase 1 improvements." Paragraph 13(c) of the Settlement identifies procedures to address unexpected seepage losses, including acquiring water or options on water from willing sellers to be utilized for additional releases from Friant Dam.

According to Paragraph 13(i), the RA is responsible for recommending to the Secretary the date for commencing full Restoration Flows in consideration of the completion of Phase 1 improvements (as subsequently described for common Restoration actions). Several Federal and State actions, including channel capacity modifications, are necessary before full Restoration Flows are released. The release of full Restoration Flows is subject to the provisions for flexible flow periods, buffer flows, and purchased water, as well as the provisions described above for Interim Flows. The release and conveyance of full Restoration Flows is defined as meeting Restoration Flow targets at six locations in the Restoration Area identified in Exhibit B of the Settlement, and in consultation with the RA, the six locations are as follows:

- **Friant Dam** – At or immediately below Friant Dam; designated as "Friant Release" in Exhibit B of the Settlement
- **Head of Reach 2A** – At Gravelly Ford; designated as "Reach 2" in Exhibit B of the Settlement
- **Head of Reach 3** – Immediately below the Chowchilla Bypass Bifurcation Structure; designated as "Reach 3" in Exhibit B of the Settlement
- **Head of Reach 4A** – Downstream from Sack Dam; designated as "Reach 4" in Exhibit B of the Settlement
- **Head of Reach 4B** – Designated as "Reach 5" in Exhibit B of the Settlement
- **Confluence of Merced River** – Designated as "Confluence" in Exhibit B of the Settlement

Flow targets vary by Restoration Year Type, and range from zero cfs (in Reaches 3, 4A, and 4B in Critical-Low years) to 4,055 cfs (at the confluence of the Merced River in Wet and Normal-Wet years). In some years, the flow targets could be met partially or entirely by flood control releases or by local runoff or return flows.

If, for any reason, full Restoration Flows are not released in any year, beginning January 1, 2014, the Secretary, in consultation with the RA, would bank, store, exchange, transfer, or sell the water through mutually acceptable agreements with Friant Division long-term contractors or third parties (with proceeds deposited into the Restoration Fund established under the Settlement), or release the water from Friant Dam during times of the year other than those specified in the applicable flow schedule. In addition, the Settlement includes provisions for the release of pulse flows in Normal-Wet and Wet Years to perform several geomorphic functions such as flushing spawning gravels, unless

the Secretary, in consultation with the RA, determines that such flows are not needed. Flushing flows would be accomplished with a quantity of water based on an average flow of 4,000 cfs from April 16 to 30, and include a peak release as close to 8,000 cfs as possible for several hours, within the constraints of channel capacity. The Settlement also includes the following provisions to modify Restoration Flows, in consideration of recommendations to be made by the RA: application of flexible flow periods, as described in Exhibit B of the Settlement; the use of a 10 percent buffer flow to help meet the Restoration Goal; and the release of acquired water for unanticipated river seepage losses for Restoration Flows.

Reclamation and the San Joaquin River Exchange Contractors have entered into a Second Amended Contract for Exchange of Waters (Contract Ilr-1144) (San Joaquin River Exchange Contract), dated February 14, 1968. Under the terms and conditions of that contract, Reclamation is obligated to make available required deliveries from the Delta-Mendota Canal (DMC) or releases from Millerton Reservoir. If Reclamation makes deliveries to the San Joaquin River Exchange Contractors via the San Joaquin River, these water deliveries would have a higher priority for channel capacity over Interim or Restoration flows. Therefore, Interim and Restoration flows would be reduced, as necessary, to provide channel capacity for water delivery to the San Joaquin River Exchange Contractors via the San Joaquin River. However, it is important to note that under Article 3(n) of the Friant Division long-term water service contracts and the recently executed Friant Division repayment contracts, "The United States agrees that it will not deliver to the Exchange Contractors thereunder waters of the San Joaquin River unless and until required by the terms of said contract, and the United States further agrees that it will not voluntarily and knowingly determine itself unable to deliver to the Exchange Contractors entitled thereto from water that is available or that may become available to it from the Sacramento River and its tributaries or the Sacramento-San Joaquin Delta those quantities required to satisfy the obligations of the United States under said Exchange Contract and under Schedule 2 of the Contract for Purchase of Miller and Lux Water Rights (Contract I1r-1145, dated July 27, 1939)."

Minimize Flood Risk from Interim and Restoration Flows. Throughout Settlement implementation, the maximum downstream extent and rate of Interim and Restoration flows to be released would be limited to then-existing channel capacities. As channel or structure modifications are completed with additional environmental compliance, maximum Interim Flow releases would be correspondingly increased in accordance with then-existing channel capacities and with the release schedule. Consistent with the Act, Interim Flows would be reduced, as needed, to address material seepage impacts, as identified through the monitoring program (see Appendix D, “Physical Monitoring and Management Plan”). If release of water from Friant Dam is required for flood control purposes, concurrent Interim and Restoration flows would be reduced by an amount equivalent to the required flood control release. If flood control releases from Friant exceed the concurrent scheduled Interim and Restoration flows, no additional releases above those required for flood control would be made for SJRRP purposes.

Then-existing channel capacities within the Restoration Area correspond to flows that would not significantly increase flood risk from Interim and Restoration flows in the Restoration Area. The action to release Interim and Restoration flows includes measures that would achieve the following objectives: (1) commit Reclamation to implementing actions that would meet performance standards that minimize increases in flood risk as a result of Interim or Restoration flows, (2) limit the release and conveyance of Interim and Restoration flows to those flows that would remain in-channel until adequate data are available to apply the performance standards and until the performance standards are satisfied, and (3) enable the Settlement to be implemented in coordination with other ongoing and future actions outside of the Settlement that could address channel capacity issues identified in the Settlement or through the SJRRP or other programs. Implementation of measures that achieve these objectives would allow for the safe release and conveyance of Interim and Restoration flows throughout the duration of Settlement implementation. Reclamation would implement the following three integrated measures that collectively minimize increases in flood risk as a result of Interim or Restoration flows during Settlement implementation:

- **Establish a Channel Capacity Advisory Group and Determine and Update Estimates of Then-Existing Channel Capacities as Needed –** The establishment and administration of a Channel Capacity Advisory Group to provide independent review of estimated then-existing channel capacities, monitoring results, and management actions to address vegetation and sediment transport within the system as identified by Reclamation.

- **Maintain Interim and Restoration Flows Below Estimates of Then-Existing Channel Capacities –** The process for limiting Interim and Restoration flows to reduce the risk of levee failure due to underseepage, through-seepage, and associated levee stability issues to less-than-significant levels.

- **Closely Monitor Erosion and Perform Maintenance and/or Reduce Interim and Restoration Flows as Necessary to Avoid Erosion-Related Impacts –** The commitment by Reclamation to implement erosion monitoring and management, including monitoring potential erosion sites, reducing Interim and Restoration flows as necessary, and reporting ongoing results of monitoring and management actions to the Channel Capacity Advisory Group.

Only limited data are currently available on San Joaquin River channel capacities and levee conditions. The levee design criteria developed by U.S. Army Corps of Engineers (USACE) and presented in *Design and Construction of Levees Engineering and Design Manual* (Manual No. 1110-2-1913) (USACE 2000) would be applied throughout the Restoration Area to identify the Interim or Restoration flows that would not cause the "Factor of Safety" to be reduced below 1.4, as calculated using USACE levee criteria shown in Table 2-6. The application of the Factor of Safety of 1.4 is required for federally authorized flood control projects. As defined by USACE, the Factor of Safety is equal to one over the exit gradient, as measured at the toe of the levee (2000).

Table 2-6.
Minimum Factors of Safety - Levee Slope Stability

Type of Slope	Applicable Stability Conditions and Required Factors of Safety			
	End-of-Construction	Long-Term (Steady Seepage)	Rapid Drawdown[a]	Earthquake[b]
New Levees	1.3	1.4	1.0 to 1.2	(see below)
Existing Levees	--	1.4[c]	1.0 to 1.2	(see below)
Other Embankments and Dikes[d]	1.3[e,f]	1.4[c,f]	1.0 to 1.2[f]	(see below)

Source: U.S. Army Corps of Engineers. 2000. Design and Construction of Levees Engineering and Design Manual. Manual No. 1110-2-1913. April. Table 6-1b, page 6-5.

Notes:

[a] Sudden drawdown analyses. F. S. = 1.0 applies to pool levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown. F. S. = 1.2 applies to pool level, likely to persist for long periods prior to drawdown.

[b] See ER 1110-2-1806 for guidance. An EM for seismic stability analysis is under preparation.

[c] For existing slopes where either sliding or large deformation have occurred previously and back analyses have been performed to establish design shear strengths lower factors of safety may be used. In such cases probabilistic analyses may be useful in supporting the use of lower factors of safety for design.

[d] Includes slopes which are part of cofferdams, retention dikes, stockpiles, navigation channels, breakwater, river banks, and excavation slopes.

[e] Temporary excavated slopes are sometimes designed for only short-term stability with the knowledge that long-term stability is not adequate. In such cases higher factors of safety may be required for end-of-construction to ensure stability during the time the excavation is to remain open. Special care is required in design of temporary slopes, which do not have adequate stability for the long-term (steady seepage) condition.

[f] Lower factors of safety may be appropriate when the consequences of failure in terms of safety, environmental damage and economic losses are small.

Until adequate data are available to determine the Factor of Safety, Reclamation would limit the release of Interim and Restoration flows to those which would remain in-channel. In-channel flows are flows that maintain a water surface elevation at or below the elevation of the landside levee toe (i.e., the base of the levee). When sufficient data are available to determine the Factor of Safety, Reclamation would limit Interim and Restoration flows to levels that would correspond to a Factor of Safety of 1.4 or higher at all times. Observation of levee erosion, seepage, boils, impaired emergency levee access, or other indications of increased flood risk identified through ongoing monitoring at potential erosion sites would indicate that the minimum Factor of Safety is not met and would trigger immediate reductions in Interim and Restoration flows at the site. Such observations would supersede channel capacity estimates, and Interim and Restoration flows would be reduced in areas where these conditions occur. Potential immediate responses to reduce, redirect, or redivert Interim or Restoration flows to reduce flow in downstream reaches is described in Section 2.4.3.

Detailed discussion of these three measures to reduce flood risk from the release and conveyance of Interim and Restoration flows is presented below.

Establish a Channel Capacity Advisory Group, and Determine and Update Estimates of Channel Capacities as Needed. In coordination with DWR and prior to releasing Interim Flows in Water Year 2013, Reclamation would establish a Channel Capacity Advisory Group to provide independent review of then-existing channel capacities estimated by Reclamation in accordance with standard USACE levee performance

criteria. The Channel Capacity Advisory Group would be responsible for providing timely independent review of data, analytical methodology, and results used to estimate then-existing channel capacities. The Channel Capacity Advisory Group would be comprised of the following:

- One member from the U.S. Bureau of Reclamation
- One member from the California Department of Water Resources
- One member from the U.S. Army Corps of Engineers
- One member from the Lower San Joaquin Levee District
- One member from the Central Valley Flood Protection Board

Reclamation would prepare a report annually or whenever Reclamation contemplates increasing the upper limit of releases for Interim or Restoration flows, which would include data and methods used to develop estimates of then-existing channel capacities. A draft report would be provided to the Channel Capacity Advisory Group for its review and comment for a period of 60 days. In the event that comments or recommendations are received from the Advisory Group within 60 days, Reclamation would be required to consider and respond to such comments and prepare a final report for distribution to the Channel Capacity Advisory Group within 60 days of the close of the draft report review period. Reclamation would not increase Interim or Restoration flows above the previously determined then-existing channel capacities until 10 days after the final report is prepared and distributed to the Channel Capacity Advisory Group. The first draft report shall be completed within 1 year of signing the PEIS/R Record of Decision. Draft reports would include the data, methods, and estimated channel capacities; flow limits and any maintenance activities; and monitoring efforts and management actions as described in this project description. Draft and final reports would be made available to the public concurrent with their distribution to the Channel Capacity Advisory Group.

Reclamation would convene the Channel Capacity Advisory Group as required until 2030, but may stop earlier, provided that then-existing channel capacities are determined to equal or exceed the maximum proposed Restoration Flows throughout the Restoration Area. If after 2030 then-existing channel capacities decrease such that full Restoration Flows cannot be conveyed, the Channel Capacity Advisory Group would be reconvened and function as described above until such time that the then-existing channel capacities are determined to equal or exceed the full Restoration Flows.

Maintain Interim and Restoration Flows at or Below Estimated Then-Existing Channel Capacities. Until sufficient data are available to determine the Factor of Safety, Reclamation would limit initial Interim and Restoration flow releases to those flows which would remain in-channel, as described below. When sufficient data are available to determine the Factor of Safety, Reclamation would limit the release of Interim and Restoration Flows to those flows which would maintain standard USACE levee performance criteria (i.e., a Factor of Safety of at least 1.4) at all times.

In coordination with DWR, Reclamation would apply standard USACE levee performance criteria for levees under a steady state of saturation and consider past performance and hydrologic and hydraulic modeling to determine and update estimates of channel capacities. The resulting estimated channel capacities would be used to establish limits for Interim and Restoration flows throughout the Restoration Area. Reclamation would be required to provide this estimate to the Channel Capacity Advisory Group for review, as previously described.

In the event that insufficient information is available to develop an estimate of channel capacities that maintain a minimum Factor of Safety for levees under saturated conditions by Water Year 2013, Reclamation would limit initial Interim and Restoration flows to those flows which would remain in-channel, as determined by DWR using one-dimensional HEC-RAS hydraulic modeling and described in Appendix I of this Draft PEIS/R. In-channel flows would have less-than-significant effects on flood risk as explained in the PEIS/R impact assessment of in-channel flows.

Factors of Safety are inversely related to the exit gradient, and describe the potential for unsafe conditions to occur. The exit gradient is the hydraulic gradient at which water leaves the soil surface under saturated conditions, and is a function of both structural design and hydrogeologic conditions. At a critical exit gradient, soil particles may move with water, resulting in unsafe conditions such as piping and boils (Craig 1997, USACE 2000). USACE recommends a Factor of Safety of 1.4 or greater for levees under a steady state of saturation for a prolonged time, such as occurs during flood conditions or with prolonged flows. Maintaining the USACE levee performance criteria for levees under a steady state of saturation would be the key levee performance criterion for maintaining flood risks at less-than-significant levels.

Systematic levee condition monitoring would be implemented as described in more detail in Appendix D, "Physical Monitoring and Management Plan." Observation of seepage or boils at the landside levee toe or evidence of levee erosion would indicate that the minimum Factor of Safety is not met. Such observations would supersede channel capacity estimates, and Interim and Restoration flows would be immediately reduced, redirected, or diverted in areas where these conditions occur (see Section 2.3.4).

Closely Monitor Erosion and Perform Maintenance and/or Reduce Interim or Restoration Flows as Necessary to Avoid Erosion-Related Impacts. As part of the draft reports prepared by Reclamation and submitted to the Channel Capacity Advisory Group (as described previously), Reclamation would describe the monitoring and management actions taken within the Restoration Area over the prior year and the monitoring and management actions planned for the following year. The draft reports would identify those monitoring and management actions that are a result of implementing the Settlement and those that are a result of regular operations and maintenance and capital improvements to flood control facilities of the Lower San Joaquin River Flood Control Project. The draft reports would be submitted to the Channel Capacity Advisory Group for review as previously described.

Reclamation would implement the flood-related monitoring and management actions included in the project description and in the draft reports to the Channel Capacity Advisory Group, and would work with the appropriate agency(ies) to implement these actions to meet the performance standards as previously described. As previously described, systematic levee condition monitoring would be implemented as described in more detail in Appendix D, "Physical Monitoring and Management Plan," and could lead to the immediate reduction of Interim or Restoration flows in areas where these conditions occur.

Erosion monitoring would be conducted by Reclamation using several standard methodologies and protocols commonly employed by DWR, reclamation districts, and/or USACE to monitor levee erosion. Aerial photography and/or ground surveys would be compared to identify changes in bank line over time, indicating potential erosion. True color aerial photographs would be inspected and compared to previous aerial photographs to identify areas of sediment mobilization, bar formation, and bank erosion. After these areas have been initially identified using aerial photography, they would be visited and inspected. If inspections indicate that erosion-related impacts exist or are imminent, management actions would be taken to address the issue.

Field surveys of potential erosion sites on the San Joaquin River between Friant Dam and the Merced River confluence would be conducted by Reclamation annually. These surveys would assess the condition of potential erosion sites, and could include a variety of techniques such as aerial photography and topographic surveys. Previous information documents the existing sediment and geomorphology conditions within the Restoration Area. Existing information developed by Reclamation includes preliminary analyses conducted to identify locations susceptible to potential erosion through comparison of present-day channel positions (2004) and historical channel positions (1937, 1938). Reclamation identified areas that may be susceptible to future erosion using the following criteria:

- Areas of channel change between 1937 and 2004 or between 1983 and 2004 where the channel has shown lateral erosion along an outer bend or where it has the potential to reoccupy an old channel position and laterally erode banks along an outer bend, and that also have low topography (for instance, several outer bends in Reach 1A are located adjacent to high bluffs, which would be considered an area of slower erosion and are thus not identified).

- Meander necks where channel sinuosity is high and could create a cutoff.

- Areas along outer bends where excavated gravel pits are located close to the active channel, regardless of whether any historical channel change has occurred.

- Areas along outer bends that are located adjacent to developed areas (such as at Firebaugh).

- Areas with the potential for future erosion identified through this process and prioritized for monitoring based on potential impacts to infrastructure. The highest priorities were those with residential developments, buildings, and bridges. Other high-priority areas included those containing levees, irrigation canals, and roads with an apparent high potential to experience some lateral migration or bank erosion.

Sediment mobilization monitoring during these annual surveys would focus on specific potential erosion sites identified through this process, and would evaluate current and potential future erosion at these sites. Channel bed deposition would be evaluated as necessary by analyzing changes identified in topographic survey data and LIDAR surveys.

The Lower San Joaquin Levee District (LSJLD) and the Central Valley Flood Protection Board (CVFPB) currently have responsibility for implementing routine operations and maintenance or capital improvements to the Lower San Joaquin River Flood Control Project.

Erosion management actions identified through monitoring as described above may fall under the routine maintenance of the Lower San Joaquin River Flood Control Project currently performed by LSJLD. If increased maintenance activities and costs are required as a result of implementing the Settlement, including additional erosion management actions identified through the monitoring activities described in this section, Reclamation would conduct or enter into an agreement with others to conduct such additional maintenance activities. Currently, Reclamation is working with LSJLD to develop and implement an agreement to provide financial assistance for additional costs incurred by LSJLD. The financial assistance agreement is intended to assist LSJLD in adapting to changes in operations and maintenance activities, as needed to maintain the existing level of flood management under release of Interim and Restoration flows.

Reoperate Downstream Flow Control Structures. In addition to management of Interim and Restoration flows at Friant Dam, Alternative A1 includes modifications to the existing operation of the Lower San Joaquin River Flood Control Project (flood management system) and the Hills Ferry Barrier, but without physical, construction-related activities to modify the channels, to address the following:

- **Reoperate Chowchilla Bypass Bifurcation Structure to convey Restoration Flows into Reach 2B –** Currently, the structure is operated as part of the flood management system to direct flood flows and irrigation deliveries based on several factors, including flows in Reach 2A, the capacity of Reach 2B, flows from the Kings River system via Fresno Slough, and water demands in the Mendota Pool. Modifications to the operating criteria would incorporate the routing of Interim and Restoration flows during nonflood operations to meet flow targets in Reach 2B. If flood releases are made from Friant Dam in excess of the Interim or Restoration flows called for, Interim and Restoration flows would not be released and standard operation of the flood management system would apply. Interim and Restoration flows would have a lower priority for downstream

channel capacity than flood flows or irrigation deliveries to the San Joaquin River Exchange Contractors.

- **Reoperate San Joaquin River Headgate Structure to convey Restoration Flows into Reach 4B1 –** The current conveyance capacity of Reach 4B1 is unknown and could be as low as zero in some locations. Currently, the San Joaquin River Headgate Structure, part of the flood management system, is maintained in a closed position whereby all flows in the river are routed into the bypass system. The San Joaquin River Headgate Structure would be operated to release Interim and Restoration flows to Reach 4B1 after completion of modifications to provide for increased capacity in Reach 4B1, and modifications to the headgate structure are completed. These releases would be limited by then-existing channel capacity in Reach 4B1.

- **Reoperate the Eastside and Mariposa bypass bifurcation structures to convey Interim and Restoration flows into Reach 4B2 –** Modifications to the operating criteria for these structures, which are part of the flood management system, would include the routing Interim and Restoration flows to the Eastside or Mariposa bypasses. Interim and Restoration flows would have a lower priority for downstream channel capacity than flood flows.

- **Operate and monitor Hills Ferry Barrier –** The main purpose of the Hills Ferry Barrier is to redirect upstream-migrating adult fall-run Chinook salmon into suitable spawning habitat in the Merced River and prevent migration into the main stem San Joaquin River upstream, where conditions are currently considered unsuitable for Chinook salmon and Central Valley steelhead. The adult Central Valley steelhead migration period overlaps with fall-run Chinook salmon, and typically occurs between October and December in the San Joaquin River basin. Because their body type is similar to salmon, Central Valley steelhead would be expected to be redirected by the barrier in a similarly effective manner. Operations and maintenance of the Hills Ferry Barrier would continue for the purpose of redirecting Chinook salmon and, incidentally, Central Valley steelhead until sufficient habitat and channel improvements to support salmonids are complete.

Establish Recovered Water Account and Program. The release of Interim and Restoration flows would reduce annual water deliveries to Friant Division long-term contractors. Consistent with Paragraph 16(b) of the Settlement, Reclamation would identify delivery reductions to Friant Division long-term contractors associated with the release of Interim and Restoration flows, as part of the RWA stipulated for implementation under Paragraph 16(b). Paragraph 16(b) also provides for the delivery of water during wet hydrologic conditions to Friant Division long-term contractors at a cost of $10 per acre-foot. Implementing Paragraph 16(b) actions could affect the amount of water that is released to the San Joaquin River in excess of Restoration Flow requirements during wet periods. The diversion of water from Friant Dam pursuant to Paragraph 16(b) would be based on the following conditions:

- Water at Friant Dam would be eligible for delivery to Friant Division long-term contractors, pursuant to Paragraph 16(b), in wet hydrologic conditions when water is not needed for Interim and Restoration flows.

- Paragraph 16(b) water would be conveyed through the Friant-Kern and Madera canals only when capacity is available, without impacting requirements to meet existing contract deliveries to Friant Division long-term contractors.

- Potential future demand for Paragraph 16(b) water in all action alternatives is based in part on the implementation of actions by Friant Division long-term contractors or other water users to increase surface water conveyance or groundwater recharge capacity.

It is anticipated that Friant Division long-term contractors would be able to accept delivery of some Paragraph 16(b) water using existing water conveyance and storage facilities. Because Paragraph 16(b) water would likely be available predominantly during periods when irrigation demand is limited, it is expected that Friant Division and non-Friant Division water users could develop additional local conveyance and storage capacity to increase their ability to receive Paragraph 16(b) water supplies. The program alternatives are evaluated in consideration of the range of potential changes in water diversions that could result from implementing water facility improvements in the Friant Division to increase delivery capability. Facility improvements to increase delivery capability would require separate environmental compliance documentation, and are not included as actions under the program alternatives. Pursuant to Part III of the Omnibus Public Land Management Act of 2009 (Public Law 111-11), the Secretary is developing proposed guidelines for projects designed to reduce, avoid, or offset the quantity of expected water supply impacts to Friant Division long-term contractors caused by Interim and Restoration flows. This process is occurring parallel to and separate from development of this Draft PEIS/R.

Reclamation is currently working with the Friant Division long-term contractors and appropriate agencies to develop procedures for identifying delivery reductions to Friant Division long-term contractors associated with the release of Interim and Restoration flows as part of the RWA stipulated for implementation under Paragraph 16(b).

Recapture Interim and Restoration Flows

Water recapture actions in Alternative A1 include recapturing Interim and Restoration flows using existing facilities in the Restoration Area and in the Delta. These actions are analyzed at a project level in this Draft PEIS/R. As described previously, action alternatives presented in this Draft PEIS/R are differentiated, in part, by the actions for recapturing Interim and Restoration flows. Recaptured water available for transfer to Friant Division long-term contractors would range from zero to 556 TAF, as shown in Table 2-4. Reclamation would identify actual delivery reductions to Friant Division long-term contractors associated with the release of Interim and Restoration flows.

Recapture in the Restoration Area. Alternative A1, and all other action alternatives, includes potential recapture of up to the total quantity of Interim and Restoration flows (556 TAF, as shown in Table 2-4) within the Restoration Area using existing facilities. As previously described, the Settlement includes flow targets in six locations to determine achievement of the Restoration Goal. Paragraph 16(a)(1) of the Settlement provides that recapture and recirculation of Interim and Restoration Flows "shall have no adverse impact on the Restoration Goal, downstream water quality or fisheries," Because recapture within the Restoration Area could prevent the flow targets from being met, recapture within the Restoration Area would occur only if necessary to avoid interfering with in-channel construction activities associated with the Restoration Goal, or to avoid potential material adverse impacts from groundwater seepage (as described in Appendix D, "Physical Monitoring and Management Plan") or for other emergency actions to avoid immediate adverse impacts. Interim and Restoration flows would be recaptured consistent with Federal, State, and local laws, and future agreements with downstream agencies, entities, and landowners. Potential locations within the Restoration Area for recapture of Interim and Restoration flows include the Mendota Pool, and the East Bear Creek Unit located in Eastside Bypass Reach 3. Only diversion facilities that have potential to recirculate Interim and Restoration flows to the Friant Division would be used for recapture locations.

No change in operational requirements would be required to recapture Interim and Restoration flows in the Restoration Area or in the Delta under the regulatory compliance standards in place at the time water is recaptured. Any increase in Restoration Area or Delta exports directly resulting from the Interim or Restoration flows would be available for recirculation to the Friant Division; however, recirculation of recaptured water to the Friant Division could require subsequent exchange agreements between Reclamation, DWR, Friant Division long-term contractors, and other south-of-Delta CVP/SWP contractors who are not included in the action alternatives. As previously described, recirculation would be subject to available capacity and existing operational constraints within CVP/SWP storage and conveyance facilities.

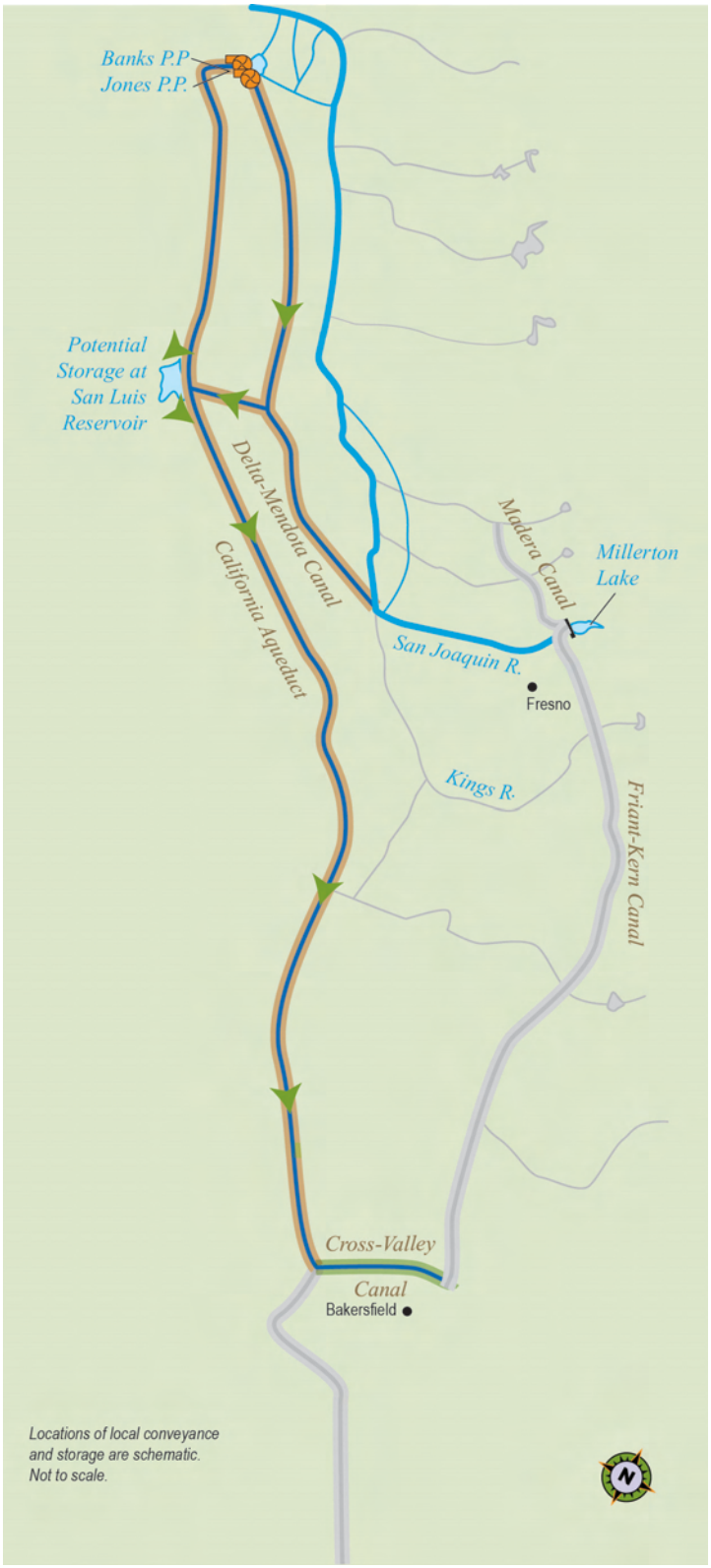
Locations available for recapture of Interim and Restoration flows within the Restoration Area include the following:

- **Recapture at Mendota Pool** – Interim and Restoration flows could be diverted from the Mendota Pool to the extent that these flows would meet demands, replacing CVP water supplies that would otherwise be delivered via the DMC. The DMC carries water from the Delta to the Mendota Pool, where the water is diverted through several existing pumps and canals with a combined capacity that exceeds upstream channel capacity. Interim and Restoration flows diverted by CVP contractors at the Mendota Pool would be in lieu of supplies typically delivered via the DMC. Therefore, CVP water supplies that would have been delivered via the DMC would be made available for delivery to the Friant Division, subject to existing contractual obligations and existing and any future agreements. In such cases, Delta exports would not change compared to the No-Action Alternative. Exported water, up to the amount diverted at the Mendota Pool, would be available for recirculation to the Friant Division using existing

south-of-Delta facilities, including the C.W. "Bill" Jones Pumping Plant (Jones Pumping Plant) and Harvey O. Banks Pumping Plant (Banks Pumping Plant), California Aqueduct, DMC, San Luis Reservoir and related pumping facilities, and other facilities operated by CVP/SWP contractors, as shown on Figure 2-7.

- **Recapture at wildlife refuge** – If considerations in Reach 5 or in downstream reaches (such as channel capacity or potential take of listed species that could not be avoided) require that less (or no) flow enters those reaches, Interim and Restoration flows could be diverted to the East Bear Creek Unit in Eastside Bypass Reach 3, to the extent that these flows would meet water supply demands. The East Bear Creek Unit has a pump lift station in the Eastside Bypass with a diversion capacity of 60 cfs. This pump station includes a 48-inch-diameter intake structure and four 125-horsepower electric motors driving 15 cfs pumps. Deliveries of Interim and/or Restoration Flows to the East Bear Creek Unit would be further constrained by actual demand for water supplies at the units. Currently, the East Bear Creek Unit receives CVP water supplies from the DMC.

Recapture in Delta. Interim and Restoration flows reaching the Delta would be recaptured at existing facilities within the Delta consistent with applicable laws, regulations, BOs, and court orders in place at the time the water is recaptured. Alternative A1 includes recapture of Interim and Restoration flows in the Delta at the Jones and Banks pumping plants (Figures 2-2 and 2-4), operated consistent with applicable laws, regulations, BOs, and court orders in place at the time the water is recaptured.



Key: P.P. = Pumping Plant

Figure 2-7.
Major Facilities That May Be Used in Recapture and Recirculation of Interim and Restoration Flows

2.4.2 Program-Level Actions

Alternative A1 actions analyzed at a program level are described below, and include recirculating recaptured Interim and Restoration flows, and common Restoration actions. The Physical Monitoring and Management Plan (Appendix D) and the Conservation Strategy, which include both project- and program-level actions, are described in a separate subsection.

Alternative A1 actions analyzed in this Draft PEIS/R at a program level and described in more detail below are as follows:

- **Recirculate recaptured Interim and Restoration flows** – Alternative A1 includes recirculating up to the full amount of recaptured Interim and Restoration flows to the Friant Division to minimize water supply impacts to Friant Division long-term contractors caused by Interim and Restoration flows.

- **Common Restoration actions –** Common Restoration actions are potential physical actions to achieve the Restoration Goal that are common to all action alternatives, and which would be implemented within the Restoration Area, as shown in Figure 2-8. These include actions to modify Reach 4B1 to convey at least 475 cfs of Interim and Restoration flows. Modifications in the Eastside and Mariposa bypasses to convey Interim and Restoration flows in excess of flows routed through Reach 4B1 are common to all alternatives, as shown in Figure 2-2, and are described as part of the common Restoration actions.

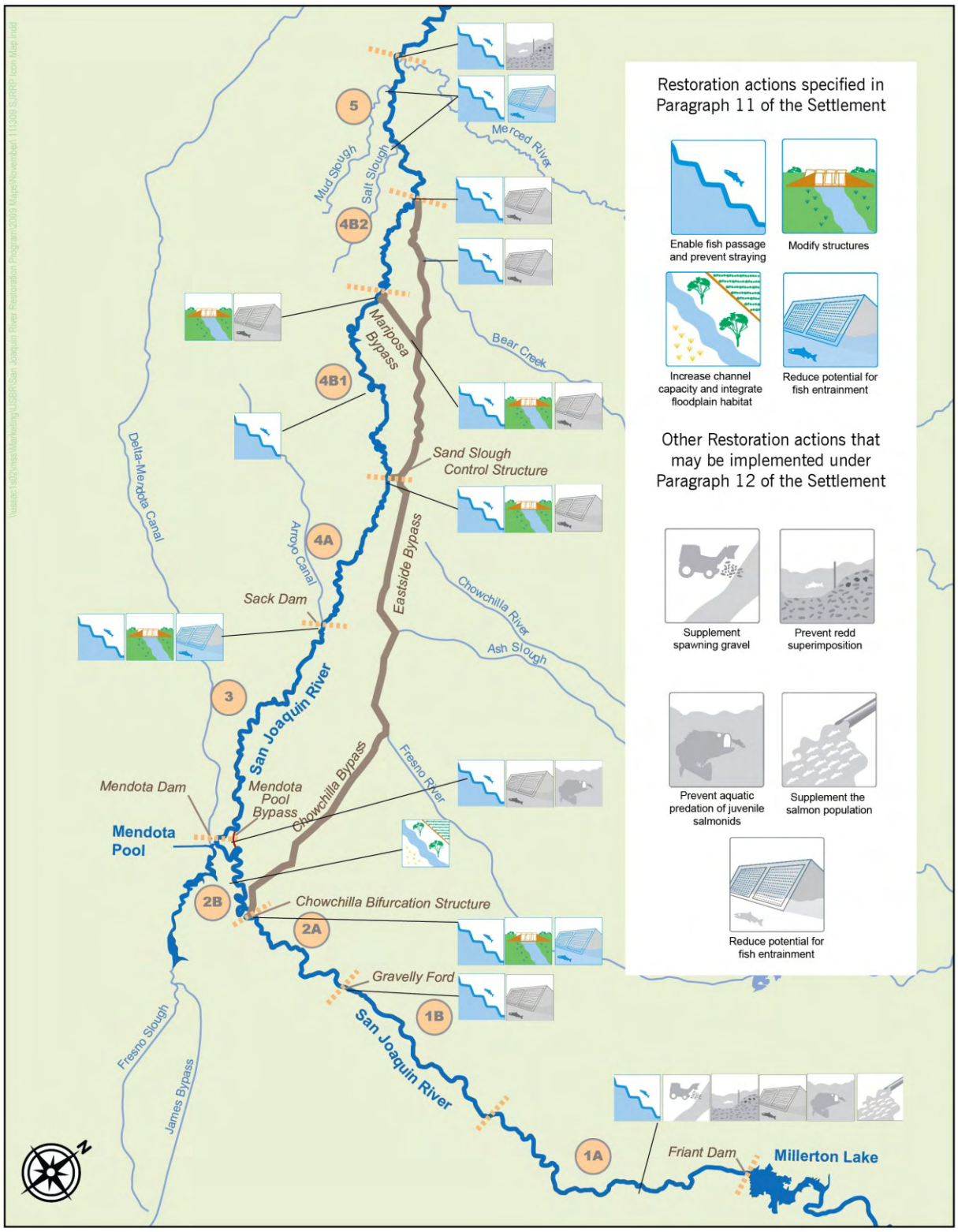


Figure 2-8.
Location of Common Restoration Actions Included in Action Alternatives

Recirculate Recaptured Interim and Restoration Flows

Paragraph 16(a) of the Settlement stipulates that the Secretary, in consultation with the Settling Parties, is to develop and implement "…a plan for recirculation, recapture, reuse, exchange, or transfer of the Interim and Restoration flows for the purpose of reducing or avoiding impacts to water deliveries to all of the Friant Division long-term contractors caused by the Interim Flows and Restoration Flows," provided "…that any recirculation, recapture, reuse, exchange or transfer of the Interim and Restoration flows shall have no adverse impact on the Restoration Goal, downstream water quality or fisheries." The quantity of water available for recirculation to the Friant Division long-term contractors would be up to the amount of water recaptured at existing facilities (under all alternatives) or new or modified facilities (Alternatives C1 and C2). Water recaptured and recirculated to the Friant Division in this manner could require exchange agreements between Reclamation, DWR, Friant Division long-term contractors, and other south-of-Delta CVP/SWP contractors. The details of the plan for recirculation would be determined through future negotiations between affected parties, and this action is therefore described at a program level in this Draft PEIS/R.

Recirculation would be subject to available capacity within CVP/SWP storage and conveyance facilities. Available capacity is capacity that is left after satisfying all statutory and contractual obligations to existing water service or supply contracts, exchange contracts, settlement contracts, transfers, or other agreements involving or intended to benefit CVP/SWP contractors served water through CVP/SWP facilities. No additional agreements would be required to recapture Interim and Restoration flows in the Restoration Area. However, recirculation of recaptured water to the Friant Division could require mutual agreements between Reclamation, DWR, Friant Division long-term contractors, and other south-of-Delta CVP/SWP contractors. Reclamation would develop these agreements in close coordination with Friant Division long-term contractors. Any mutual agreements negotiated to facilitate delivery of water to Friant Division contractors using CVP/SWP facilities would be negotiated so as not to impact CVP/SWP deliveries or operation of the CVP/SWP; such agreements may require additional environmental documentation. In addition, Paragraph 13(i) of the Settlement provides guidance on how to manage any unreleased Restoration Flows starting in 2014, including but not limited options to enter into mutually acceptable agreements with Friant Division long-term contractors or third parties, "…to (A) bank, store, or exchange such water for future use to supplement future Restoration Flows, or (B) transfer or sell such water and deposit the proceeds of such transfer or sale into the Restoration Fund created by this Settlement." Paragraph 13(i) also specifies the release the water from Friant dam during times of the year other than those specified in the applicable hydrograph. Any mutual agreements negotiated to facilitate the actions under Paragraph 13(i) would be negotiated so as not to increase water supply reductions to Friant Division long-term contractors beyond what would have been caused by releases in accordance with the hydrograph releases in Exhibit B of the Settlement. Such agreements may require additional environmental documentation.

Common Restoration Actions

Common Restoration actions require program-level coverage to address cumulative and system-wide effects, and include actions stipulated in Paragraphs 11 and 14 of the Settlement, as well as additional structural or channel improvements that may further enhance the success of achieving the Restoration Goal under Paragraph 12 of the Settlement.

- **Paragraph 11(a).** Common Restoration actions stipulated in Paragraph 11 of the Settlement include channel modifications to be completed in two phases. Phase 1 actions are the 10 actions stipulated in Paragraph 11(a) of the Settlement that are considered the highest priority channel improvements. The Settlement stipulates that those actions be completed by December 31, 2013. Two potential actions require subsequent decisions to determine their necessity: (1) modifications to the San Joaquin River Headgate Structure at the head of Reach 4B1, and (2) modifications in the Eastside and Mariposa bypasses to provide fish passage under low flows. In the following sections, these 10 Phase 1 actions are grouped by common location and/or other linkages, and include the following:

  - **Paragraphs 11(a)(1) and 11(a)(2)** – Construct Mendota Pool Bypass and Modify Reach 2B to convey at least 4,500 cfs
  - **Paragraph 11(a)(3)** – Modify Reach Reach 4B1 to convey at least 475 cfs
  - **Paragraph 11(a)(4)** – Modify San Joaquin River Headgate Structure to enable fish passage
  - **Paragraph 11(a)(5)** – Modify Sand Slough Control Structure to enable fish passage and flow routing
  - **Paragraphs 11(a)(6) and 11(a)(7)** – Screen Arroyo Canal and provide fish passage at Sack Dam
  - **Paragraphs 11(a)(8) and 11(a)(9)** – Modify Eastside and Mariposa bypasses to enable fish passage
  - **Paragraph 11(a)(10)** – Enable deployment of seasonal barriers at Mud and Salt sloughs

- **Paragraph 11(b).** The four Phase 2 actions stipulated in Paragraph 11(b) of the Settlement also are considered high priority channel improvements that may contribute to achieving the Restoration Goal. The Settlement stipulates that these projects be completed by December 31, 2016, in a manner that does not delay completion of Phase 1 actions. Subsequent decisions would be required to determine whether the Phase 2 actions are necessary and, if so, to define the scope of the actions. Phase 2 actions not included in Alternative A1 involve modifications to enable routing of up to 4,500 cfs into and through Reach 4B1, as

described for Alternative A2. The following Phase 2 actions included in Alternative A1 are described in the following sections:

  - **Paragraph 11(b)(2)** – Modify Chowchilla Bypass Bifurcation Structure
  - **Paragraph 11(b)(3)** – Fill or isolate gravel pits

- **Paragraph 14.** Paragraph 14 of the Settlement stipulates that spring-run and fall-run Chinook salmon reintroduction occur by December 31, 2012.

- **Paragraph 12.** Paragraph 12 states that additional structural or channel improvements that may further enhance the success of achieving the Restoration Goal may be recommended by the RA to the Secretary for implementation. Potential actions under Paragraph 12 are not assigned a date for completion under the Settlement. Site-specific studies and subsequent implementation of future potential Restoration actions under Paragraph 12 of the Settlement would be based on information collected through monitoring, as identified in the Physical Monitoring and Management Plan (Appendix D), during implementation of Settlement-stipulated actions. Potential Restoration actions pursuant to Paragraph 12 that could be identified by the RA at a future date range from no modifications to the level of implementation described below. Appendix E, "Fisheries Management Plan," addresses specific actions, including those described below, and evaluates their merits (including uncertainty) in an action routing process. The following potential Paragraph 12 actions included in Alternative A1 are described in the following sections:

  - Enhance Spawning Gravel
  - Reduce Potential for Redd Superimposition and/or Hybridization
  - Supplement Salmon Population
  - Modify Floodplain and Side-Channel Habitat
  - Enhance In-Channel Habitat
  - Reduce Potential for Aquatic Predation of Juvenile Salmonids
  - Reduce Potential for Fish Entrainment
  - Enable Fish Passage
  - Modify Flood Flow Control Structures

All alternatives include the anticipated range of potential implementation for common actions under Paragraphs 11, 14, and 12 of the Settlement, as described below and shown in Figure 2-8. All common Restoration actions would require future, separate project-specific planning studies and NEPA and/or CEQA documentation analyzing the effects

of implementation. The details described below for these actions are based on initial engineering concepts and information from the Fishery Management Plan (Appendix E). These details are subject to change as additional project-specific information is developed.

Common Restoration actions include modifications to the channel and flow control structures, including levees and other portions of the Lower San Joaquin Flood Control Project. As part of any modifications that could affect operation of the Lower San Joaquin Flood Control Project, the lead agencies would conduct a study to determine needed conveyance modifications, including modifications to levees and other related hydraulic features, to maintain existing levels of flood protection. Channel and facility modifications would be designed to not adversely affect flood conveyance capacity or functionality of existing channels and facilities.

Construct Mendota Pool Bypass and Modify Reach 2B. Paragraph 11(a)(1) of the Settlement stipulates the creation of a bypass channel around the Mendota Pool to convey at least 4,500 cfs from Reach 2B downstream to Reach 3. Paragraph 11(a)(2) of the Settlement stipulates modifications in channel capacity, and incorporation of new floodplain habitat and related riparian habitat, to convey at least 4,500 cfs between the Chowchilla Bypass Bifurcation Structure and new Mendota Pool Bypass. Because the functions of these channels are related, they are described together in this section:

- **Construct Mendota Pool Bypass –** Constructing Mendota Pool Bypass includes building a bypass around the Mendota Pool to convey at least 4,500 cfs from Reach 2B to Reach 3 downstream from Mendota Dam. Riparian habitat in the Mendota Pool Bypass is expected to be similar to new floodplain habitat in Reach 2B. Constructing the Mendota Pool Bypass also includes constructing a bifurcation structure in Reach 2B to convey at least 4,500 cfs to the bypass. The bifurcation structure would include a fish screen or other positive fish barrier to direct fish into the bypass channel and minimize or avoid fish passage from Reach 2B to the Mendota Pool. Additionally, the Mendota Pool Bypass would include one or more grade control structures to control bedform and create stable and suitable habitat conditions for fish in the vicinity.

- **Modify Reach 2B to convey at least 4,500 cfs –** Modifying Reach 2B to convey at least 4,500 cfs includes expanding the capacity of the reach to convey at least 4,500 cfs, with integrated floodplain habitat. New levees would be constructed, potentially along either or both sides of Reach 2B, to create an average floodplain width of between 500 feet and 3,700 feet, an associated levee system width of between 700 feet and 3,900 feet, and levee heights of an average 4 feet to 5 feet, depending on the level of floodplain habitat modifications incorporated. Specific levee alignments and modifications would be determined through a separate, project-specific study that would consider a variety of factors, including, but not limited to, fisheries and other environmental requirements, flood risk reduction, land uses, subsurface conditions, topography, and the condition of existing levees. Because of uncertainty regarding the life history behavior of introduced salmon, modifications to Reach 2B may or may not emphasize floodplain habitat for

rearing juvenile Chinook salmon, and any modifications would be determined from results of subsequent site-specific studies.

The San Mateo Road, which crosses the river in Reach 2B, may cause backwater effects and downstream scour, and may act as a barrier to upstream salmon migration during low flows. Subsequent, project-specific technical studies of this crossing would identify the type of modifications that would be necessary for flow and fish passage.

Depending on the final, constructed channel capacity of Reach 2B above the new Mendota Pool Bypass Bifurcation Structure, simultaneous release of 4,500 cfs Restoration Flows to the Mendota Pool Bypass and delivery of San Joaquin River flows to the Mendota Pool may not be possible. Similarly, because Reach 3 is anticipated to have a long-term capacity of 4,500 cfs, simultaneous release of 4,500 cfs of Restoration Flows to the Mendota Pool Bypass and conveyance of flood flows from the James Bypass would not be possible. The Secretary would prioritize flood control and water right delivery obligations over meeting flow targets for Restoration Flows, reducing Restoration Flows in these reaches if channel capacity is insufficient to meet conveyance of flood control or water delivery obligations in combination with Restoration Flows.

Modify Reach 4B1 to Convey at Least 475 cfs. Paragraph 11(a)(3) of the Settlement stipulates required channel modifications in Reach 4B to convey at least 475 cfs. The Act (Section 10009(f)(2)(B)) requires that a determination be made on increasing the channel capacity to 4,500 cfs before undertaking any "substantial construction" in Reach 4B1. Therefore, modifications in Reach 4B1 to convey at least 475 cfs would not include substantial construction, such as changes to existing levees in Reach 4B1. Based on preliminary studies, these modifications are anticipated to include removing in-channel vegetation and modifying road crossings within Reach 4B1. Modifying Reach 4B1 could also include modifications to establish a low-flow channel to support fish migration, ranging from a single low-flow channel to a series of terraced channels to convey incremental low flows of up to 475 cfs or more.

Five road crossings are present in Reach 4B1 that could require modification. These include crossings at Washington Road, Turner Island Road, and three unnamed crossings. It is not known if modifications would be required at the Washington Road or Turner Island Road crossings to allow conveyance of at least 475 cfs or to provide fish passage. Currently, all three unnamed crossings are configured with culverts that may be insufficient to convey 475 cfs and/or may present barriers to upstream migrating adult salmon. Modifying Reach 4B1 could include modifying these road crossings to provide flow capacity and fish passage, as necessary. These modifications could include installing culverts, restructuring the channel, and/or constructing clear span bridges. Project-specific technical studies of these crossings would identify the type of modifications that would be necessary for flow and fish passage, and such modifications would be evaluated in subsequent environmental documents, as needed.

Modify San Joaquin River Headgate Structure to Enable Fish Passage and Flow Routing. Paragraph 11(a)(4) stipulates modifications to the San Joaquin River Headgate Structure to enable fish passage and flow routing of between 500 and 4,500 cfs into Reach 4B1. The Settlement stipulates that these modifications are to be made consistent with the decision on whether to route 4,500 cfs through Reach 4B1. Under all action alternatives, these modifications would be made sufficient to convey at least 475 cfs into Reach 4B1. Modifications to this structure are closely related to Restoration actions in Reach 4B1, described previously.

Modify Sand Slough Control Structure to Enable Fish Passage. The Sand Slough Control Structure could present a barrier to upstream migration of adult salmon. Modifications to the Sand Slough Control Structure for fish passage are stipulated in Paragraph 11(a)(5) of the Settlement. Modifying the Sand Slough Control Structure could include modifying the structure for fish passage pursuant to Paragraph 11(a)(5) of the Settlement by removing the existing flume and replacing it with a gated structure. These modifications would be designed to not adversely affect flood conveyance capacity or functionality of the existing structure. Modifications to this structure are closely related to Restoration actions in Reach 4B1, described in a following section.

Screen Arroyo Canal and Provide Fish Passage at Sack Dam. Paragraph 11(a)(6) of the Settlement stipulates required modifications to Arroyo Canal to prevent entrainment of anadromous fish. Paragraph 11(a)(7) of the Settlement stipulates required modifications at Sack Dam for fish passage. Sack Dam currently provides the water surface elevation necessary for diversion at Arroyo Canal.

Diversions to Arroyo Canal range from zero to 800 cfs, and typically do not exceed 600 cfs. This action could include installing a screening device at the entrance to Arroyo Canal. The screen could be designed to operate with flows of up to 4,500 cfs in the river, while conveying flows into Arroyo Canal, to prevent entrainment of juvenile Chinook salmon in the canal. It also could include constructing a fish ladder at Sack Dam to allow flow and fish passage for a range of flows of up to 4,500 cfs.

Modify Eastside and Mariposa Bypasses to Enable Fish Passage. Paragraph 11(a)(8) of the Settlement stipulates modifications to structures in the Eastside and Mariposa bypass channels to provide anadromous fish passage on an interim basis until completion of Phase 2 actions described below. Paragraph 11(a)(9) of the Settlement stipulates modifications to the Eastside and Mariposa bypass channels to establish a suitable low-flow channel if the Secretary, in consultation with the RA, determines that such modifications are necessary to support anadromous fish migration through these channels. Because the function of the structures and the channel in these bypasses are related, modifications are described together in this section. Potential actions include the following:

- **Modify structures in Eastside and Mariposa bypasses to provide fish passage –**The Mariposa Bypass Bifurcation Structure at the head of the Mariposa Bypass would be modified to allow fish passage for a range of flows of up to 4,500 cfs. The Mariposa Bypass Drop Structure, at the downstream end of the Mariposa

Bypass, presents a barrier to fish passage. Modifying the Mariposa Bypass Drop Structure could include constructing a fish ladder to allow upstream and downstream fish passage for a range of flows of up to 4,500 cfs. Modifications would allow the structure to handle 8,500 cfs while not increasing upstream water levels from existing conditions.

- **Modify Eastside and Mariposa bypasses to provide fish passage under low flows –** The Eastside and Mariposa bypass channels were constructed with flat channel bottoms. Although scouring flows since construction have incised low-flow channels in some areas of the bypasses, some areas may not be passable by fish during low flows. The range of potential actions to provide fish passage under low flows could include no modifications, modifications to develop a single low-flow channel to convey at least 475 cfs, and a series of terraced channels to convey incremental low flows of up to 475 cfs.

Enable Deployment of Seasonal Barriers at Mud and Salt Sloughs. Potential false migration pathways to migrating adult salmon may be present in Mud and Salt sloughs, tributaries to Reach 5. Modifications to Mud and Salt sloughs would be made to enable the deployment of barriers on these sloughs to prevent adult salmon from entering these potentially false migration pathways, consistent with Paragraph 11(a)(10) of the settlement.

Modify Chowchilla Bypass Bifurcation Structure. Paragraph 11(b)(2) of the Settlement stipulates modifications to the Chowchilla Bypass Bifurcation Structure to provide fish passage and prevent fish entrainment, if such modifications are necessary to achieve the Restoration Goal, as determined by the Secretary in consultation with the RA, and with the concurrence of NMFS and USFWS. Gaps between the gates of the Chowchilla Bypass Bifurcation Structure allow some flow to leak through the gates, when closed. The gaps may be large enough to allow fish to pass through into the bypass, leaving them stranded. To address potential stranding of fish in the Chowchilla Bypass, modifying the Chowchilla Bypass Bifurcation Structure could include a range of potential actions, such as no modifications, monitoring and management of fish stranding under flood conditions, ranges of flows for screening the Chowchilla Bypass to prevent fish from entering the bypass, retrofitting the gates to prevent fish from passing through gaps between the closed gates, and/or adding an additional, screened gate to the structure. Modifications to this structure would be designed to not adversely affect the flood conveyance capacity or functionality of the existing structure.

Fill or Isolate Gravel Pits. Paragraph 11(b)(3) of the Settlement stipulates filling and/or isolating the highest priority gravel pits in Reach 1, based on their relative potential for reducing juvenile salmon mortality, as determined by the Secretary in consultation with the RA. Gravel pits could contribute to juvenile salmon mortality through effects on water temperatures and by providing habitat for predator species such as largemouth bass. A project-specific technical study would be necessary to identify the highest priority pits; therefore, this action has a potential range of actions, including no modifications, filling or isolating some or all pits, and regrading the floodplain to fill pits.

Modifications to gravel pits could be implemented in connection with other potential Restoration actions described later in this chapter.

Salmon Reintroduction. Paragraph 14 of the Settlement addresses reintroducing spring-run and fall-run Chinook salmon between Friant Dam and the confluence of the San Joaquin River with the Merced River by December 31, 2012. Paragraph 14 states that, "in the event that competition, inadequate spatial or temporal segregation, or other factors beyond the control of the Settling Parties make restoring spring-run and fall-run Chinook salmon infeasible, then priority shall be given to restoring self-sustaining populations of wild spring run Chinook salmon." The Secretary, through USFWS, and in consultation with the Secretary of Commerce, DFG, and the RA, will reintroduce spring- and fall-run Chinook salmon "at the earliest practical date after commencement of sufficient flows and the issuance of necessary permits." To help facilitate reintroduction of salmon, a management plan has been developed to help guide implementation of Restoration actions. The range of potential actions for salmon reintroduction spans from reintroducing only spring-run Chinook salmon to reintroducing both fall-run and spring-run Chinook salmon, and could include one or more life stages. Broodstocks would be identified through subsequent studies, and because of the uncertainty associated with broodstock life history, behavioral, and adaptive traits of potential broodstock in the Central Valley, it is most likely that broodstocks would be acquired from a variety of watersheds.

The range of potential actions for salmon reintroduction could also include the use of the existing San Joaquin Hatchery, another existing hatchery, or a new hatchery. Although the design and capacity of a new hatchery would be determined in part by management plans, a new hatchery could potentially provide for initial reintroduction of spring-run Chinook salmon, fall-run Chinook salmon, and/or other native fish. Hatchery use would be phased out over time as the fish population is reestablished. The Restoration Goal and Paragraph 14 of the Settlement emphasize the need to restore self-sustaining fish populations. Therefore, hatchery populations alone would not fulfill the Restoration Goal, and naturally reproduced individuals would need to be distinguished from hatchery-produced individuals.

This Draft PEIS/R identifies potential system effects associated with reintroducing salmon. USFWS submitted a 10(a)(1)(a) Enhancement of Species Permit application to NMFS on September 30, 2010, for introducing an experimental population of spring-run Chinook salmon, consistent with the schedule identified in the Settlement. NMFS will issue a final rule pursuant to Section 10(j) of the Federal Endangered Species Act of 1973 (ESA), as amended, by April 30, 2012. Specific environmental effects related to the reintroduction of spring-run Chinook salmon would be addressed in the subsequent project-specific NEPA analysis, and possibly CEQA analysis, in compliance with an associated Special Rule authorizing the experimental population.

Enhance Spawning Gravel. Adult Chinook salmon require suitable gravels, refuge, water depths, and velocities for spawning. The range of potential actions to provide for adequate spawning gravel could include no modifications, augmenting and/or conditioning gravel at existing riffles, or establishing new riffles, as described below:

- **No modifications –** No actions would be taken to modify, augment, or condition gravel either at existing riffles or through establishing new riffles.

- **Augment existing riffles –** This action consists of augmenting existing riffles with clean, spawning-sized gravel at some, or a portion of, the existing spawning areas in Reach 1.

- **Establish new riffles –** This action consists of establishing new riffles to increase and enhance salmonid spawning habitat in Reach 1.

Reduce Potential for Redd Superimposition and/or Hybridization. Spring-run Chinook salmon typically spawn earlier than fall-run Chinook salmon, creating the potential for redd superimposition, when fall-run Chinook salmon construct their redds on top of spring-run redds and dislodge or smother some of the spring-run eggs. In addition, a small percentage of fall-run Chinook salmon may spawn at the same time and location as spring-run Chinook salmon; therefore, potential may exist for hybridization. Hybridization may result in fish with migratory behaviors that are not viable in the San Joaquin River basin. The range of potential actions to reduce redd superimposition or hybridization includes no modifications, the deployment of seasonal barriers, and separate runs of salmon, and also could include potential operation and monitoring of the Hills Ferry Barrier on a seasonal basis.

The ability to control run timing via additional structures to separate spring- and fall-run Chinook salmon, as well as the ability to manage flows to prevent run overlap and hybridization, is unknown. The location and design of barriers has yet to be determined; evaluation of spawning habitat availability and quality would likely guide this decision.

Supplement Salmon Population. Additional actions not identified in the Settlement could be necessary to supplement the naturally reproducing population, particularly in the years immediately following salmon reintroduction. The Settlement does not stipulate any actions to supplement the salmon population; therefore, a subsequent decision would be required before any such actions could be implemented. The range of potential actions to supplement the salmon population could include no supplementation, the release of hatchery fish to supplement the natural population for monitoring and management of the natural population, and/or release of hatchery fish to supplement the natural population when natural production is low. These actions are described in greater detail below. Subsequent studies would identify stock for hatchery populations and, as described for salmon reintroduction according to Paragraph 14 of the Settlement, stock for hatchery populations would likely come from a Central Valley population with behavioral and life history characteristics compatible with anticipated conditions on the San Joaquin River. As previously discussed, hatchery populations alone would not fulfill the Restoration

Goal, and naturally reproduced individuals would need to be distinguished from hatchery-produced individuals.

- **No supplementation** – No actions would be undertaken to release fish into the San Joaquin River.

- **Release of hatchery salmon to supplement the natural population for monitoring and management** – This action consists of releasing study fish to support evaluations during implementation and monitoring, as needed.

- **Release of hatchery salmon to supplement the natural population for survival –** This action could consist of using hatchery fish to supplement the population in years when monitoring determines that the natural production of juvenile salmon is too low. This could occur during the relatively dry water year types (e.g., Settlement Critical-Low, Critical-High year types) when spring flows are either absent or inadequate to sustain Chinook salmon populations.

Modify Floodplain and Side-Channel Habitat. Additional actions not identified in the Settlement could be necessary to modify the floodplain or side-channel habitat beyond Reaches 2B or 4B1. Such modifications could benefit migrating salmon and other native fishes by providing additional food sources, increased protection from stranding, and other habitat improvements. The range of potential actions to modify floodplain and side-channel habitat outside Reaches 2B and 4B1 could include no modifications; creating and/or enhancing additional floodplain habitat; creating, enhancing, or isolating side channels; and/or reducing sand transport.

- **No modifications** – No modifications would be undertaken to modify the floodplain and side-channel habitat.

- **Create and/or enhance additional floodplain habitat –** This action could consist of creating and/or enhancing additional floodplain habitat outside Reaches 2B and 4B1 (floodplain modifications in these reaches are described previously as actions stipulated by the Settlement) to provide flexibility to accommodate variable life history strategies of future salmon populations, which may vary spatially and temporally. Modifications would be confined within the existing levee alignment. This action also includes floodplain modifications in reaches other than Reach 2B and Reach 4B1 to provide for the maintenance of floodplain vegetation at a level to be determined based on the associated contribution toward achieving the Restoration Goal.

- **Create, enhance, or isolate side channels –** Side channels occur throughout the river, some with perennial connectivity to the main channel, but most with connectivity only under high-flow conditions, as described in Chapter 3.0. In some cases, side channels could provide suitable rearing habitat for juvenile salmon, or serve as holding habitat for adult salmon, while other side channels may foster conditions that are unsuitable for salmon, including high temperatures and habitat for predatory species such as largemouth bass. Side-channel

enhancement activities could include dredging or widening side channels. Side-channel isolation could consist of filling a channel or constructing berms across the mouth of a channel. Additionally, new side channels could be created to provide additional habitat, if necessary. Creation of new side channels could likely be accomplished through dredging new channels or removing sediment blocking the connectivity of former channels.

- **Reduce sand transport –** The quantity of sand in Reaches 1 and 2 may present challenges to channel stability, and the function of hydraulic control structures and road crossings. This sand has the potential to be mobilized by Interim and Restoration flows to lower reaches that do not currently have sediment transport issues. This action would control sources of sand in Reach 1, and transport of sand in downstream river and bypass reaches, to prevent hydraulic and facilities challenges arising from channel migration, aggradation, or degradation. Control of sediment at tributary sources could include settling basins, bed stabilization (such as floodplain widening to reduce sediment transport potential) in areas where the bed is degrading, and bank stabilization in meandering reaches. In-channel sand could be removed by dredging or by constructing instream sediment detention basins, or sand traps, to capture sand. Accumulated sand would need to be removed periodically to maintain the functionality of sand traps. As previously described, portions of Reach 1 may benefit from modifications to gravel quantities and mobility.

Enhance In-Channel Habitat. This action could incorporate channel modifications to provide salmon habitat, including instream cover such as undercut banks, overhanging vegetation, boulders, large wood, surface turbulence, and features providing refuge from predation. The range of potential actions to enhance in-channel habitat could include no modifications, augmenting existing, and/or creating new, in-channel habitat. Enhancing in-channel habitat could also include modifications such as constructing pools, or dredging and grading to develop or maintain more desirable water temperatures. Deep pools remain cooler during warm summer months, and provide refuge from avian and terrestrial predators. Additional assessments would be conducted to identify the potential for groundwater influence on instream temperatures, and whether water temperature requirements may be met under different conditions and/or different timing of flow releases from Friant Dam.

Reduce Potential for Aquatic Predation of Juvenile Salmonids. Additional actions not identified in the Settlement could be necessary to prevent aquatic predation of juvenile salmonids. Additional potential actions to prevent aquatic predation of juvenile salmonids could include capturing and removing nonnative aquatic predatory species.

Reduce Potential for Fish Entrainment. Unscreened and poorly screened small diversions can entrain migrating juvenile fish. The Settlement does not stipulate actions to screen these small diversions. The range of potential actions to prevent fish entrainment at small diversions could include not screening diversions, or installing or modifying screens at small diversions throughout the Restoration Area. The number of

screens installed would be determined through future studies, but could be based on the relative impact of individual diversions to fisheries.

Enable Fish Passage. Obstacles to the successful migration of anadromous fish in the Restoration Area could include hydraulic conditions at road crossings; small San Joaquin River tributaries with unsuitable habitat for salmon spawning and rearing; hydraulic conditions in the river channel at low flow; and other physical features within the river. The range of potential actions to enable fish passage beyond the actions stipulated in the Settlement could include no modifications, establishing and/or maintaining low-flow channels, trapping and hauling juveniles and adults, modifying road crossings, and installing barriers to prevent straying.

- **No modifications** – No actions would be undertaken to enable fish passage.

- **Establish and/or maintain low-flow channels** – This action consists of modifying the channel in reaches outside the Eastside and Mariposa bypasses and Reach 4B1 to provide passage during low-flow conditions, as needed. As described above for the action to enhance in-channel habitat through reducing sand transport, establishing and/or maintaining low-flow channels could include bed stabilization in areas where the bed is degrading, and bank stabilization in meandering reaches. Removing in-channel sand to maintain a low-flow channel could be accomplished by dredging or grading. The range of actions described above for modifications to floodplain and side-channel habitat, such as managing invasive vegetation and creating and/or enhancing additional floodplain habitat, could also be applied to establish and/or maintain low-flow channels through bed and bank stabilization.

- **Trap and haul –** It may be necessary to implement a trap-and-haul operation to sustain Chinook salmon within the Restoration Area if protective features are not completed in time to reintroduce fish, if it is determined that entrainment and physical barriers exist that could hinder reintroducing and managing fish populations, or if river connectivity is disrupted (i.e., in critical water years). Implementing a trap-and-haul program could consist of trapping salmon smolts in upper reaches (likely Reach 1 or Reach 2) to transport smolts to downstream reaches for release, thereby avoiding temporary undesirable habitat conditions (such as high temperatures or discontinuous flow). In addition, implementing a trap-and-haul program could include trapping adult salmon in downstream reaches and transporting them to Reach 1, thereby avoiding temporary undesirable habitat conditions in intermediate reaches. Several trapping mechanisms could be applied under this action, including passive and active capture techniques. Trapped fish could be transported under controlled conditions by truck to suitable habitat areas and released. Trap-and-haul operations are not envisioned as a long-term management strategy, and would only be used as temporary measure if protective features are not completed in time to reintroduce fish, if it is determined that entrainment and physical barriers exist that could hinder reintroducing and managing fish populations, or if river connectivity is disrupted.

- **Modify road crossings –** This action consists of modifying road crossings to provide for fish passage in Reach 1. These crossings could be modified through installing culverts, restructuring the channel, and/or constructing clear span bridges to enable the crossings to be used during Restoration Flows while providing fish passage. Road crossings in Reaches 2B and 4B that pose potential barriers to fish passage are discussed as possible actions to address Settlement Paragraphs 11(a)(2) and 11(a)(3), respectively.

- **Install barriers to prevent straying –** This action could consist of installing temporary or permanent barriers in the channel to prevent fish from straying into tributaries, flood bypasses, or river reaches with undesirable habitat conditions. The primary categories of permanent fish barrier structures are picket barriers, velocity barriers, and vertical drop structures. Tributaries, flood bypasses, and river reaches that could be screened under this action depend in part on the flow-routing decision made consistent with Paragraph 11(b)(1) of the Settlement, but could include, but may not be limited to, Dry and Cottonwood creeks in Reach 1; Deadmans, Bear, and Owens creeks in the Eastside Bypass; the downstream end of Eastside Bypass Reach 2; the downstream end of Reach 4B; and the downstream end of Eastside Bypass Reach 3.

Modify Flood Flow Control Structures. Additional actions not identified in the Settlement could be necessary to improve fish passage and flow conveyance at flood control structures within the Restoration Area, including modifications to the Chowchilla Bypass Bifurcation Structure, Sand Slough Control Structure, and structures in the Eastside and Mariposa bypasses. The range of potential additional actions to modify flood control structures could include no modifications, retrofitting gates at flood control structures to prevent flow loss, and installing grade control structures to address backwater effects of the Chowchilla Bypass Bifurcation Structure.

- **No modifications** – No actions would be undertaken to modify flood flow control structures.

- **Retrofit gates –** As described for the range of actions to address Paragraph 11(b)(2) of the Settlement, gaps between the gates of the Chowchilla Bypass Bifurcation Structure allow some flow to leak through the gates, when closed. Because of the current function of the structure in routing relatively large flows under flood conditions, the small amount of water lost through closed gates at this and other gated flood control structures in the system (including the San Joaquin River Headgates, Eastside Bypass Bifurcation Structure, and Mariposa Bypass Bifurcation Structure) is not a concern under current operations. However, during the release of Interim and Restoration flows, the loss of water from the main stem San Joaquin River through the closed gates to the bypass channel could inhibit success of the Restoration Goal by reducing the amount of water flowing to downstream reaches. Potential actions to address flow loss range from no retrofit implementation to retrofitting the gates on the existing flood control structures to prevent flow from passing the closed gates.

- **Install grade control structures –** Local backwater effects caused by the Chowchilla Bypass Bifurcation Structure may be contributing to the accumulation of sand in Reach 2A (McBain and Trush 2002), which could mobilize under Interim or Restoration flows, thereby compromising the ability to convey Interim or Restoration flows through downstream reaches. The Settlement does not stipulate any actions to modify the Chowchilla Bypass Bifurcation Structure to address flow loss or sediment deposition due to backwater effects; therefore, a subsequent decision would be required before any such actions could be implemented. Potential actions to address sediment deposition upstream from the Chowchilla Bypass Bifurcation Structure range from no implementation to installing grade control structures to prevent sediment mobilization.

2.4.3 Physical Monitoring and Management Plan

The Physical Monitoring and Management Plan is included in this Draft PEIS/R as Appendix D, and is summarized here. The Physical Monitoring and Management Plan provides guidelines for observing and adjusting to changes in physical conditions within the Restoration Area. The Physical Monitoring and Management Plan consists of five component plans, addressing interrelated physical conditions including flow, groundwater seepage, channel capacity, propagation of native vegetation, and suitability of spawning gravel. Each component plan identifies objectives for the physical conditions within the Restoration Area, and provides guidelines for the monitoring and management of those conditions. The plans identify potential actions that could be taken to further enhance the achievement of the objectives. The component plans include immediate actions that could be taken, which are analyzed at a project level in this Draft PEIS/R. The component plans also include long-term actions that are analyzed at a program level of detail in this Draft PEIS/R. Finally, this Plan includes a description of monitoring activities which apply to one or more of the component plans. The five component plans include the following:

- **Flow** – To ensure compliance with the hydrograph releases in Exhibit B of the Settlement and any other applicable flow releases (e.g., Buffer Flows)
- **Seepage** – Reduce or avoid adverse or undesirable seepage impacts
- **Channel capacity** – Maintain flood conveyance capacity
- **Native vegetation** – Establish and maintain native riparian habitat
- **Spawning gravel** – Maintain gravels for spawning

The Physical Monitoring and Management Plan includes monitoring activities and a set of immediate (project level) responses that would be implemented, as needed, to attain the management objectives. The plan also identifies potential long-term (program level) responses that could be implemented to attain the management objectives, if necessary. Monitoring activities and responses are described below. Monitoring and management guidelines related to biological conditions for fish are separately described in Appendix F, “Fisheries Management Plan.”

Monitoring Activities

Monitoring activities include past, present, and future physical and nonphysical activities within the Restoration Area. Site-specific documentation has been completed for those actions completed or currently underway, and would be completed as necessary for those actions described at a program level of detail in this Draft PEIS/R. Monitoring activities, as described in the Physical Monitoring and Management Plan, are guidelines for monitoring and could change as part of implementation of the Settlement. These activities include the following:

- **Flow monitoring** – Flow, cross sections, and surface water stage at six gaging stations, and at additional locations during high-flow events
- **Groundwater level monitoring** – Groundwater elevation in monitoring wells
- **Aerial and topographic surveys** – True color aerial photographs and topographic surveys to assess river stage, hydraulic roughness, river width, bed elevation, and vegetation conditions
- **Vegetation surveys** – Surveys of seed dispersal start and peak times, and native riparian vegetation establishment
- **Sediment mobilization monitoring** – Sediment mobilization, bar formation, and bank erosion through aerial and topographic surveys of areas with elevated erosion potential
- **Spawning gravel monitoring** – Pebble count or photographic surveys of riffles following Normal-Wet or Wet years

Immediate Management Actions – Project Level

Potential immediate responses have been identified to contribute to attaining the seepage, channel capacity, and spawning gravel management objectives. No immediate responses have been identified to contribute to attaining the flow or vegetation management objectives. Potential immediate responses to attain the groundwater seepage, channel capacity, and spawning gravel management objectives include the following:

- **Seepage –** Reduce, redirect, or redivert Interim or Restoration flows to reduce flow in downstream reaches. This could include the following:
  - **Reductions of Interim or Restoration Flow Releases at Friant Dam** – Reductions in the release rate from Friant Dam to limit the potential for seepage impacts to occur downstream. Planned thresholds for reductions at Friant would need to consider travel time and associated response delays.
  - **Redirection of Interim or Restoration Flows at Chowchilla Bypass Bifurcation Structure** – Directing flow into the bypass system at the Chowchilla Bypass Bifurcation Structure would reduce flow in Reach 2B and downstream reaches.
  - **Delivery of Interim or Restoration Flows at Mendota Pool** – Delivery of water to Mendota Pool would reduce flows in Reach 3 and downstream reaches.
  - **Delivery of Interim or** Restoration **Flows at Arroyo Canal** – When San Luis Canal Company is not diverting at the full capacity of Arroyo Canal, additional water diversions to the canal would reduce flows in Reach 4A and downstream reaches.
  - **Redirection of Interim or Restoration Flows at Sand Slough Control Structure** – During the first year of Interim Flows, water would not be directed into Reach 4B. In subsequent years, diverting flows into the bypass system at Sand Slough Control Structure would reduce flows in Reach 4B.
- **Channel capacity** – Removal of vegetation and debris that would cause Interim or Restoration flows to exceed channel capacity. Vegetation would be removed by mechanical or chemical means. Nonnative plant removal would receive priority over removal of native species.
- **Spawning gravel –** Modify releases from Friant Dam to adjust flows to flush or mobilize based on monitoring reports and recommendations of spawning gravel conditions (including potential modifications to Restoration Flow Guidelines to improve the success of Flushing Flows).

Long-Term Management Actions – Program Level

Potential long-term responses have been identified to contribute to attaining the flow, groundwater seepage, channel capacity, native vegetation, and spawning gravel management objectives. Potential long-term responses to attain the management objectives may require additional environmental documentation, and include the following:

- **Flow** – Paragraph 13(c) of the Settlement provides for adjusting releases due to unexpected seepage losses. These actions could include but would not be limited to acquisition and release of purchased water from willing sellers. The procedures for purchasing and releasing additional water are under development and would be detailed in the Restoration Flow Guidelines, a document that would be attached to the Friant Operation Guidelines.

- **Seepage –** Long-term management actions for seepage may include, but would not be limited to, purchasing easements and/or compensation for seepage effects, construction of slurry walls to reduce seepage flows, construction of seepage berms to protect against levee failure, construction of drainage interceptor ditches to protect affected lands, or installation of tile drains on affected lands.

- **Channel capacity –** Long-term management actions for channel capacity may include, but would not be limited to, providing a larger floodplain between levees through the acquisition of land and construction of setback levees, regrading of land between levees, construction of sediment traps, construction of grade control structures, or channel grading.

- **Native vegetation –** Long-term management actions for native vegetation may include, but would not be limited to, active plantings and irrigation of desired native plants.

- **Spawning gravel –** Long-term management actions for spawning gravel may include, but would not be limited to gravel augmentation and/or conditioning at existing riffles, establishment of new riffles, engineered channel modifications, construction of sediment traps on the San Joaquin River or tributaries with high sediment loads, or construction of grade control structures.

2.4.4 Conservation Strategy

As part of Settlement implementation, a comprehensive strategy for the conservation of listed and sensitive species and habitats has been prepared, and would be implemented in coordination with USFWS, NMFS, and DFG. The strategy's purpose is to serve as a tool built into the project description to minimize and avoid potential impacts to sensitive species and habitats. This Conservation Strategy guides development and implementation of specific conservation measures for project- and program-level actions. The Conservation Strategy includes conservation goals and measures for species and communities (such as avoidance, minimization, monitoring, and management measures) consistent with adopted recovery plans, as described below. If avoidance and minimization measures are impractical or infeasible, then further consultation actions and

mitigation measures will be pursued and developed in coordination with the appropriate regulatory agency.

To achieve the Restoration Goal, a number of actions that are proposed to be implemented may substantially alter not only the aquatic ecosystem of the San Joaquin River, but also the river's riparian and wetland ecosystems, and some adjacent upland ecosystems. Riparian, wetland, and upland ecosystems of the Central Valley, such as those along the San Joaquin River, provide habitat for a large number of species, including several Federally listed and State-listed species. Therefore, the action alternatives include this Conservation Strategy, which would be implemented in a manner that is consistent with adopted conservation plans for sensitive species, and for wetland and riparian ecosystems of the Restoration Area.

The Conservation Strategy consists of management actions that would result in a net benefit for riparian and wetland habitats in the Restoration Area, to avoid reducing the long-term viability of sensitive species, and to be consistent with adopted conservation plans. The goals of the strategy are described below:

- **Conserve riparian vegetation and waters of the United States, including wetlands** – It is anticipated that implementing the Settlement would result in a net increase in the acreage of riparian and wetland vegetation in the Restoration Area. However, several program actions may disturb or eliminate riparian vegetation or waters of the United States (including wetlands). If impacts to waters of the United States (including wetlands), navigable waters, or the Federal levee system cannot be avoided, a USACE Section 404, Section 408, and/or Section 10 permit and Central Valley Regional Water Quality Control Board (RWQCB) Section 401 water quality certification would be obtained. Increased acreage of wetlands resulting from Interim and Restoration flows may be considered a means of replacing, restoring, or enhancing wetlands. However, the acreage, location, and methods of replacing, restoring, or enhancing wetlands would be determined during these permitting processes.

- **Control and manage invasive species** – Because of their adverse effects on aquatic and riparian ecosystems, the spread of invasive plant species as a result of release of Interim and Restoration flows would be controlled and managed. For each invasive plant species with known infestations, thresholds for management responses and specific management responses would be established and implemented (including species-specific control methods).

- **Conserve special-status species** – Populations of special-status species would benefit from restoring and sustaining riparian and wetland habitat, and controlling invasive species, as described previously. However, during the initiation of Interim and Restoration flows, and the construction of related actions, a variety of special-status species of upland, wetland, and riparian habitats could experience adverse effects. Therefore, this strategy includes measures to prevent or reduce impacts that could result from loss of habitat within project footprints or from impacts on adjacent habitat or species. In addition, this strategy includes

coordination with appropriate regulatory agencies to provide mitigation or compensation, consistent with applicable conservation plans, to avoid or minimize effects when actions would result in a net loss of habitat or other substantial adverse effects, if the implementation of avoidance and minimization measures is infeasible or impractical.

These measures address all potentially affected Federally listed and/or State-listed species, and all other species identified by USFWS, NMFS, or DFG as candidates, sensitive, or special-status in local or regional plans, policies, or regulations. For individual project- and program-level actions under each of the action alternatives, the applicable, feasible measures would guide development of action-specific conservation strategies. Table 2-7 presents the Conservation Strategy.

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
VP	**Vernal pool habitats, fleshy (succulent) owl's clover, Hoover's spurge, Bogg's Lake hedge-hyssop, Colusa grass, San Joaquin Valley Orcutt grass, hairy Orcutt grass, Conservancy fairy shrimp, longhorn fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, and western spadefoot toad**		
VP-1. Avoid effects to species	a) If vernal pools or vernal pool species are anticipated within a project area, a qualified biologist will identify and map vernal pool and seasonal wetland habitat potentially suitable for listed vernal pool plants, invertebrates, and western spadefoot toad within the project footprint. b) Facility construction and other ground-disturbing activities will be sited to avoid core areas identified in the *Vernal Pool Recovery Plan* (USFWS 2005) because conservation of these areas is a high priority for recovering listed vernal pool species.	Project and Program	USFWS DFG
VP-2. Minimize effects to species	a) If vernal pools are present, a buffer around the microwatershed or a 250-foot-wide buffer, whichever is greater, will be established before ground-disturbing activities around the perimeter of vernal pools and seasonal wetlands that provide suitable habitat for vernal pool crustaceans or vernal pool plants. This buffer will remain until ground-disturbing activities in that area are completed. Suitable habitat and buffer areas will be clearly identified in the field by staking, flagging, or fencing. b) Appropriate fencing will be placed and maintained around all preserved vernal pool habitat buffers during ground-disturbing activities to prevent impacts from vehicles and other construction equipment. c) Worker awareness training and on-site biological monitoring will occur during ground-disturbing activities to ensure buffer areas are being maintained.	Program	Lead Agency

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
VP-3. Compensate for temporary or permanent loss of habitat	a) If activities occur within the microwatershed or 250-foot-wide buffer for vernal pool habitat will be affected by the SJRRP, the project proponent will develop and implement a compensatory mitigation plan, consistent with the USACE and EPA April 10, 2008, Final Rule for Compensatory Mitigation for Losses of Aquatic Resources (33 CFR Parts 325 and 332 and 40 CFR Part 230) and other applicable regulations and rules at the time of implementation, that will result in no net loss of acreage, function, and value of affected vernal pool habitat. Unavoidable effects will be compensated through a combination of creation, preservation, and restoration of vernal pool habitat or purchase of credits at a mitigation bank approved by the applicable regulatory agency/agencies. b) Project effects and compensation will be determined in consideration of the *Vernal Pool Recovery Plan* goals for core areas, which call for 95 percent preservation for habitat in the Grasslands Ecological Area and Madera core areas, and 85 percent habitat preservation in the Fresno core area (USFWS 2005). c) Appropriate compensatory ratios for loss of habitat both in and out of core areas will be determined during coordination and consultation with USFWS and/or DFG, as appropriate. d) If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be and developed as part of the USFWS and/or DFG coordination and consultation process. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations. Any impacts that result in a compensation purchase will require an endowment for land management in perpetuity before any project groundbreaking activities.	Project and Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
CH	**Critical habitat**		
CH-1. Avoid and minimize effects to critical habitat	a) Designated critical habitats shall be identified and mapped. b) All SJRRP actions will be designed to avoid direct and indirect adverse modifications to these areas. c) Minimization measures, such as establishing and maintaining buffers around areas of designated critical habitat, shall be implemented if avoidance is not feasible.	Project and Program	USFWS
CH-2. Compensate for unavoidable adverse effects on Federally designated critical habitat	a) If critical habitat may be adversely modified by the implementation of SJRRP actions, the area to be modified will be evaluated by a qualified biologist to determine the potential magnitude of the project effects (i.e., description of primary constituent elements present and quantification of those affected) at a level of detail necessary to satisfy applicable environmental compliance and permitting requirements. b) Compensatory conservation measures developed through Section 7 consultation with USFWS will be implemented. If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be included in and developed as part of the USFWS consultation process. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations. Any impacts that result in a compensation purchase require an endowment for land management in perpetuity before any project groundbreaking activities.	Project and Program	USFWS
CTS	**California tiger salamander**		
CTS-1. Avoid and minimize effects to species	a) If potential California tiger salamander habitat or species are anticipated within the project area, within 1 year before project construction activities, a qualified biologist shall identify and map potential California tiger salamander habitat (areas within 1.3 miles of known or potential California tiger salamander breeding habitat) within the project footprint. One week before ground-disturbing activities, a qualified biologist will survey for and flag the presence of ground squirrel and gopher burrow complexes. Where burrow complexes are present, a 250-foot-wide buffer shall be placed to avoid and minimize disturbance to the species. b) Facility construction and other ground-disturbing activities shall be sited to avoid areas of known California tiger salamander habitat and avoidance buffers. c) To eliminate an attraction to predators of the California tiger salamander, all food-related trash items such as wrappers, cans, bottles, and food scraps, must be disposed of in closed containers and removed at least once every day from the entire project site.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
CTS-2. Minimize effects to species	a) Before and during construction activities, construction exclusion fencing will be installed just outside the work limit or around vernal pools where California tiger salamander may occur. This fencing shall be maintained throughout construction and will be removed at the conclusion of ground-disturbing activities. No vehicles will be allowed beyond the exclusion fencing. A USFWS-approved biological monitor shall be present on site, during intervals recommended by USFWS, to inspect the fencing. b) The biological monitor will be on site each day during any wetland restoration or construction, and during initial site grading or development of sites where California tiger salamanders have been found. c) Before the start of work each day, the biological monitor will check for animals under any equipment to be used that day, such as vehicles or stockpiles of items such as pipes. If California tiger salamanders are present, they will be allowed to leave on their own, before the initiation of construction activities for the day. To prevent inadvertent entrapment of California tiger salamanders during construction, all excavated, steep-walled holes or trenches more than 1 foot deep shall be covered, by plywood or similar materials, at the close of each working day or provided with one or more escape ramps constructed of earth fill or wooden planks. Before such holes or trenches are filled, they must be thoroughly inspected for trapped animals. d) Plastic monofilament netting (erosion control matting) or similar material shall not be used at the project site because California tiger salamanders may become entangled or trapped. Acceptable substitutes include coconut coir matting or tackified hydroseeding compounds. e) All ground-disturbing work shall occur during daylight hours. Clearing and grading will be conducted between April 15 and October 15, in coordination with USFWS and DFG, and depending on the level of rainfall and site conditions. f) Revegetation of project areas temporarily disturbed by construction activities will be conducted with locally occurring native plants.	Program	USFWS
CTS-3. Compensate for temporary or permanent loss of habitat	a) If California tiger salamander, or areas within 1.3 miles of known or potential California tiger salamander breeding habitat, would be affected by the SJRRP, the project proponent will develop and implement a compensatory mitigation plan in coordination with USFWS and DFG, as appropriate. Unavoidable effects will be compensated through a combination of creation, preservation, and restoration of habitat or purchase of credits at a mitigation bank approved by the regulatory agencies. b) If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be included in and developed as part of the USFWS and/or DFG coordination and consultation process. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations. Any impacts that result in a compensation purchase will require an endowment for land management in perpetuity before any project groundbreaking activities.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
DBC	**Delta button-celery**		
DBC-1. Avoid and minimize loss of habitat and individuals	a) Historically, Delta button celery was known to exist in the Eastside and Mariposa bypasses (CNDDB). In most areas of the bypasses, local flows up to 1,500 cfs remain in the main channel, and do not inundate the floodplain. Maintaining flows at or below 1,500 will not impact Delta button celery populations. In general, historical Delta button celery populations have been located below the 2,500 cfs inundation area (CNDDB). If these historical populations are still thriving in these areas, flows between 1,500 cfs and 2,500 cfs will most likely impact these populations. Potential areas of impact within the Eastside Bypass from the Sand Slough Bypass to the Mariposa Bypass are approximately 400 acres, and for the Mariposa Bypass, approximately 100 acres. Before increasing flows above 1,500 cfs in these specific areas, comprehensive surveys will be conducted.Surveys will include remapping and recensus of the documented occurrences during at least 2 consecutive or nonconsecutive years when habitat conditions are favorable to detect the species to determine the population trend. Status updates for these occurrences will be provided to DFG. b) A Delta button-celery conservation plan will be developed and implemented that includes a preservation and adaptive management strategy for existing occurrences within the Restoration Area. The conservation plan will be developed in collaboration with DFG and other species experts, and be supported by review of the existing literature, including information on species' life history characteristics, historic and current distribution, and microhabitat requirements.	Project and Program	DFG
DBC-2. Avoid and minimize loss of habitat and risk of take for implementation of construction activities	a) If direct impacts to Delta button celery could occur, DFG and the appropriate State lead agency will coordinate to determine specific minimization and mitigation measures	Program	Lead Agency

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
DBC-3. Compensate for temporary or permanent loss of habitat	a) Compensatory mitigation for Delta button-celery will be developed in consultation with DFG. Mitigation may include the development and implementation of habitat creation and enhancement designs to incorporate habitat features for Delta button-celery (e.g., depressions within seasonally inundated areas) into floodplains with potentially suitable habitat conditions. Compensatory mitigation may also include efforts to establish additional populations in the Restoration Area or to enhance existing populations on or off site. Mitigation sites will avoid areas where future SJRRP activities are likely. The project proponent will obtain site access through a conservation easement or in-lieu fee title and will provide adequate funding to implement the required compensation measures, and to monitor compliance with and success of the conservation measures. b) Establishment of new occurrences will be attempted by transplanting seed and plants from affected locations to created habitat or suitable, but unoccupied, existing habitat. c) Monitoring, performance criteria, and protective measures will be applied to compensatory mitigation sites. The replacement requirements, and any additional conservation and mitigation measures will be determined in coordination with DFG.	Project and Program	DFG
PALM	**Palmate-bracted bird's beak**		
PALM-1. Avoid and minimize effects to species	a) If palmate-bracted bird's beak is anticipated within the project area, a qualified botanist will identify and map the location of palmate-bracted bird's beak plants within the project footprint, within 1 year before the start of activities that may cause disturbance from either release of flows over 1,660 cfs or from ground-disturbing actions. b) A minimum 500-foot-wide buffer shall be placed around occurrences of palmate-bracted bird's beak during construction activities, consistent with recommendations in the *Recovery Plan for Upland Species of the San Joaquin Valley, California* (USFWS 1998). The 500-foot-wide buffer will be clearly identified in the field by staking, flagging, or fencing. Project activity will avoid buffer areas, and work awareness training and biological monitoring will be conducted to ensure that the buffer area is not encroached on and that effects are being avoided.	Project and Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
PALM-2. Compensate for temporary or permanent loss of occupied habitat	a) A compensatory conservation plan shall be developed in coordination with USFWS and DFG, as appropriate. The conservation plan will require the project proponent to maintain viable plant populations in the Restoration Area and will identify compensatory measures for any populations affected. The conservation plan shall include monitoring and reporting requirements for populations to be preserved in or adjacent to construction areas, or populations to be protected or enhanced off site. b) If relocation efforts are part of the conservation plan, the plan will include details on the methods to be used: collection, relocation/transplant potential, storage, propagation, preparation of receptor site, installation, long-term protection and management, monitoring and reporting requirements, and remedial action responsibilities should the initial effort fail to meet compensation requirements. c) If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be included in the conservation plan and must occur with full endowment for management in perpetuity before groundbreaking. The plan will include information on responsible parties for long-term management, holders of conservation easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	Project and Program	USFWS DFG
VELB	**Valley elderberry longhorn beetle**		
VELB-1. Avoid and minimize effects to species	a) If elderberry shrubs and valley elderberry longhorn beetle are anticipated within the project area, within 1 year before the commencement of ground-disturbing activities, a qualified biologist shall identify any elderberry shrubs in the project footprint. Qualified biologist(s) will survey potentially affected shrubs for valley elderberry longhorn beetle exit holes in stems greater than 1 inch in diameter. b) If elderberry shrubs are found on or adjacent to the construction project site, a 100-foot-wide avoidance buffer – measured from the dripline of the plant – will be established around all elderberry shrubs with stems greater than 1 inch in diameter at ground level and will be clearly identified in the field by staking, flagging, or fencing. No activities will occur within the buffer areas and worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.	Project and Program	USFWS
VELB -2. Compensate for temporary or permanent loss of habitat	a) The project proponent will consult with USFWS to determine appropriate compensation ratios. Compensatory mitigation measures will be consistent with the *Conservation Guidelines for Valley Elderberry Longhorn Beetle* (USFWS 1999a), or current guidance. b) Compensatory mitigation for adverse effects may include transplanting elderberry shrubs during the dormant season (November 1 to February 15), if feasible, to an area protected in perpetuity, as well as required additional elderberry and associated native plantings and approved by USFWS. c) If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	Project and Program	USFWS

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
BNLL	**Blunt-nosed leopard lizard**		
BNLL-1. Avoid and minimize effects to species	a) Three areas have been identified as having potential blunt-nosed leopard lizard habitat based on aerial maps. These areas include approximately 2,460 acres along the southwest side of the San Joaquin River in Reach 2, approximately 490 acres in a portion of the Eastside Bypass and adjacent lands near Reach 4A of the San Joaquin River, and approximately 2,938 acres encompassing the northern side of the Mariposa Bypass and parcels north of the Mariposa Bypass and west of the Eastside Bypass. Within 1 year before the commencement of the proposed project, focused site visits and habitat assessment will be conducted on these lands. Based on focused assessment, and discussions with the USFWS and DFG, protocol-level surveys may be conducted. If blunt-nosed leopard lizard are detected within or adjacent to the project site, measures that will avoid direct take of this species will be developed in cooperation with USFWS and DFG and implemented before ground disturbing activities. (DWR 2010).	Project and Program	USFWS DFG
BNLL-2. Compensate for temporary or permanent loss of habitat or species	a) Compensation for impacts to the species, if needed, will be determined in coordination with USFWS and DFG as appropriate.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
PLANTS	**Other special-status plants**		
PLANTS-1. Avoid and minimize effects to special-status plants	a) Within 1 year before the commencement of ground-disturbing activities, habitat assessment surveys for the special-status plants listed in Table 1 of Appendix L of this Draft PEIS/R, "Biological Resources – Vegetation and Wildlife," will be conducted by a qualified botanist, in accordance with the most recent USFWS and DFG guidelines and at the appropriate time of year when the target species would be in flower or otherwise clearly identifiable. b) Locations of special-status plant populations will be clearly identified in the field by staking, flagging, or fencing a minimum 100-foot-wide buffer around them before the commencement of activities that may cause disturbance. No activity shall occur within the buffer area, and worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented. c) Some special-status plant species are annual plants, meaning that a plant completes its entire life cycle in one growing season. Other special-status plant species are perennial plants that return year after year until they reach full maturity. Because of the differences in plant life histories, all general conservation measures will be developed on a case-by-case basis and will include strategies that are species- and site-specific to avoid impacts to special-status plants.	Program	USFWS DFG
PLANTS-2. Compensate for temporary or permanent loss of special-status plants	a) USFWS and/or DFG will be consulted to determine appropriate compensation measures for the loss of special-status plants, as appropriate. b) Appropriate mitigation measures may include the creation of off-site populations through seed collection or transplanting, preservation and enhancement of existing populations, restoration or creation of suitable habitat, or the purchase of credits at a regulatory-agency-approved mitigation bank. If off-site compensation includes dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
GGS	**Giant garter snake**		
GGS-1. Avoid and minimize loss of habitat for giant garter snake	a) If giant garter snake habitat is anticipated to be present within the project area, preconstruction surveys will be completed by a qualified biologist approved by USFWS and DFG within a 24-hour period before any ground disturbance of potential giant garter snake habitat. If construction activities stop on the project site for a period of 2 weeks or more, a new giant garter snake survey will be completed no more than 24 hours before the restart of construction activities. Avoidance of suitable giant garter snake habitat, as defined by USFWS (USFWS 1993) and DFG, will occur by demarcating and maintaining a 300-foot-wide buffer around these areas. b) For projects within potential giant garter snake habitat, all activity involving disturbance of potential giant garter snake habitat will be restricted to the period between May 1 and October 1, the active season for giant garter snakes. The construction site shall be reinspected if a lapse in construction activity of 2 weeks or greater has occurred. c) Clearing will be confined to the minimal area necessary to facilitate construction activities. Giant garter snake habitat within or adjacent to the project will be flagged, staked, or fenced and designated as an Environmentally Sensitive Area. No activity shall occur within this area, and USFWS-approved worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented. Construction activities shall be minimized within 200 feet of the banks of giant garter snake habitat. Movement of heavy equipment will be confined to existing roadways to minimize habitat disturbance. d) Vegetation shall be hand-cleared in areas where giant garter snakes are suspected to occur. Exclusionary fencing with one-way exit funnels shall be installed at least 1 month before activities to allow the species to passively leave the area and to prevent reentry into work zones, per USFWS and/or DFG guidance. e) If a giant garter snake is found during construction activities, USFWS, DFG, and the project's biological monitor will immediately be notified. The biological monitor, or his/her assignee, will stop construction in the vicinity of the find and allow the snake to leave on its own. The monitor will remain in the area for the remainder of the work day to ensure the snake is not harmed. Escape routes for giant garter snake should be determined in advance of construction and snakes will be allowed to leave on their own. If a giant garter snake does not leave on its own within 1 working day, USFWS and DFG will be consulted. f) All construction-related holes shall be covered to prevent entrapment of individuals. Where applicable, construction areas shall be dewatered 2 weeks before the start of activities to allow giant garter snakes and their prey to move out of the area before any disturbance.	Program	Lead Agency USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
GGS-2. Compensate for temporary or permanent loss of habitat	a) Temporarily affected giant garter snake aquatic habitat will be restored in accordance with criteria listed in the USFWS *Mitigation Criteria for Restoration and/or Replacement of Giant Garter Snake Habitat* (Appendix A to Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake Within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties, California (USFWS 1997)), or the most current criteria from USFWS or DFG. b) Permanent loss of giant garter snake habitat will be compensated at a ratio and in a manner consulted on with USFWS and DFG. Compensation may include preservation and enhancement of existing populations, restoration or creation of suitable habitat, or purchase of credits at a regulatory-agency-approved mitigation bank in sufficient quantity to compensate for the effect. Credit purchases, land preservation, or land enhancement to minimize effects to giant garter snakes should occur geographically close to the impact area. If off-site compensation is chosen, it shall include dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, and the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	Program	USFWS DFG
WPT	**Western pond turtle**		
WPT-1. Avoid and minimize loss of individuals	a) A qualified biologist will conduct surveys in aquatic habitats to be dewatered and/or filled during project construction. Surveys will be conducted immediately after dewatering and before fill of aquatic habitat suitable for western pond turtles. If western pond turtles are found, the biologist will capture them and move them to nearby USFWS- and/or DFG-approved areas of suitable habitat that will not be disturbed by project construction.	Program	DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
EAGLE	**Bald eagle and golden eagle**		
EAGLE-1. Avoid and minimize effects to bald and golden eagles (as defined in the Bald and Golden Eagle Protection Act)	a) Surveys for bald and golden eagle nests will be conducted within 2 miles of any proposed project within areas supporting suitable nesting habitat and important eagle roost sites and foraging areas. These surveys will be conducted in accordance with the USFWS *Protocol for Evaluating Bald Eagle Habitat and Populations in California* and DFG *Bald Eagle Breeding Survey Instructions* or current guidance (*USFWS Draft Project Design Criteria and Guidance for Bald and Golden Eagles)*. b) If an active eagle's nest is found, project disturbance will not occur within ½ mile of the active nest site during the breeding season (typically December 30 to July 1) or any project disturbance if it is shown to disturb the nesting birds. A no-disturbance buffer will be established around the nest site for construction activities in consultation with USFWS and DFG, and will depend on ecological factors, including topography, surrounding vegetation, nest height, and distance to foraging habitat, as well as the type and magnitude of disturbance. c) Project activity will not occur within the ½-mile-buffer areas, and worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.	Program	USFWS DFG
SWH	**Swainson's hawk**		
SWH-1. Avoid and minimize impacts to Swainson's Hawk	a) Preconstruction surveys for active Swainson's hawk nests will be conducted in and around all potential nest trees within 0.5 miles of project-related disturbance (including construction-related traffic).. b) If known or active nests are identified through preconstruction surveys or other means, a ½ mile no-disturbance buffer shall be established around all active nest sites if construction cannot be limited to occur outside the nesting season (February 15 through September 15). c) Worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.	Program	DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
SWH-2. Compensate for loss of nest trees and foraging habitat	a) If foraging habitat for Swainson's hawk is removed in association with project implementation, foraging habitat compensation will occur in coordination with DFG. Foraging habitat mitigation may consist of planting and establishing alfalfa, row crops, pasture, or fallow fields. b) If potential nesting trees are to be removed during construction activities, removal will take place outside of Swainson's hawk nesting season, and the project proponent will develop a plan to replace known Swainson's hawk nest trees with a number of equivalent native trees that were previously determined to be impacts through consultation with DFG. Compensation shall include dedication of conservation easements, purchase of mitigation credits, or other off-site conservation measures, and the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations.	Program	DFG
RAPTOR	**Other nesting raptors**		
RAPTOR-1. Avoid and minimize loss of individual raptors	a) Construction activity, including vegetation removal, will only occur outside the typical breeding season for raptors (September 1 to February 14), if raptors are determined to be present. b) Preconstruction surveys will be conducted by a qualified biologist in areas of suitable habitat to identify active nests in the project footprint. c) If active nests are located in the project footprint, a no-disturbance buffer will be established until a qualified biologist determines that the nest is no longer active. The size of the buffer shall be established by a qualified biologist in coordination with DFG based on the sensitivity of the resource, the type of disturbance activity, and nesting stage. No activity shall occur within the buffer area, and worker awareness training and biological monitoring will be conducted to ensure that avoidance measures are being implemented.	Program	DFG
RAPTOR-2. Compensate for loss of nest trees	a) Native trees removed during project activities will be replaced with an appropriate number of native trees, in coordination with DFG.	Program	DFG
MBTA	**Other birds protected by the Migratory Bird Treaty Act**		
MBTA-1. Avoid and minimize effects to species	a) Native nesting birds will be avoided by not conducting project activity, including vegetation removal, during the typical breeding season (February 1 to September 1), if species covered under the Migratory Bird Treaty Act and Fish and Game Code Sections 3503, 3503.5, and 3513 are determined to be present. b) An Avian Protection Plan shall be established in coordination with USFWS and DFG. Any overhead utility companies within the project area, whose lines, poles, or towers may be moved in association with the project, will also be consulted as part of the Avian Protection Plan.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
BRO	**Burrowing owl**		
BRO-1. Avoid loss of species	a) Preconstruction surveys for burrowing owls will be conducted in areas supporting potentially suitable habitat and within 30 days before the start of construction activities. If ground-disturbing activities are delayed or suspended for more than 30 days after the preconstruction survey, the site should be resurveyed. b) Occupied burrows shall not be disturbed during the breeding season (February 1 through August 31). A minimum 160-foot-wide buffer shall be placed around occupied burrows during the nonbreeding season (September 1 through January 31), and a 250-foot-wide buffer shall be placed around occupied burrows during the breeding season. Ground-disturbing activities shall not occur within the designated buffers.	Program	DFG
BRO-2. Minimize impacts to species	a) If a DFG-approved biologist can verify through noninvasive methods that owls have not begun egg-laying and incubation, or that juveniles from occupied burrows are foraging independently and are capable of independent survival, a plan shall be coordinated with DFG to offset burrow habitat and foraging areas on the project site if burrows and foraging areas are taken by SJRRP actions. b) If destruction of occupied burrows occurs, existing unsuitable burrows should be enhanced (enlarged or cleared of debris) or new burrows created. This should be done in consultation with DFG. c) Passive owl relocation techniques must be implemented. Owls should be excluded from burrows in the immediate impact zone within a 160-foot-wide buffer zone by installing one-way doors in burrow entrances. These doors shall be in place at least 48 hours before excavation to insure the owls have departed. d) The project area shall be monitored daily for 1 week to confirm owl departure from burrows before any ground-disturbing activities. e) Where possible, burrows should be excavated using hand tools and refilled to prevent reoccupation. Sections of flexible plastic pipe should be inserted into the tunnels during excavation to maintain an escape route for any animals inside the burrow.	Program	DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
BAT	**Special-status bats**		
BAT-1. Avoid and minimize loss of species	a) If suitable roosting habitat for special-status bats will be affected by project construction (e.g., removal of buildings, modification of bridges), surveys for roosting bats on the project site will be conducted by a qualified biologist. The type of survey will depend on the condition of the potential roosting habitat and may include visual surveys or use of acoustic detectors. Visual surveys may consist of a daytime pedestrian survey for evidence of bat use (e.g., guano) and/or an evening emergence survey for the presence or absence of bats. The type of survey will depend on the condition of the potential roosting habitat. If no bat roosts are found, then no further study is required. b) If evidence of bat use is observed, the number and species of bats using the roost will be determined. Bat detectors may be used to supplement survey efforts. c) If roosts are determined to be present and must be removed, the bats will be excluded from the roosting site before the facility is removed. A mitigation program addressing compensation, exclusion methods, and roost removal procedures will be developed in consultation with DFG before implementation. Exclusion methods may include use of one-way doors at roost entrances (bats may leave, but not reenter), or sealing roost entrances when a site can be confirmed to contain no bats. Exclusion efforts may be restricted during periods of sensitive activity (e.g., during hibernation or while females in maternity colonies are nursing young).	Program	DFG
BAT-2. Compensate for loss of habitat	a) The loss of each roost will be replaced, in consultation with DFG, and may include construction and installation of bat boxes suitable to the bat species and colony size excluded from the original roosting site. Roost replacement will be implemented before bats are excluded from the original roost sites. Once the replacement roosts are constructed and it is confirmed that bats are not present in the original roost sites, the structure may be removed.	Program	DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
SJAS	**San Joaquin antelope squirrel**		
SJAS-1. Avoid and minimize loss of individuals	a) A 50-foot-wide minimum buffer shall be maintained from all small mammal burrows of suitable size for San Joaquin antelope squirrel. b) If work is to occur within the 50-foot-wide buffer, a qualified, permitted biologist shall conduct focused visual surveys for San Joaquin antelope squirrel within a 500-foot-wide buffer of the work area. These surveys shall coincide with the squirrels' most active season, April 1 to September 30, and shall be conducted only when air temperatures are between 20° to 30° C (68° to 86° F). Surveys should be conducted using daytime line transects with 10- to 30-meter spacing. Focused live trapping may also be required, in coordination with DFG. If San Joaquin antelope squirrels are observed during surveys, no vegetation or soil disturbance will be allowed within 50 feet of occupied burrows or burrow systems until the individuals are determined to no longer be occupying the area, as determined by a qualified biologist. c) Focused surveys, which may involve live trapping, may be required, in coordination with DFG, as appropriate. Additional conservation measures may developed pending the results of surveys, and in consultation with DFG. d) Construction activities shall be conducted when they are least likely to affect the species (i.e., after the normal breeding season). This timing shall be coordinated with USFWS and DFG.	Program	DFG
SJAS-2: Compensate for temporary or permanent loss of habitat or species	a) Compensation for impacts to the species, if needed, will be determined in coordination with DFG, as appropriate.	Program	DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
FKR	**Fresno kangaroo rat**		
FKR-1. Avoid and minimize effects to species	a) Preconstruction surveys will be conducted by a qualified biologist per USFWS and DFG survey methodology to determine if potential burrows for Fresno kangaroo rat are present in the project footprint. Surveys will be conducted within 30 days before ground-disturbing activities. The biologist will conduct burrow searches by systematically walking transects, which shall be adjusted based on vegetation height and topography, and in coordination with USFWS and DFG. Transects shall be used to identify the presence of kangaroo rat burrows. When burrows are found within 100 feet of the proposed project footprint, focused live trapping surveys shall be conducted by a qualified and permitted biologist, following a methodology approved in advance by USFWS and DFG. Additional conservation measures may be developed pending the results of surveys, and in consultation with USFWS and DFG. b) Construction activities shall be conducted when they are least likely to affect the species (i.e., after the normal breeding season). This timing shall be coordinated with USFWS and DFG.	Program	USFWS DFG
FKR-2. Avoid disturbance of designated critical habitat	a) Facility construction and modification and other restoration projects shall be sited to avoid primary constituent elements of designated critical habitat for Fresno kangaroo rat.	Program	USFWS DFG
FKR-3: Compensate for temporary or permanent loss of habitat or species	a) Compensation for impacts to the species, if needed, will be determined in coordination with DFG and USFWS, as appropriate.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
SJKF	**San Joaquin kit fox**		
SJKF-1. Avoid and minimize effects to species	a) A qualified biologist will conduct preconstruction surveys no less than 14 days and no more than 30 days before the commencement of activities to identify potential dens more than 5 inches in diameter. The project proponent shall implement USFWS' (1999b) *Standardized Recommendations for Protection of San Joaquin Kit Fox Prior to or During Ground Disturbance.* The project proponent will notify USFWS and DFG in writing of the results of the preconstruction survey within 30 days after these activities are completed. b) If dens are located within the proposed work area, and cannot be avoided during construction activities, a USFWS-approved biologist will determine if the dens are occupied. c) If occupied dens are present within the proposed work, their disturbance and destruction shall be avoided. Exclusion zones will be implemented following the latest USFWS procedures (currently USFWS 1999b). d) The project proponent will notify USFWS and DFG immediately if a natal or pupping den is found in the survey area. The project proponent will present the results of preactivity den searches within 5 days after these activities are completed and before the start of construction activities in the area. e) Construction activities shall be conducted when they are least likely to affect the species (i.e., after the normal breeding season). This timing shall be coordinated with USFWS and DFG.	Program	USFWS DFG
SJKF-2. Compensate for loss of habitat	a) The project proponent, in coordination with USFWS and DFG, will determine if kit fox den removal is appropriate. If unoccupied dens need to be removed, the USFWS-approved biologist shall remove these dens by hand-excavating them in accordance with USFWS procedures (USFWS 1999b). b) Additional conservation measures will be coordinated with USFWS and DFG, and may include replacing dens, installing off-site artificial dens, acquiring compensation habitat, or other options to be determined. Compensation may include dedicating conservation easements, purchasing mitigation credits, or other off-site conservation measures, and the details of these measures will be included in the mitigation plan and must occur with full endowments for management in perpetuity. The plan will include information on responsible parties for long-term management, holders of conservations easements, long-term management requirements, and other details, as appropriate, for the preservation of long-term viable populations. c) The project proponent will present the results of den excavations to USFWS and DFG within 5 days after these activities are completed.	Program	USFWS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
PL	**Pacific lamprey**		
PL-1. Avoid and minimize effects to species	a) A qualified biologist will conduct preconstruction surveys as outlined in Attachment A of USFWS' *Best Management Practices to Minimize Adverse Effects to Pacific Lamprey (Entosphenus tridentatus)* (2010). b) Work in documented areas of Pacific lamprey presence will be timed to avoid in-channel work during typical lamprey spawning (March 1 to July 1). c) If temporary dewatering in documented areas of lamprey presence is required for instream channel work, salvage methods shall be implemented to capture and move ammocoetes to a safe area, in consultation with USFWS.	Program	USFWS
DS	**Delta smelt**		
DS-1. Avoid and minimize effects to species	a) All in-water work within delta smelt habitat, as defined by most recent USFWS guidance, shall be confined to a seasonal work window of August 1 - November 30, when delta smelt are least likely to be present. Because this species does not regulate its movements strictly within this time frame, modifications to the work windows may be approved by USFWS before project implementation, based on information from the various in-Delta monitoring programs. b) If activities occur within Delta smelt habitat, measure will be taken to maintain or increase shading of suitable shallow water habitat. The project will also avoid areas deemed suitable for delta smelt habitat that have established aquatic vegetation or have not been previously disturbed.	Program	USFWS DFG
RHSNC	**Riparian habitat and other sensitive natural communities**		
RHSNC-1. Avoid and minimize loss of riparian habitat and other sensitive natural communities	a) Biological surveys will be conducted to identify, map, and quantify riparian and other sensitive habitats in potential construction areas. b) Construction activities will be avoided in areas containing sensitive natural communities, as appropriate. c) If effects occur to riparian habitat, emergent wetland, or other sensitive natural communities associated with streams, the State lead agency will comply with Section 1602 of the California Fish and Game Code; compliance may include measures to protect fish and wildlife resources during the project.	Project and Program	DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
RHSNC-2. Compensate for loss of riparian habitat and other sensitive natural communities	a) The Riparian Habitat Mitigation and Monitoring Plan for the SJRRP will be developed and implemented in coordination with DFG. Credits for increased acreage or improved ecological function or riparian and wetland habitats resulting from the implementation of SJRRP actions will be applied as compensatory mitigation before additional compensatory measures are required. b) If losses of other sensitive natural communities (e.g., recognized as sensitive by CNDDB, but not protected under other regulations or policies) would not be offset by the benefits of the SJRRP, then additional compensation will be provided through creating, restoring, or preserving in perpetuity in-kind communities at a sufficient ratio for no net loss of habitat function or acreage. The appropriate ratio will be determined in consultation with USFWS or DFG, depending on agency jurisdiction.	Project and Program	DFG
WUS	**Waters of the United States/waters of the State**		
WUS-1. Identify and quantify wetlands and other waters of the United States	a) Before SJRRP actions that may affect waters of the United States or waters of the State, Reclamation will map the distribution of wetlands (including vernal pools and other seasonal wetlands) in the Eastside and Mariposa bypasses. b) The project proponent will determine, based on the mapped distribution of these wetlands and hydraulic modeling and field observation, the acreage of effects, if any, on waters of the United States. c) If it is determined that vernal pools or other seasonal wetlands will be affected by the SJRRP, the project proponent will conduct a delineation of waters of the United States, and submit the delineation to USACE for verification. The delineation will be conducted according to methods established in the USACE *Wetlands Delineation Manual* (Environmental Laboratory 1987) and *Arid West Supplement* (Environmental Laboratory 2008). d) Construction and modification of road crossings, control structures, fish barriers, fish passages, and other structures will be designed to minimize effects on waters of the United States and waters of the State, and will employ BMPs to avoid indirect effects on water quality.	Project and Program	USACE
WUS-2. Obtain permits and compensate for any loss of wetlands and other waters of the United States/waters of the State	a) The project proponent, in coordination with USACE, will determine the acreage of effects on waters of the United States and waters of the State that will result from implementation of the SJRRP. b) The project proponent will adhere to a "no net loss" basis for the acreage of wetlands and other waters of the United States and waters of the State that will be removed and/or degraded. Wetland habitat will be restored, enhanced, and/or replaced at acreages and locations and by methods agreed on by USACE and the Central Valley RWQCB, as appropriate, depending on agency jurisdiction. c) The project proponent will obtain Section 404 and Section 401 permits and comply with all permit terms. The acreage, location, and methods for compensation will be determined during the Section 401 and Section 404 permitting processes. d) The compensation will be consistent with recommendations in the Fish and Wildlife Coordination Act Report (Appendix F of this Draft PEIS/R).	Project and Program	USACE

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
INV	**Invasive plants**		
INV-1. Implement the Invasive Vegetation Monitoring and Management Plan	a) Reclamation and the project lead agencies will implement the Invasive Vegetation Monitoring and Management Plan for the SJRRP (Appendix L of this Draft PEIS/R), which includes measures to monitor, control, and where possible eradicate, invasive plant infestations during flow releases and construction activities. b) The implementation of the Invasive Vegetation Monitoring and Management Plan (Appendix L of this Draft PEIS/R) will include monitoring procedures, thresholds for management responses, success criteria, and adaptive management measures for controlling invasive plant species. c) The control of invasive weeds and other recommended actions in the Invasive Vegetation Monitoring and Management Plan (Appendix L of this Draft PEIS/R) will be consistent with recommendations in the Fish and Wildlife Coordination Act Report (Appendix F of this Draft PEIS/R).	Project and Program	Lead Agency
CP	**Conservation plans**		
CP-1. Remain consistent with approved conservation plans	a) Facility siting and construction activities will be conducted in a manner consistent with the goals and strategies of adopted habitat conservation plans, natural community conservation plans, or other approved local, regional, or State habitat conservation plans to the extent feasible. Coordination shall occur with USFWS and/or DFG, as appropriate.	Program	USFWS DFG
CP-2. Compensate effects consistent with approved conservation plans	a) The project proponent shall compensate effects consistent with applicable conservation plans and implement all applicable measures required by the plans.	Program	USFWS DFG
GS	**Southern distinct population segment of North American green sturgeon**		
GS-1. Avoid and minimize loss of habitat and individuals	a) The SJRRP will be operated in such a way that actions within green sturgeon habitat shall be done in accordance with existing operating criteria of the CVP and SWP, and prevailing and relevant laws, regulations, BOs, and court orders in place when the action(s) are performed.	Project and Program	NMFS

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
CVS	**Central Valley steelhead**		
CVS-1. Avoid loss of habitat and risk of take of species	a) Impacts to habitat conditions (i.e., changes in flows potentially resulting in decreased flows in the tributaries, increases in temperature, increases in pollutant concentration, change in recirculation/recapture rates and methods, decrease in floodplain connectivity, removal of riparian vegetation, decreased in quality rearing habitat, etc.) must be analyzed in consultation with NMFS. b) The Hills Ferry Barrier will be operated and maintained to exclude Central Valley steelhead from the Restoration Area during construction activities and until suitable habitat conditions are restored. c) Maintenance of conservation measures will be conducted to the extent necessary to ensure that the overall long-term habitat effects of the project are positive. d) Before implementation of site-specific actions, the action agency shall conduct an education program for all agency and contracted employees relative to the Federally listed species that may be encountered within the study area of the action, and required practices for their avoidance and protection. A NMFS-appointed representative shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner. e) Disturbance of riparian vegetation will be avoided to the greatest extent practicable. f) A spill prevention plan will be prepared describing measures to be taken to minimize the risk of fluids or other materials used during construction (e.g., oils, transmission and hydraulic fluids, cement, fuel) from entering the San Joaquin River or contaminating riparian areas adjacent to the river itself. In addition to a spill prevention plan, a cleanup protocol will be developed before construction begins and shall be implemented in case of a spill. g) Stockpiling of materials, including portable equipment, vehicles and supplies, such as chemicals, shall be restricted to the designated construction staging areas, exclusive of any riparian and wetland areas. h) A qualified biological monitor will be present during all construction activities, including clearing, grubbing, pruning, and trimming of vegetation at each job site during construction initiation, midway through construction, and at the close of construction, to monitor implementation of conservation measures and water quality. i) The San Joaquin River channel shall be designed to decrease or eliminate predator holding habitat, in coordination with NMFS.	Project and Program	NMFS

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
CVS-2. Minimize loss of habitat and risk of take of species	a) In-channel construction activities that could affect designated critical habitat for Central Valley steelhead will be limited to the low-flow period between June 1 and October 1 to minimize potential for adversely affecting Federally listed anadromous salmonids during their emigration period. b) In-channel construction activities that could affect designated critical habitat for Central Valley steelhead will be limited to daylight hours during weekdays, leaving a nighttime and weekend period of passage for Federally listed fish species. c) Construction BMPs for off-channel staging, and storage of equipment and vehicles, will be implemented to minimize the risk of contaminating the waters of the San Joaquin River by spilled materials. BMPs will also include minimization of erosion and stormwater runoff, as appropriate. d) Riparian vegetation removed or damaged will be replaced at a ratio, coordinated with NMFS, within the immediate area of the disturbance to maintain habitat quality. e) If individuals of listed species are observed present within a project area, NMFS must be notified. NMFS personnel shall have access to construction sites during construction, and following completion, to evaluate species presence and condition and/or habitat conditions. f) If bank stabilization activities should be necessary, then such stabilization shall be constructed to minimize predator habitat, minimize erosion potential, and contain material suitable for supporting riparian vegetation.	Program	NMFS
WRCS	**Sacramento Valley winter-run Chinook salmon**		
WRCS-1. Avoid and minimize loss of habitat and individuals	a) The SJRRP will be operated in such a way that actions related to the SJRRP in the vicinity of winter-run Chinook salmon habitat shall be performed in accordance with existing operating criteria of the CVP and SWP, and prevailing and relevant laws, regulations, BOs, and court orders in place at the time the actions are performed.	Project and Program	NMFS DFG
SRCS	**Central Valley spring-run Chinook salmon**		
SRCS-1. Avoid and minimize loss of habitat and individuals	a) The SJRRP will be operated in such a way that actions in the vicinity of spring-run Chinook salmon habitat shall be done in accordance with existing operating criteria of the CVP and SWP, and prevailing and relevant laws, regulations, BOs, and court orders in place at the time the actions are performed. b) SJRRP actions shall be performed in accordance with the Experimental Population 4(d) rule, as it is developed, and where applicable.	Project and Program	NMFS DFG

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
EFH	**Essential fish habitat (Pacific salmonids and starry flounder)**		
EFH-1. Avoid loss of habitat and risk of take of species	a) Impacts to habitat conditions (e.g., changes in flows potentially resulting in decreased flows in the tributaries, increases in temperature, increases in pollutant concentration, change in recirculation/recapture rates and methods, decrease in floodplain connectivity, removal of riparian vegetation, decreased in quality rearing habitat) must be analyzed in consultation with NMFS. b) The Hills Ferry Barrier will be operated and maintained to exclude Pacific salmonids from the Restoration Area during construction activities, and until suitable habitat conditions are restored. c) Maintenance of conservation measures will be conducted to the extent necessary to ensure that the overall long-term habitat effects of the project are positive. d) Before implementation of site-specific actions, the action agency shall conduct an education program for all agency and contracted employees relative to the Federally listed species that may be encountered within the study area of the action, and required practices for their avoidance and protection. A NMFS-appointed representative shall be identified to employees and contractors to ensure that questions regarding avoidance and protection measures are addressed in a timely manner. e) Disturbance of riparian vegetation will be avoided to the greatest extent practicable. f) A spill prevention plan will be prepared describing measures to be taken to minimize the risk of fluids or other materials used during construction (e.g., oils, transmission and hydraulic fluids, cement, fuel) from entering the San Joaquin River or contaminating riparian areas adjacent to the river itself. In addition to a spill prevention plan, a cleanup protocol will be developed before construction begins and shall be implemented in case of a spill. g) Stockpiling of materials, including portable equipment, vehicles and supplies, such as chemicals, shall be restricted to the designated construction staging areas, exclusive of any riparian and wetland areas. h) A qualified biological monitor will be present during all construction activities, including clearing, grubbing, pruning, and trimming of vegetation at each job site during construction initiation, midway through construction, and at the close of construction to monitor implementation of conservation measures and water quality. i) The bottom topography of the San Joaquin River channel will be designed to decrease or eliminate predator holding habitat.	Project and Program	NMFS

Table 2-7.
Conservation Measures for Biological Resources That May Be Affected by Settlement Actions (contd.)

Conservation Measure and Identifier	Applicable Habitat and/or Species, and Conservation Measure Description	Level of Compliance	Regulatory Agency
EFH-2. Minimize loss of habitat and risk of take from implementation of construction activities	a) In-channel construction activities that could affect habitat for will be limited to the low-flow period between June 1 and October 1 to minimize potential for adversely affecting Federally listed anadromous salmonids during their emigration period. b) In-channel construction activities that could affect habitat for starry flounder and Pacific salmonids will be limited to daylight hours during weekdays, leaving a nighttime and weekend period of passage for Federally listed fish species. c) Construction BMPs for off-channel staging and storage of equipment and vehicles will be implemented to minimize the risk of contaminating the waters of the San Joaquin River by spilled materials. BMPs will also include minimization of erosion and stormwater runoff, as appropriate. d) Riparian vegetation removed or damaged will be replaced at a ratio, coordinated with NMFS, within the immediate area of the disturbance to maintain habitat quality. e) If individuals of listed species are observed present within a project area, NMFS must be notified. NMFS personnel shall have access to construction sites during construction and following completion to evaluate species presence and condition and/or habitat conditions. f) If bank stabilization activities should be necessary, then such stabilization shall be constructed to minimize predator habitat, minimize erosion potential, and contain material suitable for supporting riparian vegetation.	Program	NMFS

Key:
°C = degrees Celsius
°F = degrees Farenheit
BMP = best management practice
BO = Biological Opinion
CFR = Code of Federal Regulations
cfs = cubic feet per second
CNDDB = California Natural Diversity Database
CVP = Central Valley Project
DFG = California Department of Fish and Game
DWR = California Department of Water Resources
EPA = Federal Environmental Protection Agency
NMFS = National Marine Fisheries Service
PEIS/R = Program Environmental Impacts Statement/Report
Reclamation = U.S. Department of the Interior, Bureau of Reclamation
RWQCB = Regional Water Quality Control Board
Settlement = Stipulation of Settlement in *NRDC, et al,. v. Kirk Rodgers, et al.*
SJRRP = San Joaquin River Restoration Program
State = State of California
SWP = State Water Project
USACE = U.S. Army Corps of Engineers
USFWS = U.S. Fish and Wildlife Service

2.5 Alternative A2 Reach 4B1 at 4,500 cfs, Delta Recapture

Project-level actions in Alternative A2 are identical to project-level actions in Alternative A1. Program-level actions in Alternative A2 include all of the program-level actions in Alternative A1, plus additional Restoration actions in Reach 4B1 and the bypass system to increase the capacity of Reach 4B1, as described below and as shown in Table 2-2. Flow routing and water recapture under Alternative A2 are shown in Figure 2-9.

2.5.1 Additional Restoration Actions

Alternative A2 includes all of the modifications to Reach 4B1 described in Alternative A1 plus additional modifications needed to increase the capacity of Reach 4B1 to at least 4,500 cfs, with integrated floodplain habitat, as specified in Paragraph 11(b)(1) of the Settlement. The additional modifications to increase the capacity of Reach 4B1 to at least 4,500 cfs would be implemented during Phase 2, unless the Secretary, in consultation with the RA and with concurrence by NMFS and USFWS, determines that such modifications would not substantially enhance achievement of the Restoration Goal. These modifications to Reach 4B1 would require subsequent environmental compliance documentation, and would include modifications to the San Joaquin River Headgates at the upstream end of Reach 4B1 to provide for fish passage, and enable flow routing of between 500 cfs and 4,500 cfs into Reach 4B1, and related modifications to the Sand Slough Control Structure, as stipulated in Paragraphs 11(a)(4) and 11(a)(5) of the Settlement, respectively.

Before modifications are completed to convey at least 4,500 cfs in Reach 4B1, Interim and Restoration flows of up to 475 cfs would be routed through Reach 4B1, with remaining Interim and Restoration flows routed through the Eastside Bypass. After modifications are completed to convey at least 4,500 cfs through Reach 4B1, all Interim and Restoration flows would be routed through Reach 4B1. Modifications to and operations of Reach 4B1, the San Joaquin River Headgate, and the Sand Slough Control Structure to convey at least 4,500 cfs through Reach 4B1 in Alternative A2 are the same in Alternatives B2 and C2, as shown in Figures 2-2 and 2-8, and therefore are not discussed further in the presentation of those alternatives.

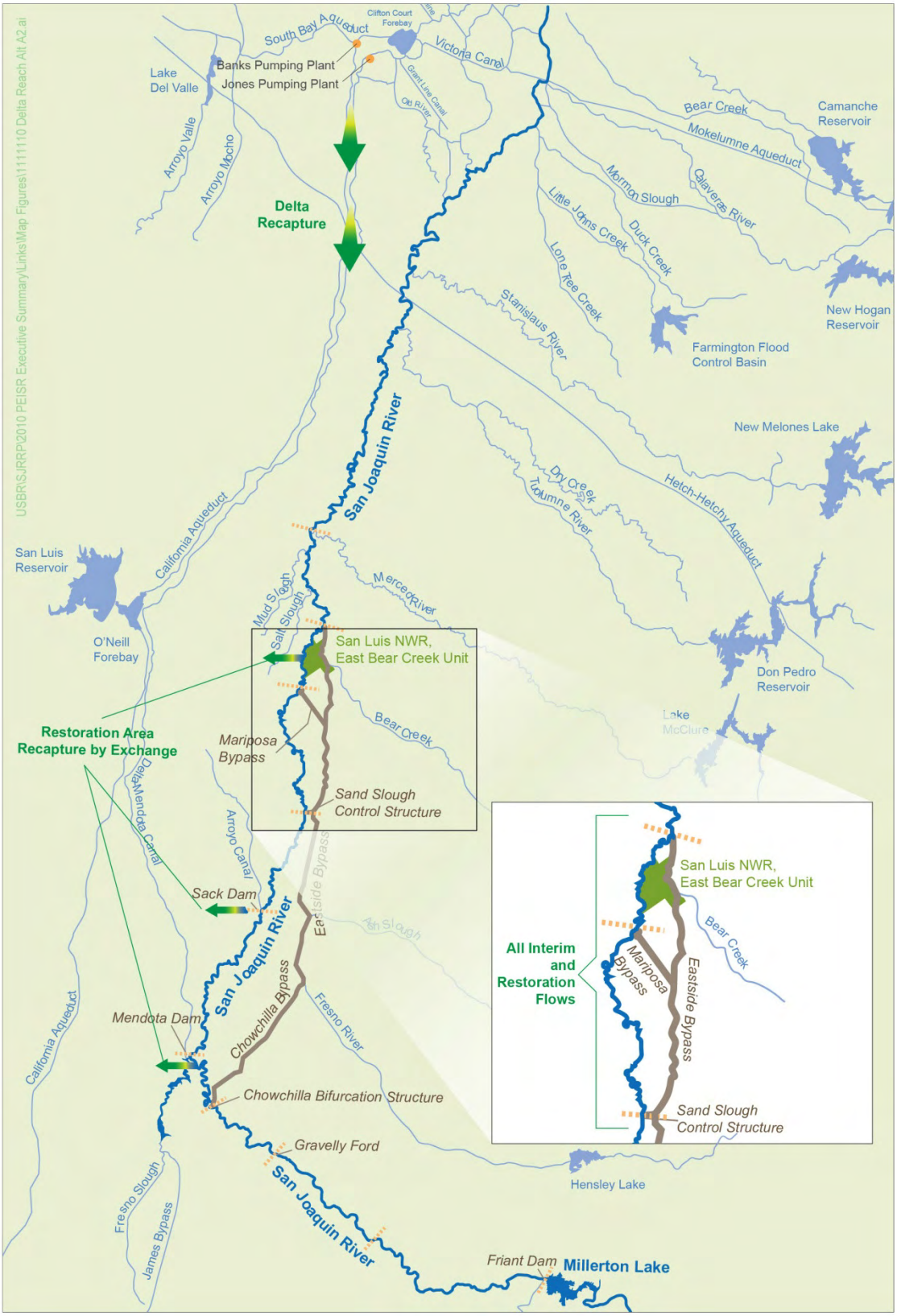


Figure 2-9.
Flow Routing and Water Recapture Under Alternative A2

Although the exact extent of potential floodplain habitat through Reach 4B1 has not been identified, floodplains in Reach 4B1 could provide significant benefits for salmon and other native fish. Therefore, Alternative A2 includes modifications to Reach 4B1 that bracket a reasonable range of potential implementation. New levees would be constructed in Reach 4B1 to provide new floodplain habitat ranging in average width from about 1,900 feet to 4,800 feet, and levee heights at an average of 4 feet to 5 feet, depending on the characteristics of the floodplain habitat. Specific levee alignments, modifications, and floodplain characteristics would be determined through a project-specific study that would consider a variety of factors, as specified in the Act, including, but not limited to, fisheries and other ecological requirements, flood risk reduction, land uses, subsurface conditions, topography, and the condition of existing levees. The Fisheries Management Plan (Appendix E) addresses specific actions to improve habitats and evaluates their merits (including uncertainty) in an action routing process.

Road crossings are present at several locations in Reach 4B1. Washington Road crosses the river just downstream from the San Joaquin River Headgates. Turner Island Road crosses the river approximately midway along the reach. Three unnamed crossings are also present in Reach 4B1, as described in Alternative A1. These crossings would be modified to provide flow capacity and fish passage, if necessary. Project-specific studies of these crossings would identify specific modifications needed to facilitate flow and fish passage.

2.6 Alternative B1 Reach 4B1 at 475 cfs, San Joaquin River Recapture

Project-level actions in Alternative B1 are identical to project-level actions in Alternatives A1 and A2. Program-level actions in Alternative B1 include all of the program-level actions in Alternative A1, plus additional Water Management actions to recapture Interim and Restoration flows using existing facilities along the San Joaquin River between the Merced River and the Delta, as shown in Table 2-2. Flow routing and water recapture under Alternative B1 are shown in Figure 2-10.

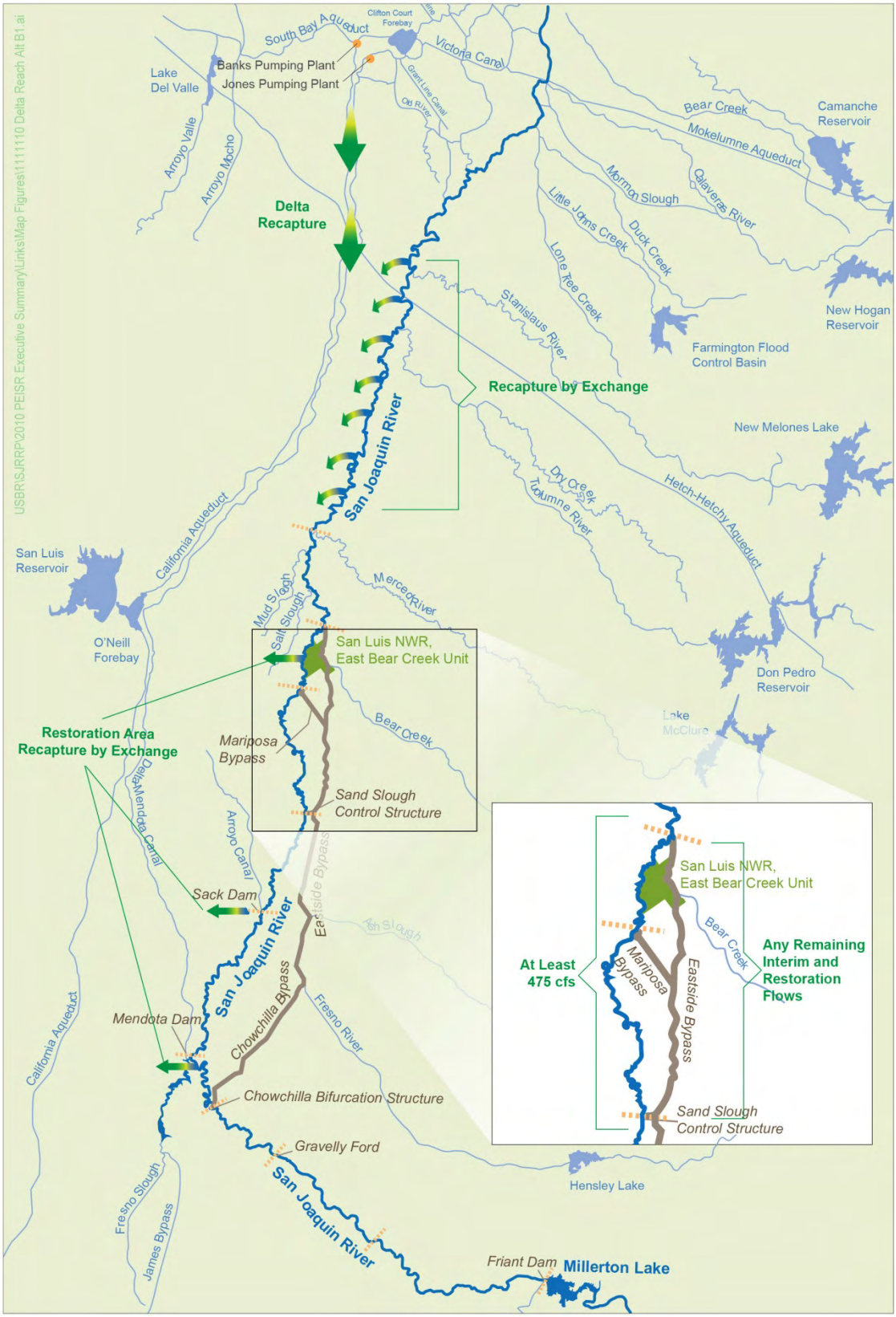


Figure 2-10.
Flow Routing and Water Recapture Under Alternative B1

2.6.1 Additional Water Management Actions on San Joaquin River

Alternative B1 includes recapturing Interim and Restoration flows from the San Joaquin River below the Merced River confluence at existing pumping facilities owned and operated by CVP contractors who possess San Joaquin River water rights, as illustrated in Figure 2-10. These actions could include potential in-district modifications to existing off-river facilities to facilitate routing or storage of water, such as expanding existing canals or constructing lift stations on existing canals. These actions are analyzed at a program level in this Draft PEIS/R. Recaptured Interim and Restoration flows from the San Joaquin River would be exchanged for CVP Delta water supplies scheduled for delivery to these CVP contractors. Implementing recapture at existing facilities on the San Joaquin River would require agreements with San Joaquin River water right holders to allow pumping of Interim and Restoration flows in exchange for delivery of CVP water from the Delta. Recapture of Interim or Restoration flows at existing facilities would occur only if doing so would not adversely affect downstream water quality or fisheries, consistent with the requirements of Paragraph 16(a)(1) of the Settlement. To the extent they are available, CVP storage and conveyance facilities would be used to convey the exchanged water to the Friant Division. As a result of these diversions along the San Joaquin River, the portion of the Restoration Flows reaching the Delta under Alternative B1 would be less than under Alternative A1.

Water supply recaptured through exchange with San Joaquin River water right holders available to Friant Division long-term contractors would range from zero to the total amount of recaptured Interim and Restoration flows. Recapture would be limited by conveyance capacity and conditions identified by exchanging entities, such as water quality requirements for land application or other potential concerns.

Implementing Alternative B1 would require exchange and/or conveyance agreements between Reclamation and CVP water users who possess water rights on the San Joaquin River. This alternative also would require exchange and/or conveyance agreements for recirculating recaptured Interim and Restoration flows at Delta export pumping facilities, as described under Alternative A1.

2.7 Alternative B2 Reach 4B1 at 4,500 cfs, San Joaquin River Recapture

Project-level actions in Alternative B2 are identical to project-level actions in Alternatives A1, A2, and B1. Program-level actions in Alternative B2 include all of the program-level actions in Alternative B1, plus additional Restoration actions in Reach 4B1 and the bypass system to increase the capacity of Reach 4B1 to at least 4,500 cfs, as described for Alternative A2, as shown in Table 2-2. Flow routing and water recapture under Alternative B2 are shown in Figure 2-11.

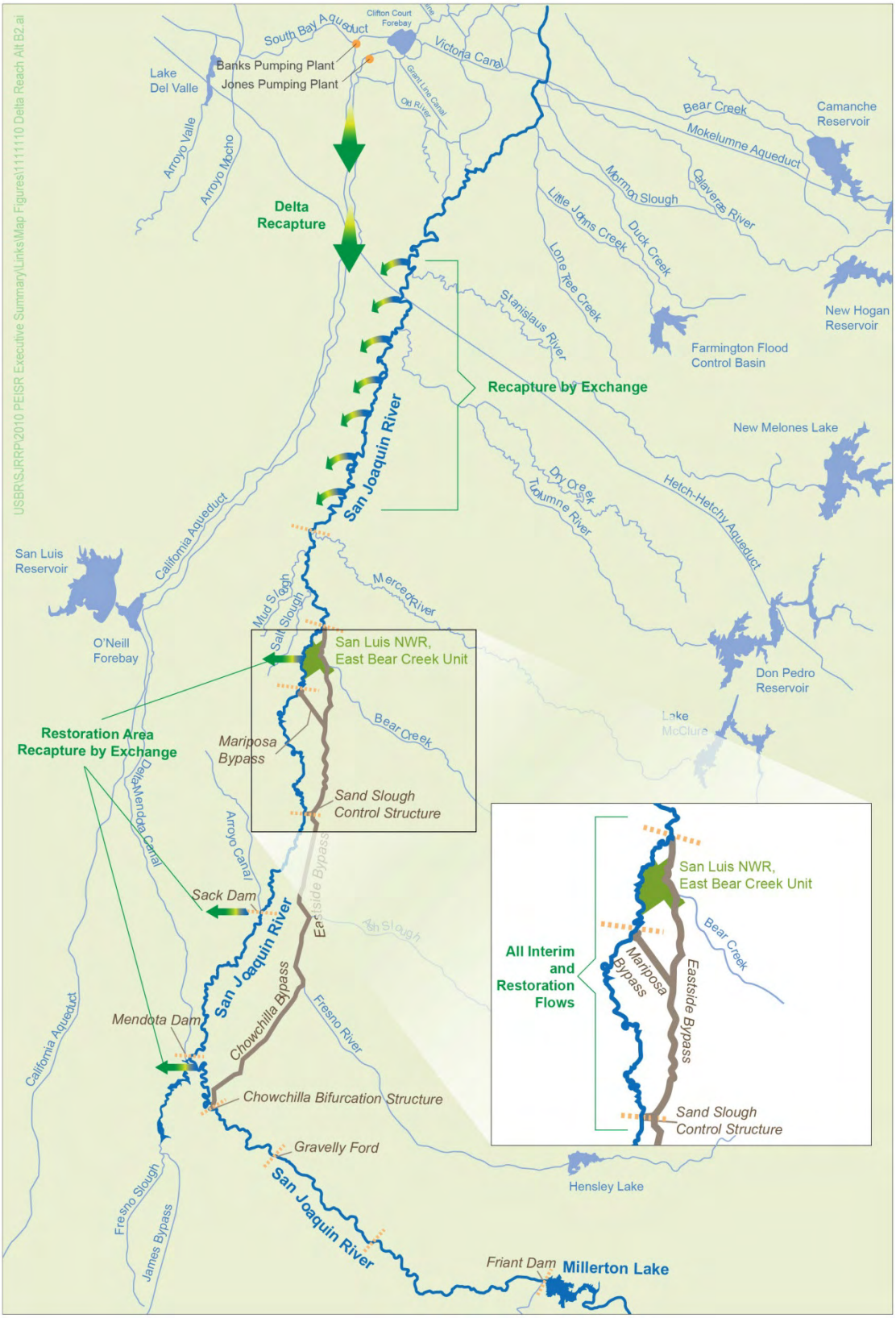


Figure 2-11.
Flow Routing and Water Recapture Under Alternative B2

2.8 Alternative C1 Reach 4B1 at 475 cfs, New Pumping Plant Recapture

Project-level actions in Alternative C1 are identical to project-level actions in alternatives A1, A2, B1, and B2. Program-level actions in Alternative C1 include all of the program-level actions in Alternative B1, plus additional Water Management actions for constructing and operating new infrastructure to facilitate recapture of Interim and Restoration flows on the San Joaquin River below the confluence of the Merced River, as described below and as shown in Table 2-2. Flow routing and water recapture under Alternative C1 are shown in Figure 2-12.

2.8.1 Additional Water Management Actions on San Joaquin River

In addition to water exchanges with existing water right holders along the San Joaquin River, Alternative C1 also includes constructing new infrastructure to increase pumping capacity along the San Joaquin River below the Merced River confluence for the direct recapture of Interim and Restoration flows, and infrastructure to convey recaptured flows to the DMC or California Aqueduct. Construction of new pumping capacity would include a new pumping plant on the San Joaquin River or enlarging the pumping capacity of an existing facility on the San Joaquin River. This action is analyzed at a program level in this Draft PEIS/R. Before completion of new pumping capacity on the river, recapture would occur in the Delta, as described under Alternatives A1 and A2, and/or at existing facilities along the river, as described under Alternatives B1 and B2. After construction of new pumping capacity, a smaller portion of Restoration Flows would reach the Delta under Alternative C1 than under Alternative B1, because of the additional recapture that would be possible along the San Joaquin River at the new pumping infrastructure. A smaller portion of Interim and Restoration Flows would be available for recapture through exchange at existing facilities under Alternative C1 than under Alternative B1 because of recapture of flows at the new pumping infrastructure.

The new pumping infrastructure could have a capacity of up to 1,000 cfs, and would be located on the San Joaquin River downstream from the Merced River confluence and upstream from Vernalis. This river reach includes a range of anticipated flows and water quality conditions that would affect design and operation of the facility; therefore, the location and capacity of the pumping infrastructure would be determined as part of a subsequent site-specific study. New pumping infrastructure would also include infrastructure to convey recaptured flows to the DMC or California Aqueduct. To the extent they are available, existing south-of-Delta CVP and SWP storage and conveyance facilities would be used to recirculate recaptured water to the Friant Division, as described for Alternative B1.

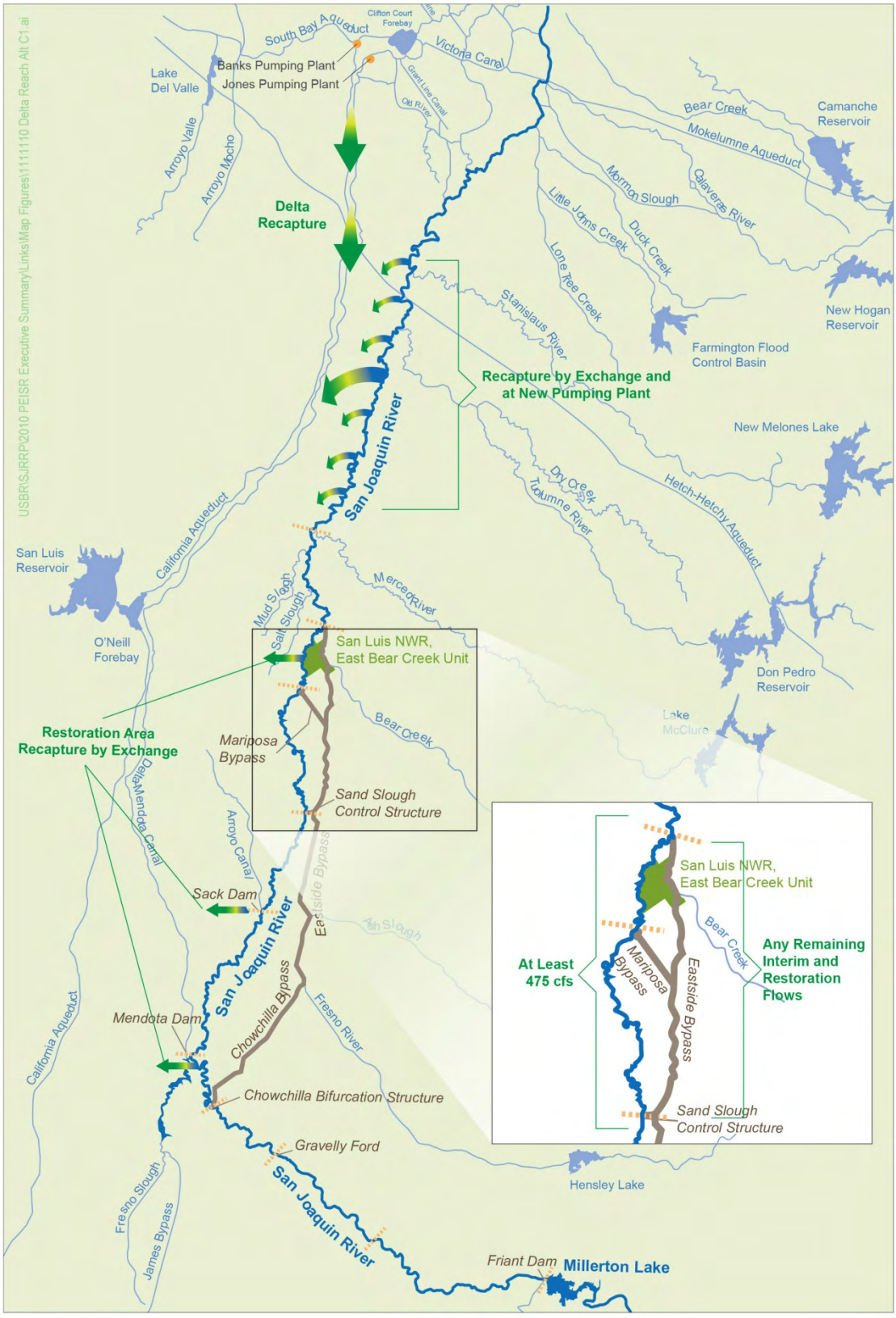


Figure 2-12.
Flow Routing and Water Recapture Under Alternative C1

The availability of water would be limited to direct recapture of Interim and Restoration flows in the San Joaquin River and in the Delta. Recaptured water available to Friant Division long-term contractors would range from zero to the total amount of recaptured Interim and Restoration flows, and would be limited by conveyance capacity and water quality requirements for introducing recaptured water to the DMC and California Aqueduct. The conveyance of water would be limited by physical pumping plant capacity, permit limitations for pumping from the San Joaquin River, and available conveyance capacity in the DMC and the California Aqueduct. New water right permits, or modifications to existing permits, would be needed to redivert water from the San Joaquin River at new pumping infrastructure.

2.9 Alternative C2 Reach 4B1 at 4,500 cfs, New Pumping Plant Recapture

Project-level actions in Alternative C2 are identical to project-level actions in Alternatives A1, A2, B1, B2, and C1. Program-level actions in Alternative C2 include all of the program-level actions in Alternative C1, plus additional Restoration actions in Reach 4B1 and the bypass system, to increase the capacity of Reach 4B1 to at least 4,500 cfs, as described for Alternative A2 and as shown in Table 2-2. Flow routing and water recapture under Alternative C1 are shown in Figure 2-13.

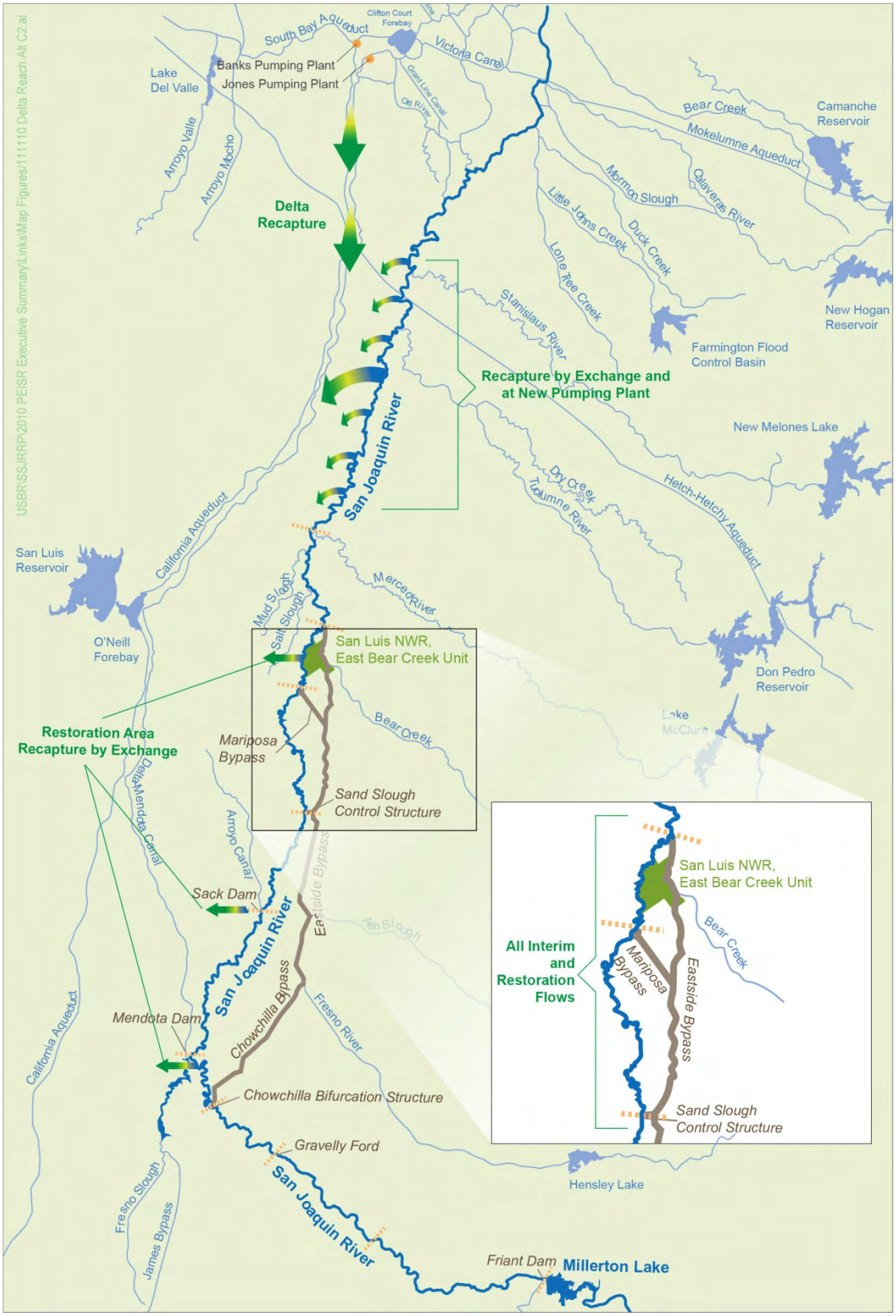


Figure 2-13.
Flow Routing and Water Recapture Under Alternative C2

2.10 Alternatives Considered and Eliminated from Further Consideration

Formulation of a range of program alternatives for evaluation in this Draft PEIS/R began with a review of Settlement provisions for achieving the Restoration and Water Management goals. This was followed by identifying the purpose, need, and objectives; developing criteria for including actions in the program alternatives; defining planning and implementation constraints; and identifying related projects and opportunities associated with achieving the purpose and need. These steps were applied to actions, identified in Settlement provisions and in comments received during the public scoping process, to identify a range of alternatives to be addressed. The IPAR identified a reasonable range of alternatives and eliminated some potential actions, as previously described.

Several sources of information were used in formulating program alternatives for evaluation in this Draft PEIS/R. These included the Settlement, previous and ongoing studies that address possible Restoration and Water Management strategies or actions, input from Settling Parties and other stakeholders, and input received from the public through the NEPA and CEQA scoping processes. Following the release of the NOP and NOI, Reclamation and DWR held a series of formal public scoping meetings throughout the study area during the specified scoping period. Reclamation and DWR also held a series of informal meetings during development of alternatives to receive input from a range of interested parties.

The Implementing Agencies received numerous suggestions for potential actions to achieve the goals of the Settlement. Each suggestion was reviewed for inclusion in program alternatives relative to the planning considerations, including NEPA and CEQA requirements, the project purpose and objectives, and the need for action, as described in Chapter 1.0, "Introduction," as well as associated opportunities and planning constraints described in Appendix G, "Plan Formulation." Some actions suggested during the scoping process and considered by the SJRRP were not retained for inclusion in the program alternatives because they would not meet the purpose, need, and objectives of the Settlement, including the following:

- **Release Restoration Flows of a different timing and magnitude than those presented in Exhibit B of the Settlement –** The Settlement specifies the timing and magnitude of Restoration Flows, and provides flexibility in the flow schedules through provisions that include flexible flow periods and buffer flows. Consistent with Exhibit B of the Settlement, alternative methods for allocating flow and alternative methods for transforming allocated flows between flow schedules for the six year types were considered, as presented in Appendix G, "Plan Formulation." However, implementing alternatives to the flow schedules, beyond the alternative allocation and transformation methods, would be inconsistent with the Settlement. This action was not retained because it would prevent achieving the SJRRP purpose.

- **Utilize the Chowchilla Bypass to Route Interim Flows and/or Restoration Flows on a Permanent Basis –** Routing of Interim and/or Restoration flows through the Chowchilla Bypass instead of through the San Joaquin River on a permanent basis would not be consistent with the Restoration Goal, which is to "restore and maintain fish populations in good condition in the main stem of the San Joaquin River." This action was not retained because it would prevent achieving the SJRRP purpose and need, consistent with the Settlement.

- **Restore other rivers in California that are currently undergoing restoration –** Restoration of other river systems in the State would not meet the SJRRP purpose. The Restoration Goal calls for restoring the San Joaquin River, not other rivers. This action was not retained because it does not substantially contribute to the SJRRP purpose.

- **Consider population growth, and demands on water supply in the San Joaquin Valley and throughout California –** The Settlement specifies the amount of water to be used for restoration, and impacts on water users are considered in the program alternatives analyses presented in Chapters 4.0 through 26.0. Implementing a policy to limit population growth in California does not contribute to the SJRRP purpose. This action was not retained because it does not substantially contribute to the SJRRP purpose.

- **Encourage the Central Valley Regional Water Quality Control Board to develop salinity standards/restrictions to cap salt loading to the San Joaquin River –** While this could benefit the SJRRP goals, it would require a broad program with many entities and many years to complete, does not directly contribute to the Restoration or Water Management goals, and is not necessary for achieving the SJRRP purpose. This action was not retained because it does not substantially contribute to the SJRRP purpose.

- **Remove trash and debris from the river –** The SJRRP would consider removing debris that may adversely affect Restoration actions. However, while removing trash/debris from the river may help restoration efforts, it would exceed the needs of the Implementing Agencies for implementing the Settlement. This action was not retained because it does not substantially contribute to the SJRRP purpose.

- **Design and create a conservation zone from the river parkway to the San Francisco Bay Area –** The SJRRP could fit into a conservation zone if one were formed, but this would require efforts beyond those required for restoration of the 150-mile reach of the San Joaquin River. This action was not retained because it does not substantially contribute to the SJRRP purpose.

- **Raise Friant Dam to store more water for dry year supply and provide flood control –** Because of the long lead time for permitting, design, and construction of this type of project, it would not satisfy the implementation timing necessary if used for Restoration Flows. Also, development of additional storage at or

upstream from Friant Dam is currently being studied under separate authorization. This action was not retained because it does not substantially contribute to the SJRRP purpose.

- **Require the Central Valley Flood Protection Board to ensure the integrity of the flood management system through a permitting process before any activity affecting the system is undertaken –** Potential impacts of implementing program alternatives on the flood control system, and appropriate mitigation measures, are presented in Chapter 11.0, "Hydrology – Flood Management." The Central Valley Flood Protection Board (CVFPB) is responsible for reviewing and approving proposed projects that could affect the integrity of flood management systems. Incorporating this activity into the program alternatives would be redundant to existing processes. This action was not retained because it does not substantially contribute to the SJRRP purpose.

2.11 Settlement Implementation

Implementation of the Settlement began in October 2006, with Court approval of the Settlement and subsequent formation of the SJRRP. Implementation of physical actions to implement the Settlement began in 2009, with the installation of stream flow gages and monitoring wells, the release and recapture of Interim Flows and establishment of the RWA in October 2009. All actions of the Settlement are addressed in this Draft PEIS/R. Site-specific documentation was completed as necessary for actions completed or currently underway, and would be completed, as necessary, for actions described at a program level of detail in this Draft PEIS/R. Site-specific NEPA and CEQA environmental documentation was prepared for actions necessary to meet the Settlement schedule for release of Interim Flows. These actions, which are included in the action alternatives, include installing and rehabilitating stream gages, installing monitoring wells, and releasing and conveying Water Year 2010 and 2011 Interim Flows, as shown in Table 2-8.

Table 2-8.
Site-Specific NEPA/CEQA Environmental Compliance Documentation for Settlement Actions Completed or in Progress

Action	Description	NEPA/CEQA Environmental Compliance Document(s)[1]	Lead Agency/ Agencies
Install water level recorders	Install up to seven water level recorders in the San Joaquin River in Fresno and Madera counties to provide data related to hydrograph translation characteristics.	San Joaquin River Restoration Program Water Level Recorder Installation and Data Collection NOE. February 2009.	DWR (CEQA)
Install scour chains	Install scour chains in the San Joaquin River at locations in Fresno and Madera counties to provide data on sediment transport.	San Joaquin River Restoration Program Scour Chain Installation and Data Collection NOE. February 2009.	DWR (CEQA)

Table 2-8.
Site-Specific NEPA/CEQA Environmental Compliance Documentation for Settlement Actions Completed or in Progress (contd.)

Action	Description	NEPA/CEQA Environmental Compliance Document(s)[1]	Lead Agency/ Agencies
Install and rehabilitate stream gages	Rehabilitate and retrofit the existing stream gage stations at the Chowchilla Bypass Bifurcation Structure and below Sack Dam on the San Joaquin River, and install two new monitoring stations at the top of Reach 4B and one at the confluence of the Merced and San Joaquin rivers.	Installation and Rehabilitation of Stream Gages on the San Joaquin River, Fresno, Madera, and Merced Counties, California EA/FONSI. December 2008. Stream Gage Installation and Operation and Maintenance Project IS/MND. March 2009.	Reclamation (NEPA) and DWR (CEQA)
Sample streambed sediment	Sample bed material at 20 locations to establish baseline data before release of Water Year 2010 Interim Flows.	San Joaquin River Restoration Program Stream Bed and Sand Sampling NOE. April 2009.	DWR (CEQA)
Seal gates of Chowchilla Bypass Bifurcation Structure	Install seals on the gates of the Chowchilla Bypass Bifurcation Structure to reduce or prevent flow from entering the sediment catchment basin downstream from the gates.	Chowchilla Bifurcation Structure Gate Seal Installation NOE. August 2009.	DWR (CEQA)
Release Water Year 2010 Interim Flows	Implement provisions of the Settlement related to Water Year 2010 Interim Flows and to collect relevant data to guide future releases of Interim and Restoration flows.	Water Year 2010 Interim Flows Project EA/FONSI and IS/MND. September 2009.	Reclamation (NEPA) and DWR (CEQA)
Gather geotechnical data and install monitoring wells	Install groundwater monitoring wells adjacent to the San Joaquin River and collect geotechnical data through exploration holes at existing and potential new levees, control structures, river crossing structures, and test pits to identify possible borrow material.	Draft San Joaquin River Restoration Program Geotechnical Investigation and Seepage Well Installation Project IS/MND. October 2009.	DWR (CEQA)
Release Water Year 2011 Interim Flows	Implement provisions of the Settlement related to Water Year 2011 Interim Flows and collect relevant data to guide future releases of Interim and Restoration flows.	Water Year 2011 Interim Flows Project Supplemental EA/FONSI. September 2010.	Reclamation (NEPA)

Note:
[1] Authors of these documents are the lead agency/agencies listed for the relevant action.

Key:
CEQA = California Environmental Quality Act
DWR = California Department of Water Resources
EA/FONSI = Environmental Assessment/Finding of No Significant Impact
IS/MND = Initial Study/Mitigated Negative Declaration
NEPA = National Environmental Policy Act
NOE = Notice of Exemption
Reclamation = U.S. Department of the Interior, Bureau of Reclamation

As referenced throughout this "Description of Alternatives" chapter, the RA has an integral role in implementing the Settlement. The RA's duties are defined in the Settlement, and include making recommendations to the Secretary on the release of Interim and Restoration flows. The RA is also responsible for consulting with the Secretary on implementing Paragraph 11 actions, and for identifying and recommending additional actions under Paragraph 12, as described previously. In addition, the RA is responsible for consulting with the Secretary on the reintroduction of Chinook salmon under Paragraph 14. The RA's recommendations would be taken into consideration by the Secretary in making decisions or specific actions to be implemented under the Settlement.

Before the release of Interim and Restoration flows, several actions would be completed by Reclamation, including estimating channel capacity restrictions throughout the Restoration Area, and estimating water supply demands at the Mendota Pool and/or the East Bear Creek Unit, if those points are to be used for recapturing Interim or Restoration flows. Reclamation would verify the Interim or Restoration flow schedule provided by the RA for consistency with the Settlement, system capacity and water supply demand estimates, and applicable environmental compliance documents and approvals. Reclamation would then allocate water supply for Interim or Restoration flows based on the RA's schedule and on hydrologic conditions (i.e., water year type).

Before and during release of Interim or Restoration flows, Reclamation would implement the components of the plans, mitigation measures, and permit and approval conditions, as described throughout this Draft PEIS/R and in any permits or approvals issued for implementing the Settlement. In coordination with State and local agencies, Reclamation would monitor and manage the response of the system during release of Interim and Restoration flows, and reduce or redirect flows, as necessary and as previously described, to avoid and minimize impacts.

2.11.1 Strategies for Implementation

This section describes several strategies that would be employed throughout implementation of the Settlement, including the following:

- Grouping of site-specific projects
- Estimating then-existing channel capacities for implementing Interim and Restoration flows in response to monitoring results and project implementation
- Updating operating guidelines and obtaining biological clearance and other agreements

Grouping Site-Specific Projects

This "Description of Alternatives" chapter identifies several channel and facility modifications that would be implemented to increase channel capacity and improve fish passage in the Restoration Area. Because some of these projects have hydraulic and other physical interdependencies, implementation would be accomplished by combining related projects into groups. Project planning, environmental compliance, permitting, design, and construction would be coordinated for projects in each group.

Estimating Then-Existing Channel Capacities for Implementing Interim and Restoration Flows

Release of Interim and Restoration flows would occur over time and would be constrained by channel capacity, among other factors. As channel capacity limitations and other factors are addressed, the SJRRP would implement additional actions (such as Paragraph 11(b) and Paragraph 12 actions) and/or increase Interim and Restoration flows up to the amounts specified in the Settlement. Throughout implementation of the Settlement Reclamation, through coordination with the Channel Capacity Advisory Group as previously described, would estimate then-existing channel capacities in the Restoration Area. Reclamation would provide estimates of then-existing channel capacities to the RA, to allow the RA to incorporate those estimates in the RA's recommendations for Interim and Restoration flow schedules.

The SJRRP is being implemented concurrently with other programs that other agencies are considering to modify the San Joaquin River and the Lower San Joaquin River Flood Control Project to address flood protection needs. In particular, DWR is characterizing the condition of levees along the San Joaquin River and the bypasses in the Restoration Area through the Initial findings from these evaluations indicate deficiencies in flood conveyance capacity at several locations in the Restoration Area that were not identified for channel improvements in the Settlement. Channel improvements to address these deficiencies in flood protection have not yet been identified and evaluated, and are not included in the Settlement (and therefore are not part of the action alternatives).

Potential channel improvements to increase channel capacity for reaches not specified in the Settlement may be implemented by parties other than Reclamation to improve levee integrity for conveyance of flood flows irrespective of Settlement implementation. Such modifications could include levee setbacks; cutoff/slurry walls; levee strengthening, widening, and raising; and channel dredging or other techniques to increase channel capacity. These types of future projects would provide flood control benefits and would be expected to have independent utility outside of the implementation of the Settlement as DWR evaluates levee conditions along the San Joaquin River and the bypasses in the Restoration Area through the Non-Urban Levee Evaluation Project as part of the California FloodSAFE initiative. Because these potential future levee and channel modifications are not specified in the Settlement, they are not part of the SJRRP and are not included as part of the alternatives evaluated in the PEIS/R. Specific future modifications to the flood control system under the FloodSAFE initiative are uncertain and speculative, and are not considered reasonably foreseeable or probable future actions at this time. Reclamation and DWR recognize the importance of coordination and communication in planning and implementing projects that affect the flood control system in order to prevent impacts to flood management. Therefore, the potential for cumulative effects associated with implementation of the Settlement and FloodSAFE programs and projects is presented in Chapter 26.0, "Cumulative Impacts."

Updating Operating Guidelines, Agreements, and Approvals

The LSJLD operates and maintains the flood management system and is financially supported through landowner assessments. The change in operations at Friant Dam and the routing of Interim and Restoration flows could result in increased operations and maintenance activities, including increased flap gate inspection and debris removal, operation of flow control structures, levee patrols, vegetation control, and sand excavation (these actions are as described under Alternative A1, "Physical Monitoring and Management Plan"). Reclamation is currently working with LSJLD to develop a financial assistance agreement to offset costs associated with conducting increased operation and maintenance activities as a result of implementing the Settlement.

The change in operations at Friant Dam and the routing of Interim and Restoration flows also would likely result in the need for revisions to existing guidelines for the operation of flood management and water diversion facilities, including guidelines for splitting Interim and Restoration flows at bifurcation structures. In addition, a revised plan of flood control may be required that incorporates these guidelines and changes in operations. Reclamation may make recommendations for these revisions. Subsequent site-specific studies and structural modifications associated with program-level actions would likely result in recommendations for additional revisions to the guidelines at the time those studies are completed. However, LSJLD would continue to operate the flood management system and, in coordination with CVFPB, would be responsible for development of the necessary agreements and revisions.

Before Interim and Restoration flows can be increased based on the estimate of then-existing capacities, the Implementing Agencies would obtain any additional necessary regulatory compliance for biological resources, as described in this Draft PEIS/R. In some reaches of the river and bypass system, field surveys would be required to determine if listed species are present. Biological resources surveys would be designed and scheduled to provide information relevant to contemplated changes in flow during the time frame that survey results would be valid. Survey results would be used to determine maximum flows that could be conveyed based on biological conditions. Until appropriate conservation measures can be implemented, flows would be limited to levels that would not adversely affect listed species.