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July 2020

FERC/EIS-0293F

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSES

Don Pedro Hydroelectric Project
Project No. 2299-082—California

La Grange Hydroelectric Project
Project No. 14581-002—California

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE, Washington, D.C. 20426

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FEDERAL ENERGY REGULATORY COMMISSION

WASHINGTON, D.C. 20426

OFFICE OF ENERGY PROJECTS

To the Agency or Individual Addressed:

Reference: Final Environmental Impact Statement

Attached is the final environmental impact statement (EIS) for the Don Pedro Hydroelectric Project (No. 2299-082) and the La Grange Hydroelectric Project (No. 14581-002). The Don Pedro Project is located on the Tuolumne River in Tuolumne County, California. It occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). The La Grange Project is located on the Tuolumne River in Stanislaus and Tuolumne Counties, California. It occupies 14 acres of federal land administered by BLM. BLM administers the federal lands occupied by these projects under the Sierra Resource Management Plan.

This final EIS documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicants, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicants' proposals and alternatives for relicensing the Don Pedro Project and for issuing an original license for the La Grange Project.

Before the Commission makes a licensing decision, it will take into account all concerns relevant to the public interest. The final EIS will be part of the record from which the Commission will make its decision. The final EIS was sent to the U.S. Environmental Protection Agency and made available to the public on or about July 7, 2020.

Copies of the final EIS are available for review in the Commission's Public Reference Branch, Room 2A, located at 888 First Street, N.E., Washington, D.C. 20426. The final EIS also may be viewed on the Internet at at elibrary.ferc.gov/idmws/search/fercgensearch.asp. Please call (202) 502-8222 for assistance.

Attachment: Final Environmental Impact Statement

COVER SHEET

a. Title:	Relicensing the Don Pedro Hydroelectric Project, FERC Project No. 2299-082, and issuing an original license for the La Grange Hydroelectric Project, FERC Project No. 14581-002
b. Subject:	Final Environmental Impact Statement
c. Lead Agency:	Federal Energy Regulatory Commission
d. Abstract:	The Don Pedro Project is located on the Tuolumne River in Tuolumne County, California. It occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). The La Grange Project is located on the Tuolumne River immediately downstream of the Don Pedro Project in Stanislaus and Tuolumne Counties, California. It occupies 14 acres of federal land administered by BLM. BLM administers the federal lands occupied by these projects under the Sierra Resource Management Plan. Turlock Irrigation District and Modesto Irrigation District, collectively, Districts or applicants, filed an application for a new major license with the Federal Energy Regulatory Commission (Commission) to continue to operate and maintain the 168-megawatt (MW) Don Pedro Hydroelectric Project. In addition to providing for hydroelectric power generation, Don Pedro Reservoir provides water supply for the irrigation of more than 200,000 acres of Central Valley farmland and municipal and industrial uses, flood control benefits along the Tuolumne and San Joaquin Rivers, and a water-banking arrangement for the benefit of the City and County of San Francisco. The Districts filed an application for an original license with the Commission to continue to operate and maintain the 4.7-MW La Grange Hydroelectric Project. This existing, unlicensed project was determined to require licensing in an order issued by the Commission on December 19, 2012. The order found that the project is located on a navigable river and occupies federal lands. The staff's recommendation is to license the projects as proposed by the Districts with some staff modifications and additional measures.

e.	Contact:	James Hastreiter Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, D.C. 20426 (503) 552-2760
f.	Transmittal:	This final environmental impact statement to relicense the Don Pedro Hydroelectric Project and to issue an original license for the La Grange Hydroelectric Project is being made available for public comment on or about July 7, 2020, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 CFR, Part 380).

[1] National Environmental Policy Act of 1969, amended (Pub. L. 91-190, 42 U.S.C. 4321–4347, January 1, 1970, as amended by Pub. L. 94-52, July 3, 1975, Pub. L. 94-83, August 9, 1975, and Pub. L. 97-258, § 4(b), September 13, 1982).

FOREWORD

The Federal Energy Regulatory Commission (Commission), pursuant to the Federal Power Act (FPA)[2] and the U.S. Department of Energy Organization Act[3] is authorized to issue licenses for up to 50 years for the construction and operation of non-federal hydroelectric developments subject to its jurisdiction, on the necessary conditions:

That the project adopted . . . shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use or benefit of interstate or foreign commerce, for the improvement and utilization of water-power development, for the adequate protection, mitigation, and enhancement of fish and wildlife (including related spawning grounds and habitat), and for other beneficial public uses, including irrigation, flood control, water supply, and recreational and other purposes referred to in section 4(e) . . . . [4]

The Commission may require such other conditions not inconsistent with the FPA as may be found necessary to provide for the various public interests to be served by the project.[5] Compliance with such conditions during the licensing period is required. The Commission's Rules of Practice and Procedure allow any person objecting to a licensee's compliance or noncompliance with such conditions to file a complaint noting the basis for such objection for the Commission's consideration.[6]

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[2] 16 U.S.C. § 791(a)-825r, as amended by the Electric Consumers Protection Act of 1986, Pub. L. 99-495 (1986), the Energy Policy Act of 1992, Pub. L. 102-486 (1992), and the Energy Policy Act of 2005, Pub. L. 109-58 (2005).

[3] Public Law 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a).

[5] 16 U.S.C. § 803(g).

[6] 18 CFR § 385.206 (2018).

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ACRONYMS AND ABBREVIATIONS

7DADM	7-day average daily maximum
ACEC	Area of Critical Environmental Concern
Advisory Council	Advisory Council on Historic Preservation
AIRs	additional information requests
AMP	adaptive management plan
APE	area of potential effects
BA	Biological Assessment
base case	model scenario for environmental baseline (no action)
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin Basins
BAWSCA	Bay Area Water Supply and Conservation Agency
Bay-Delta Plan	Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary
BCDC	San Francisco Bay Conservation and Development Commission
BLM	U.S. Department of the Interior, Bureau of Land Management
BMI	benthic macroinvertebrates
BMPs	best management practices
B.P.	Before Present
ºC	degrees Celsius
California DFA	California Department of Food and Agriculture
California DFW	California Department of Fish and Wildlife
California DWR	California Department of Water Resources
California SHPO	California State Historic Preservation Officer
CCSF	City and County of San Francisco
certification	water quality certification
CESA	California Endangered Species Act
CFR	Code of Federal Regulation
cfs	cubic feet per second
CGREA10%	model scenario for Conservation Groups' recommended project operations
CHTR	collection, handling, transport, and release
cm	centimeter
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Commission	Federal Energy Regulatory Commission
Conservation Groups	California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater,

	Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, Central Sierra Environmental Resource Center and Tuolumne River Conservancy
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
Delta	Sacramento-San Joaquin River Delta
DFWREA	model scenario for California Department of Fish and Wildlife's recommended project operations
Districts	Turlock Irrigation District and Modesto Irrigation District
DO	dissolved oxygen
DPP-1r	model scenario for the Districts' preferred proposed project operations
DPP-1r-NoIG	model scenario for the Districts' proposed project operations with interim minimum instream flows
DPRA	Don Pedro Recreation Agency
DPS	Distinct Population Segment
ECHOREA-NoIG	model scenario for ECHO: The Wilderness Company's recommended project operations
E. coli	*Escherichia coli*
EFH	Essential Fish Habitat
EIS	environmental impact statement
ELJ	engineered log jam
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
ºF	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FR	*Federal Register*
FWS	U.S. Department of the Interior, Fish and Wildlife Service
FWSREA	model scenario for U.S. Department of the Interior, Fish and Wildlife Service's recommended project operations
GIS	geographic information system
GDP	gross domestic product
Hetch Hetchy System	Hetch Hetchy Water and Power System
HHLSM	water system operations model for the San Francisco Public Utilities Commission
HPMP	Historic Properties Management Plan

LTRHIP	Lower Tuolumne River Habitat Improvement Program
LWM	large woody material (also referred to as large woody debris)
mgd	million gallons per day
mg/L	milligrams per liter
MID	Modesto Irrigation District
mm	millimeter
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NHPA	National Historic Preservation Act of 1966
NMFS	National Marine Fisheries Service
NMFSREA	model scenario for ECHO: The Wilderness Company's recommended project operations
NTU	nephelometric turbidity unit
PA	Programmatic Agreement
Park Service	National Park Service
PER	predation event recorder
PHABSIM	physical habitat simulation model
REA	ready for environmental analysis
RM	river mile
RRMP	Recreation Resource Management Plan
RST	rotary screw trap
RWS	Regional Water System
SD1	Scoping Document 1
SD2	Scoping Document 2
1995 Settlement Agreement	Settlement Agreement between the Districts and California DFW, FWS, CCSF; and four NGOs that provided for minimum flow releases from the Don Pedro Project to the lower Tuolumne River to improve conditions for fall-run Chinook salmon
SFPUC	San Francisco Public Utilities Commission
SHIRA	Spawning Habitat Integrated Rehabilitation Approach
SRP	special run pool
STM Work Group	Stanislaus, Tuolumne and Merced Work Group
SWBREA	model scenario for State Water Resources Control Board's recommended project operations
TAF	thousand acre-feet

TBIREA-NoIG	model scenario for The Bay Institute's recommended project operations
TCP	traditional cultural property
TID	Turlock Irrigation District
TPAC	Tuolumne Partnership Advisory Committee
TREG	Tuolumne River Ecological Group
TRMP	Terrestrial Resources Management Plan
TRTAC	Tuolumne River Technical Advisory Committee
U.S.C.	United States Code
USGS	U.S. Department of the Interior, Geological Survey
draft Voluntary Agreement	Draft voluntary agreement submitted to the Water Board by California DFW and California DWR on March 1, 2019, that would serve as a Tuolumne River-specific alternative to the Water Board's update to the Bay-Delta Plan
VRMS	Visual Resource Management System
Water Board	California State Water Resources Control Board
WNS	white-nose syndrome
WUA	weighted usable area

EXECUTIVE SUMMARY

On April 28, 2014, Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, Districts or applicants) filed an application for a new major license with the Federal Energy Regulatory Commission (Commission or FERC) to continue to operate and maintain the Don Pedro Hydroelectric Project (FERC No. 2299-082). Subsequently, the Districts filed an amended application on October 11, 2017. The 168-megawatt (MW) project is located at river mile (RM) 54.8 on the Tuolumne River in Tuolumne County, California. The Don Pedro Project currently occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). BLM administers the federal lands occupied by the project under the Sierra Resource Management Plan. The project generates an average of about 550,000 megawatt-hours (MWh) of energy annually.

On October 11, 2017, the Districts filed an application for an original license with the Commission to continue to operate and maintain the La Grange Hydroelectric Project (FERC No. 14581-002).[7] The 4.7-MW project is located at RM 52.2 on the Tuolumne River in Stanislaus and Tuolumne Counties, California, immediately downstream of the Don Pedro Project. The proposed project boundary would occupy 14 acres of federal land administered by BLM. The project generates an average of about 18,077 MWh of energy annually.

Project Description and Operation

Don Pedro Project

The Don Pedro Project includes the following existing facilities: (1) a 580-foot-high, 1,900-foot-long, earth and rockfill dam; (2) a reservoir with a gross storage capacity of 2,030,000 acre-feet and a usable storage capacity of 1,721,000 acre-feet; (3) a 30-foot-high, 45-foot-wide, 135-foot-long, gated spillway including three 45-foot-wide by 30-foot-high radial gates; (4) a 995-foot-long, ungated ogee emergency spillway with a crest elevation of 830 feet National Geodetic Vertical Datum of 1929[8]; (5) a set of outlet works that are located at the left abutment of the dam and consist of three individual gate housings in the diversion tunnel, each containing two 4-foot-by-5-foot slide gates; (6) a 3,500-foot-long, concrete-lined diversion tunnel with a total hydraulic capacity of

[7] On December 19, 2012, Commission staff issued an order finding that the existing, unlicensed La Grange Project requires licensing because it is located on a navigable river and occupies federal lands. *Turlock Irrigation Dist. and Modesto Irrigation Dist.*, 141 FERC ¶ 62,211 (2012), *order on reh'g*, 144 FERC 61,051 (2013), *aff'd sub nom., Turlock Irrigation Dist. v. FERC*, 786 F.3d 18 (D.C. Cir. 2015).

[8] All elevation data in this final EIS are given in National Geodetic Vertical Datum of 1929.

7,500 cubic feet per second (cfs); (7) a 2,960-foot-long power tunnel located in the left abutment of the dam that transitions from an 18-foot-diameter, concrete-lined section to a 16-foot-diameter, steel-lined section; (8) a 21-foot-high, 12-foot-wide, emergency closure fixed-wheel gate; (9) a powerhouse located immediately downstream of the dam containing a 72-inch hollow jet valve and four Francis turbine-generator units with a total nameplate capacity of 168,015 kilowatts and a maximum hydraulic capacity of 5,500 cfs; (10) a switchyard located on top of the powerhouse; (11) a 75-foot-high, earth and rockfill dike (Gasburg Creek Dike) with a slide-gate controlled 18-inch-diameter conduit located near the downstream end of the spillway; (12) three small embankment dikes—dike A located between the main dam and spillway and dikes B and C located east of the main dam; (13) recreation facilities on Don Pedro Reservoir, including Fleming Meadows, Blue Oaks, and Moccasin Point; and (14) appurtenant facilities and features including access roads.

In addition to providing hydroelectric power generation, Don Pedro Reservoir provides water supply for the irrigation of more than 200,000 acres of Central Valley farmland and municipal and industrial uses, flood control along the Tuolumne and San Joaquin Rivers, and a water-banking arrangement with the City and County of San Francisco (CCSF), which helps to supply water to over 2 million people in the Bay Area. The Don Pedro Project is hydrologically linked with the CCSF's upstream Hetch Hetchy Water and Power System (Hetch Hetchy System), a series of reservoirs, diversion conduits, and powerhouses located on the upper Tuolumne River.[9]

Flow releases from the project are scheduled based on requirements for: (1) flood flow management, including pre-releases in advance of anticipated high flows in wet years, (2) the Districts' irrigation and municipal and industrial demands, (3) storage of up to 570,000 acre-feet of water to manage flow releases from the Hetch Hetchy System in compliance with agreements with the CCSF, and (4) protection of aquatic resources in the lower Tuolumne River in accordance with the terms of the FERC license. Scheduled flow releases are generally provided through the four turbine-generator units (up to 5,500 cfs) located in the Don Pedro Powerhouse. Flows are delivered to the powerhouse via the power tunnel, which has an inlet centerline elevation of 534.3 feet and connects to a manifold that feeds each unit. A bifurcation in the manifold passes flow to Unit 4 and/or to a hollow jet discharge valve. The valve discharge is limited to 800 cfs when Unit 4 is operating, but the valve can release up to 3,000 cfs when Unit 4 is not operating. Units 1, 2, and 3 discharge to the Tuolumne River directly from the powerhouse. Unit 4

[9] The Hetch Hetchy System is not a part of the licensed project. CCSF owns and operates it to provide hydroelectric power and water supply pursuant to the authority conferred in the Raker Act (38 Stat. 242 (1913)). The Raker Act requires the Hetch Hetchy System to release a specified amount of water to the Districts. Section 29 of the Federal Power Act, 16 U.S.C. § 823 (2018), prohibits the Commission from modifying or repealing any provisions of the Raker Act.

discharges through a 190-foot-long, 13-foot horseshoe-shaped tunnel to the diversion tunnel, which discharges downstream of the powerhouse. An additional 7,500 cfs can be passed through the low-level outlet works tunnel that discharges downstream of the powerhouse. The gated spillway can release up to 172,500 cfs if reservoir water levels approach elevation 830 feet. If the reservoir water elevation exceeds 830 feet, up to 300,000 cfs can pass over the crest of the emergency ungated spillway (based on maximum elevation 850 feet).

When electrical demand is high, flow releases at the project may be increased to generate more electricity, subject to meeting the flow schedule requirements. These flow releases are limited by the small amount of usable storage available in the La Grange Reservoir, which is not sufficient to allow it to re-regulate variations in hourly outflows, and also by the capacity of the TID main canal. Outflows from the Don Pedro Powerhouse may vary by about 1,200 cfs between on-peak and off-peak periods, which can result in daily water fluctuations of about 1.8 inches in Don Pedro Reservoir.

During the winter, inflows are stored for water supply and only limited hydropower generation occurs. The releases during this period consist of releases to satisfy minimum flows to the lower Tuolumne River, to provide water to fill downstream irrigation storage reservoirs, or to manage flood storage.

La Grange Project

The La Grange Project includes the following existing facilities: (1) a 310-foot-long, 131-foot-high, masonry arch diversion dam (La Grange Diversion Dam); (2) a reservoir with a total storage capacity of 400 acre-feet and a usable storage capacity of about 100 acre-feet; (3) the MID canal headworks, the first 400 feet of the MID canal, and the "hillside" discharge gates (two 42-inch-diameter and one 60-by-60-inch) that are part of MID's retired irrigation canal facilities[10] and are currently used to provide flows to the plunge pool downstream of the dam; (4) the TID irrigation intake and tunnel, which provides flow to the penstock intake structure and to the headworks of the TID upper main canal; (5) a penstock intake structure containing a trashrack and three 7.5-foot-wide by 14-foot-tall concrete intake bays with manually operated gates and two automated 5-foot-high by 4-foot-wide sluice gates that can be used to discharge flow to the river via a sluice channel; (6) two penstocks leading to a powerhouse with two Francis turbine-generator units with a maximum combined generating capacity of 4.7 MW and a maximum combined hydraulic capacity of approximately 580 cfs; (7) a

[10] Because of maintenance and repair issues, MID abandoned the upper portion of its canal on the west side of the dam and constructed a new intake and diversion tunnel about 100 feet upstream of La Grange Diversion Dam. The new intake and diversion tunnel are used divert water into the MID canal for consumptive use, and are not part of the La Grange Project.

700-foot-long excavated tailrace; and (8) a substation. The project's estimated average annual generation was about 18,077 MWh from 1997 through 2016.

The La Grange Project operates run-of-river. Flows released from Don Pedro Reservoir flow into La Grange Reservoir and are diverted into the TID and MID intakes and tunnels or pass over the spillway. Part of the flow that passes into the TID tunnel intake is diverted at the forebay through the penstock intake structure to the penstocks leading to the powerhouse, which has an operating range of 100 to 580 cfs. The sluice gates in the penstock structure can also be used to release flow into the tailrace. The rest of the flow to the forebay passes through the TID main canal intake structure at the forebay and flows into the canal. The Districts normally release a flow of approximately 5 to 10 cfs about 400 feet downstream of La Grange Diversion Dam via gates at the end of the retired MID intake canal. This release is made to support favorable water quality for resident and migratory fish species and to maintain a stable flow regime for fish present in the plunge pool.

Existing Environmental Measures

In 1995, the Districts entered into a settlement agreement (1995 Settlement Agreement) with the California Department of Fish and Wildlife (California DFW); the U.S. Department of the Interior, Fish and Wildlife Service (FWS); CCSF; and four non-governmental organizations that provided for increased minimum flow releases from the Don Pedro Project to the lower Tuolumne River to improve conditions for fall-run Chinook salmon. The Commission issued an order on July 31, 1996, amending the Don Pedro license to incorporate the lower Tuolumne River minimum flow provisions contained in the 1995 Settlement Agreement.[11] The summertime minimum flows range from 50 to 250 cfs, a substantial increase over the prior summertime minimum flow of 3 cfs; fall through winter minimum flows vary from 150 to 300 cfs, depending on water year type. To account for varying inflow, the 1995 Settlement Agreement established 10 water year type classifications: (1) critical and below; (2) median critical; (3) intermediate critical-dry; (4) median dry; (5) intermediate dry below normal; (6) median below normal; (7) intermediate below normal-above normal; (8) median above normal; (9) intermediate above normal-wet; and (10) median wet/maximum. The water year classifications are determined using the California State Water Resources Control Board's San Joaquin Basin 60-20-20 Water Supply Index and the California Department of Water Resources April 1 San Joaquin Valley unimpaired runoff forecast. The 1995 Settlement Agreement and license amendment also provide for the annual release of pulse flows to stimulate the upstream migration of adult salmon in the fall and in the spring to facilitate the outmigration of juvenile salmon, the volume of which also varies with water year type.

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[11] *Turlock Irrigation Dist. and Modesto Irrigation Dist.*, 76 FERC ¶ 61,117 (1996).

In accordance with the 1995 Settlement Agreement, the Districts also monitor the fall-run Chinook salmon population in the lower Tuolumne River and file annual reports summarizing the results of their monitoring activities. The agreement will remain in effect until the expiration of the current license for the Don Pedro Project.

Proposed Facility Modifications

Don Pedro Project

The Districts propose to install and operate two in-river infiltration galleries at approximately RM 25.9[12] on the lower Tuolumne River, one of which has been partially constructed. The infiltration galleries would be used to withdraw some of the water required to meet municipal and industrial needs and reduce the amount of water withdrawn at the La Grange Diversion Dam, which would result in additional flow in the 26-mile-long reach between the La Grange Powerhouse and the infiltration galleries, for the benefit of in-river fisheries habitat.

The Districts also propose to upgrade the turbines and generators for units 1, 2, and 3. The existing authorized capacity of the project is 168,015 kilowatts (kW) and the proposal would increase the authorized capacity to 220,000 kW. The upgrades would increase the total maximum hydraulic capacity of the project from 5,530 cfs to 6,100 cfs. The upgrades would increase the average annual generation by about 20,000 megawatt-hours (MWh).

La Grange Project

The Districts do not propose to construct any new project facilities at the La Grange Project other than those proposed as environmental measures, described below.

Proposed Project Boundary

Don Pedro Project

The existing project boundary for the Don Pedro Project encloses all the project facilities described above. The Districts propose to expand the existing project boundary to include a proposed fish counting/barrier weir to be located at RM 25.5 and the infiltration galleries within noncontiguous portions of the Don Pedro Project boundary.

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[12] Various locations are given for the infiltration galleries in Exhibit E and subsequent filings provided by the Districts (responses to additional information requests and reply comments), ranging from RM 25 to RM 26. Throughout this EIS, we use RM 25.9 based on the location shown in figure 5.5-1, located on page 5-15 of the amended final license application for the Don Pedro Project.

La Grange Project

The proposed project boundary for the La Grange Project would enclose the dam, a portion of MID's retired canal, spillway pool, TID's diversion tunnel, forebay, penstock, powerhouse, substation, and tailrace, and the La Grange Reservoir up to elevation 300 feet.

Proposed Project Operation

Don Pedro Project

Other than the flow-related measures to enhance aquatic and recreational resources and the lower minimum reservoir elevation during extended drought conditions, which are described below, the Districts propose to operate the Don Pedro Project consistent with existing operation. Except in years with high flows, the infiltration galleries would operate from June 1 through October 15. To improve boating, the infiltration galleries would be turned off during certain summer weekends and holidays. The infiltration galleries would have a combined capacity of 200 to 225 cfs.

La Grange Project

Other than the minimum flow release of 5 to 10 cfs to the plunge pool downstream of the La Grange Diversion Dam described below, the Districts do not propose to make substantive changes to the operation of the La Grange Project.

Proposed Environmental Measures

The Districts propose the following environmental measures:

Don Pedro Project

- Reduce the minimum reservoir level for Don Pedro Reservoir from elevation 600 to 550 feet to make an extra 150,000 acre-feet of water available to meet water needs during extended drought conditions.
- Implement the Spill Prevention Control and Countermeasure Management Plan (filed as appendix E-3 of the Don Pedro amended final license application).
- Maintain the following minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources and accommodate recreational boating.

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)[a]	RM 25.5	RM 51.7 (La Grange Gage)[a]
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[b]	150
July 1 through October 15	350	150[c]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75[c]	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[a] U.S. Department of the Interior, Geological Survey (USGS) gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] Cease irrigation gallery withdrawals for one pre-scheduled weekend to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

[c] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July, or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

- Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7, with infiltration galleries shut off to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would be provided in wet, above normal, and below normal water years only.[13]
- Provide spring pulse flows in the following amounts to facilitate the outmigration of juvenile fall-run Chinook salmon from the lower Tuolumne River. The timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application.

    - Wet and above normal water years: 150,000 acre-feet
    - Below normal water years: 100,000 acre-feet
    - First dry water year: 75,000 acre-feet
    - Dry water years following a dry or critical water year: [14] 45,000 acre-feet
    - First critical water year: 35,000 acre-feet
    - Critical water year following a dry or critical water year: 11,000 acre-feet

- Develop a spill management plan to maximize the benefits from the release of water that would be spilled or is in excess of other project needs, subject to the constraints of flood control, project safety, and water demands, to benefit fall-run Chinook salmon floodplain rearing, juvenile outmigration or adult upstream migration; in-channel rearing; riparian recruitment; and/or temperature management. The spill management plan would identify the preferred timing of releases, minimum durations, and preferred flow rates.
- Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5[15] to enumerate upstream migrating Chinook

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[13] Flushing flows are proposed to occur only in these water year types, when they would have less effect on the amount of water available for consumptive use than they would in dry or critical water years.

[14] In their April 12, 2019 comments on the draft EIS, the Districts modified their proposal to reduce the flow volume allocated for spring pulse flows from 75,000 acre-feet to 45,000 acre-feet in dry years following a dry or critical water year (Districts, 2019a).

[15] The location of this facility is also stated as RM 25.7 at some places in the Don Pedro amended final license application.

salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat.

- Implement a predator control and suppression plan that includes sponsoring fishing derbies; reward-based angling; public outreach programs in local communities to promote fishing for black bass and striped bass; educational programs on the effects of predation on native salmonid populations; and removal and/or isolation of predatory fish via electrofishing, seining, fyke netting, and other collection methods to control and suppress striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir.
- Conduct a coarse sediment management program in the lower Tuolumne River between RM 39 and RM 52 over a 10-year period, including annual surveys of fall-run Chinook salmon and *O. mykiss*[16] spawning use of new gravel patches for five years following completion of gravel augmentation, and a spawning gravel evaluation in year 12, to improve spawning conditions for fall-run Chinook salmon and *O. mykiss*.
- Provide gravel mobilization flows of 6,000 to 7,000 cfs in the lower Tuolumne River downstream of La Grange Diversion Dam, during years when sufficient spill is projected to occur, to improve salmonid spawning habitat.
- Implement a fall-run Chinook salmon spawning superimposition[17] reduction program that includes the annual installation of a temporary barrier weir downstream of the new La Grange Bridge after November 15 to encourage spawning on less used suitable habitat.
- Conduct a five-year program of experimental gravel cleaning using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology, including monitoring interstitial fines before and after gravel cleaning, to improve the quality of salmonid spawning gravel in the lower Tuolumne River. Gravel cleaning would be conducted at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (RM 50.3) and Peaslee Creek (RM 45.5).
- Develop a plan to implement the Lower Tuolumne River Habitat Improvement Program (LTRHIP) and associated $38 million capital fund and annual funding accounts. The plan would address establishment of the fund account,

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[16] The term *O. mykiss* is used to represent both resident and anadromous life history forms of rainbow trout/steelhead, *Oncorhynchus mykiss*.

[17] Redd superimposition occurs when later arriving female salmonids dig redds on top of existing redds, which can result in mortality to incubating eggs.

management of the funds in the account, administration of the Tuolumne Partnership Advisory Committee (TPAC), guidance for selection of recommended enhancement projects by the committee, and the Districts' obligations with respect to the operation, maintenance, monitoring, and reporting associated with enhancement projects.

- Create the above-noted TPAC to provide recommendations on development and implementation of the spill management plan and the LTRHIP. The committee would consist of the Districts, FWS, and CCSF. Other parties, including National Marine Fisheries Service (NMFS) and California DFW would be encouraged to participate in the committee as full members.
- Implement the Aquatic Invasive Species Management Plan (filed as appendix E-4 of the Don Pedro amended final license application) that includes measures to prevent the introduction and spread of aquatic invasive species.
- Make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years, subject to other requirements and constraints including flood control, water supplies, spill management, project safety, and rapidly changing weather patterns.
- Implement the Terrestrial Resources Management Plan (TRMP) (filed as appendix E-6 of the Don Pedro amended final license application) that includes measures for controlling non-native plant species, protecting special-status species, revegetating disturbed areas, protecting bald eagles from disturbance, excluding bats from project facilities, and reporting incidental observations of western pond turtles.
- Implement the Recreation Resource Management Plan (RRMP) (filed as appendix E-7 of the Don Pedro amended final license application) that includes measures to address existing and future recreation resource needs within the project boundary.
- Construct a new boat launch facility to provide boating access upstream of old Don Pedro Dam when reservoir levels are low.[18]
- Implement the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) that includes measures for the

[18] The final license application does not identify the proposed location; however, we assume the boat launch would be located on the northeast shoreline in the vicinity of the location of old Don Pedro Dam shown in figure 1.1.1-1. Old Don Pedro Dam, which was inundated when the new Don Pedro Dam was constructed, is located 1.6 miles upstream of new Don Pedro Dam.

collection, storage, and disposal of woody material to minimize hazards to boating and other recreational uses in Don Pedro Reservoir.

- Provide a new boat take-out/put-in facility at RM 25.5 at the location of the fish counting/barrier weir.
- Install a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge.
- Annually notify BLM about the location and type of any project road maintenance projects on BLM lands and convene a meeting to confer on project details if requested by BLM.
- Implement the Fire Prevention and Response Management Plan (filed as appendix E-2 of the Don Pedro amended final license application) that includes procedures for fire prevention, reporting, and safe fire practices for project facilities.
- Implement the Historic Properties Management Plan (HPMP) (filed as appendix E-8 of the Don Pedro amended final license application) that includes specific actions and processes to manage historic properties.

La Grange Project

- Conduct dissolved oxygen (DO) monitoring in the La Grange Project forebay, immediately downstream from the powerhouse and at the lower end of the tailrace channel, from September 1 to November 30 each year for the first two years after license issuance. If results indicate that a specific cause for low DO exists, the Districts would develop and file an action plan in year 3 of the license.
- Provide a minimum flow of approximately 5 to 10 cfs from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam at all times to ensure consistent and adequate flow to support aquatic resources.
- Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice channel during powerhouse outages.
- Construct a foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir, including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow and reservoir elevation changes).
- Implement the HPMP filed on July 10, 2018, to manage potential effects on historic properties.

Public Involvement

Before filing their license applications, the Districts conducted pre-filing consultation under the Commission's integrated licensing process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to formal filing of the application with the Commission.

As part of the National Environmental Policy Act scoping process for the Don Pedro Project, Commission staff distributed a scoping document to stakeholders and other interested parties on April 8, 2011. Two scoping meetings were held on May 11, 2011, in Turlock and Modesto, California, and an environmental site review was conducted on May 10, 2011. Based on comments made during the scoping meetings and written comments filed with the Commission, Commission staff issued a revised scoping document on July 25, 2011.

For the La Grange Project, Commission staff distributed a scoping document to stakeholders and other interested parties on May 23, 2014. Two scoping meetings were held on June 18, 2014, in Turlock and Modesto, California, and an environmental site review was conducted on June 19, 2014. Based on comments made during the scoping meetings and written comments filed with the Commission, Commission staff issued a revised scoping document on September 5, 2014.

On November 30, 2017, Commission staff issued a notice that the Districts' applications for a new license for the Don Pedro Project and an original license for the La Grange Project are ready for environmental analysis, and requesting comments, terms and conditions, recommendations, and prescriptions.

The Commission issued a draft environmental impact statement (EIS) on February 11, 2019, and requested that comments be filed by April 12, 2019. The Commission also held two public meetings on March 26, 2019, in Modesto, California to receive oral comments on the draft EIS.

Alternatives Considered

This final EIS analyzes the effects of continued project operation and recommends conditions for any licenses that may be issued for these projects. In addition to the Districts' proposals, the final EIS considers three alternatives for each project: (1) no action, meaning the projects would continue to be operated as they currently are with no changes; (2) the Districts' proposals with staff modifications (staff alternative); and (3) the staff alternative with all mandatory conditions.

Staff Alternative—Don Pedro Project

Under the staff alternative, the project would include many of the Districts' proposed measures with the exception of the following: the early-October annual

flushing flow, the permanent fish counting/barrier weir, the predator control and suppression plan, the fall-run Chinook salmon spawning superimposition reduction program, the establishment of an LTRHIP fund account, the TPAC, the new whitewater boat take-out facility upstream of the Ward's Ferry Bridge, the new boat launch facility to provide boating access upstream of old Don Pedro Dam, and the new boat take-out/put-in facility at the proposed fish counting/barrier weir.

We do not recommend the early-October annual flushing flow because the volume of water proposed (1,000 cfs) is not likely sufficient to achieve the intended purpose of improving spawning gravel quality, and the proposed timing could cause adult Chinook salmon to migrate into the Tuolumne River before water temperatures are suitable. Instead, we recommend that this water be used later in the fall to promote the timely upstream migration of adult fall-run Chinook salmon, with the timing and shaping of the flow release to be determined via annual consultation with the fisheries agencies.

We do not recommend the predator control and suppression plan or the associated fish counting/barrier weir because decisions related to the control of predatory fish, which support recreational fisheries, are fishery management activities under the responsibility of state and federal resource agencies and not the Districts. Implementation of other habitat-related measures included in the staff alternative (i.e., increased base flows, spring pulse flows, gravel augmentation, and habitat enhancement measures under the LTRHIP), however, would decrease the amount of available predator habitat (by providing flows above the most suitable range for predatory species, and increasing the amount of gravel transported into the special run pools), expedite the outmigration of Chinook salmon smolts, and increase the quality and quantity of available salmonid spawning and rearing habitat, including escape cover.

We do not recommend implementing the proposed fall-run Chinook spawning superimposition program because of the potential for injury to adult Chinook salmon from contact with the temporary barrier, which could also result in the "take" of federally listed California Central Valley steelhead (if present), and because other measures recommended by staff, including flows, gravel augmentation and cleaning, and implementation of habitat enhancement measures under the LTRHIP would increase the amount of available spawning habitat and reduce the risk of redd superimposition.

We do not recommend requiring the Districts to create a TPAC to guide implementation of the proposed spill management plan and LTRHIP because the Commission has no authority to require other agencies to participate in such a committee. Instead, we recommend that the Districts consult with appropriate federal, state, and local agencies in preparation of the spill management plan and the LTRHIP. We also do not recommend requiring that the Districts establish an LTRHIP funding account because the Commission is concerned with protecting resources with specific enforceable provisions towards that end rather than requiring a licensee to provide a general funding source to be used at least in part, by entities over which the Commission has no authority and to fund unspecified measures and actions to which the Commission may or may not have control

through a license. Instead, we recommend that the Districts identify and implement specific measures under the LTRHIP in consultation with federal, state, and local agencies and approved by the Commission. As license conditions, implementation of these measures would be the responsibility of the Districts and would be under the jurisdiction of the Commission.

We do not recommend the installation of a whitewater boat take-out facility upstream of Ward's Ferry as a license requirement because the proposed lifting platform does not address safety concerns related to hoisting heavy rafts in a confined area where they could be blown into each other while being hoisted and potentially swing into or fall onto recreationists in the narrow river canyon area below the platform. Instead, we recommend that the existing trails on both sides of the river be improved to facilitate hand-carrying rafts from the river. We also do not recommend construction of a new boat launch at Don Pedro Reservoir upstream of old Don Pedro Dam. The existing boat launches provide adequate boating access to Don Pedro Reservoir unless hydrologic conditions drier than those that occurred during the 42-year period of record occur in the future, which would likely be very infrequent. We also do not recommend that the Districts provide a new boat take-out/put-in to facilitate boat passage past the proposed fish counting/barrier weir, because we do not recommend construction of the weir.

The staff alternative also includes the following recommended modifications of the Districts' proposal and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project-related construction involving ground-disturbing activities authorized by the license that includes: (1) a description of best management practices (BMPs) to reduce the quantity of soil and sediment entering the river during construction; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during ground-disturbing activities and thereafter until soil conditions have stabilized.
- Modify the Districts' proposed coarse sediment management program to: (1) expand the reach where potential gravel augmentation sites would occur to extend downstream to RM 24.5; (2) require 75,000 tons of gravel to be placed at sites between RM 52 and RM 39, and 25,000 tons of gravel to be placed at sites between RM 39 and RM 24.5, for a total not to exceed 100,000 tons over the duration of any license; (3) require filing of an implementation plan for the first group of gravel augmentation sites within one year of license issuance, after review and input from California DFW, NMFS, and FWS; (4) require

filing of a summary report with the Commission in year 12 after license issuance presenting monitoring, mapping, and evaluation of projects conducted in the first 10 years, and based on the results of the monitoring, any recommendations for additional gravel augmentation at the initial sites or new augmentation sites; and (5) if any new gravel augmentation sites are recommended, require filing of a plan for Commission approval for the new gravel augmentation sites identified in the summary report.

Aquatic Resources

- Modify the proposed Spill Prevention Control and Countermeasure Management Plan in consultation with the California State Water Resources Control Board (Water Board), California DFW, FWS, NMFS, and BLM to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of equipment and procedures to be used to ensure containment and cleanup of any spilled hazardous substance; (3) a provision to notify the Water Board, California DFW, FWS, NMFS, and BLM within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.

- Develop a plan to monitor water temperatures at five sites in the lower Tuolumne River, in consultation with California DFW, FWS, NMFS, and the Water Board, to include: (1) real-time monitoring at the La Grange gage and a site near the temporary fish counting weir; (2) periodic monitoring in Don Pedro Reservoir near the dam whenever the reservoir elevation is lower than 700 feet; (3) a provision to make available to these agencies water temperature data from the La Grange gage and temporary fish counting weir in real time and Don Pedro Reservoir temperature according to the schedule defined in the plan; (4) a provision to file annual summary reports of all temperature monitoring conducted in each year; and (5) a provision to file a summary report after five years that includes any recommendations for adjusting future monitoring and any measures recommended to enhance water temperature conditions to benefit Chinook salmon and *O. mykiss* in the lower Tuolumne River.

- Develop a fall pulse flow release plan that would include provisions for: (1) the annual release of 5,950 acre-feet of water downstream of La Grange Diversion Dam to promote the upstream migration of Chinook salmon during favorable instream thermal conditions; (2) annual consultation with the fisheries agencies to determine the timing and magnitude of flow releases;

(3) annual monitoring of upstream passage at the temporary fish counting weir to assist the determination on the timing of the fall pulse flow releases to coincide with the upstream migration; (4) notification of the selected pulse flow release timing and magnitude to the Commission, and (5) a summary report after 10 years of monitoring to evaluate effectiveness and any recommended changes to the fall pulse flow release plan. These flows would be provided in wet, above normal, and below normal water years only.

- Modify the proposed spring pulse flows to include the floodplain rearing pulse flows provided in the draft Voluntary Agreement[19] to be implemented via the proposed spring pulse flow adaptive management plan (AMP)[20] in consultation with California DFW, NMFS, FWS and CCSF. The floodplain pulse flows would be timed to coincide with Chinook salmon springtime rearing, and would provide a flow of 2,750 cfs for 20 days in wet and above normal water years, 18 days in below normal water years, 14 days in dry water years, and 9 days in critical water years. When one or two below normal water years follow a single dry or critical water year, the duration of the floodplain rearing pulse flows would be reduced from 18 days to 14 days. In successive dry or critical water years, no floodplain rearing pulse flows would be provided, and floodplain rearing pulse flows would not resume until an above normal or wet water year occurs. Finally, if three successive below normal water years occur following a wet or above normal water year, the Districts, CCSF and California DFW would confer to determine whether any water is available for a floodplain rearing pulse flow.
- Modify the proposed spill management plan to include a provision for annual consultation with resource agencies to determine the preferred magnitude, duration, and timing of releases made under the plan and specific criteria for evaluating whether project operations during the descending limb of the spring snowmelt runoff period reasonably mimic the natural hydrograph.

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[19] California DFW and California DWR submitted the draft Voluntary Agreement to the Water Board on March 1, 2019. The agreement would serve as a Tuolumne River-specific alternative to the Water Board's update to the Bay-Delta Plan.

[20] The AMP would use estimates of run timing based on counts from the temporary adult counting weir in conjunction with temperature monitoring data to model fish growth and estimate the timing of smoltification, and rotary screw traps would be used to monitor effectiveness. After a period of 7 years, the results of the pulse flow management program would be assessed to determine adjustments in pulse flow triggers and duration, as well as whether other pulse flow management options should be considered.

- Develop a drought management plan to include: (1) a definition of drought conditions based on available data specific to the project (e.g., current and projected storage in Don Pedro Reservoir, watershed snowpack and precipitation conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); (2) identification of license requirements (e.g., required flow-related measures) that may need a temporary variance to meet any critical shortfalls in water available for consumptive uses during drought conditions; and (3) a description of how available cool-water storage and instream temperatures would be incorporated into the proposed operational variances.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in any license issued for the projects.
- Modify the proposed LTRHIP to require incorporating a minimum of 6,535 cubic feet of large woody material into the design of the first group of habitat enhancement projects, anchored in a manner designed to provide the maximum sustained habitat benefit, and to eliminate the associated $38 million capital fund, annual funding accounts, and guidance of the plan by the TPAC.
- Modify the proposed Aquatic Invasive Species Management Plan to include: (1) educating recreational users on ways to reduce the spread of invasive species by providing signage and information pamphlets at designated public access sites and on websites used to provide the public with information on project facilities; (2) continuing the boater self-inspection permit program; (3) identifying project operation or maintenance activities that could result in the introduction, spread, or proliferation of aquatic invasive species, and the measures that would be used to control each species for which there is a risk of spread or introduction; and (4) recording and communicating incidental observations of aquatic invasive species to BLM, FWS, and California DFW.

Terrestrial Resources

- Modify the proposed TRMP to include:
  - Conducting noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants and using manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources.
  - Implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road.

- Implementing BMPs to minimize potential for pesticides[21] to affect non-target species and avoidance and minimization measures where project-related ground disturbance authorized by the license would involve heavy machinery within 300 feet of wetlands and riparian areas.
- Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, and BLM for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.
- Conducting surveys for special-status plants following California DFW protocols on project lands within the Red Hills Area of Critical Environmental Concern (ACEC) every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and where project-related disturbance is reasonably expected to occur.
- Installing interpretive signs about the unique plant communities on project lands within the Red Hills ACEC requesting recreationists to stay on trails.
- Conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c; California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.
- Conducting a bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance; and resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting.

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[21] Pesticide refers to many kinds of chemicals intended to control, destroy, repel, or attract pests, including insecticides, herbicides, and rodenticides. The Districts use herbicides annually for vegetation management and rodenticides occasionally for ground squirrel management. The resource agency recommendations frequently reference "pesticides," which we interpret as meaning both herbicides and rodenticides. For the purposes of this EIS, the use of the term "pesticide" includes both herbicides and/or rodenticides.

- Reporting any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).
- Recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a).
- Describing specific project locations where the Districts' proposed rodent control activities could occur.
- Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols (FWS, 2011; FWS, 2003; and California DFW, 2008) prior to any rodent control or ground disturbance activities that could destroy potential burrows and implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox, burrowing owl, and California tiger salamander during other biological surveys for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.
- Implementing BMPs to protect California tiger salamander from project-related activities, which include conducting project-related ground disturbance or vegetation management within 300 feet of suitable California tiger salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions) and conducting project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15.
- Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander.
- Decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys within

suitable habitat on all lands within 0.25 mile of the shoreline of Don Pedro Reservoir, conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004) to identify areas where limited vegetation management operating periods[22] are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project lands are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

Recreation Resources

- Modify the proposed RRMP to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) a provision to invite BLM and other interested parties to an annual coordination meeting to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) conceptual drawings and descriptions of project recreation facilities that are consistent with the outcome of design review by BLM and would be constructed, reconstructed, or rehabilitated on BLM-managed land; (6) consultation with BLM to design visitor use surveys, to ensure data are collected about topics relevant to visitor use of project facilities on BLM-managed lands; (7) designation of the Fleming Meadows Visitor Center as a project recreational facility and a description of its operation and maintenance;

[22] Limited operating periods include seasonal restrictions on vegetation maintenance or other activities that result in loud noises that would have potential to disturb nesting or winter roosting bald eagles, as described in the National Bald Eagle Management Guidelines (FWS, 2007).

(8) identification of the access designation (i.e., public versus non-public) of adjacent non-project lands on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (9) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (10) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors, provide safe egress from the river for hand-carrying rafts, and reduce erosion and vegetation damage caused by user-created trails; (11) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir; (12) consultation with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day) and making information on the planned boating releases and the minimum flow schedule available to the public; and (13) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of project recreation facilities, including restrooms, that are currently in poor condition or do not meet accessibility guidelines, which includes proposed accessibility upgrades. The schedule should allow adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities.

- Modify the proposed Woody Debris Management Plan to include provisions requiring the Districts to maintain a valid burn plan for any woody material stored and burned on project land that is also BLM-administered land and a description of the coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge. This measure would prevent large concentrations of wood from accumulating and becoming boating hazards and obstructing water surface and shoreline use.

Land Use and Aesthetics

- Modify the Fire Prevention and Response Management Plan to include information on fire history, references, results of fire occurrence analysis, permits, and use and storage of explosives to ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.

- Develop a transportation system management plan to ensure proper annual and long-term maintenance of project roads and trails over the license term.

- Develop a visual resources management plan that addresses effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities.

Cultural Resources

- Implement the HPMP filed on February 14, 2019, except that any disputes regarding cultural resources would be resolved in accordance with the dispute resolution stipulation of the Programmatic Agreement (PA; filed on September 30, 2019) and not the process specified in the HPMP.

Staff Alternative—La Grange Project

Under the staff alternative, the project would include all the Districts' proposed measures, except for constructing a foot trail to the La Grange Reservoir as a license condition for the La Grange Project. Instead, we recommend this measure as a license condition for the Don Pedro Project because: (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway.

The staff alternative also includes the following recommended modifications of the Districts' proposal and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project-related construction involving ground-disturbing activities authorized by the license that includes: (1) a description of BMPs to reduce the quantity of soil and sediment entering the river during construction; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during ground-disturbing activities and thereafter until soil conditions have stabilized.

Water Quality

- Develop a plan in consultation with Water Board, California DFW, FWS, and NMFS to determine and effectively mitigate the La Grange Project's contribution to not meeting the Basin Plan DO objectives in the La Grange Powerhouse tailrace, which would include monitoring of DO and water temperature at 15-minute intervals supplemented with weekly observations of

aquatic vegetation and algae, providing annual reports and a final report after three years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objectives, proposed mitigation to address these low DO concentrations, and plans for monitoring the effectiveness for any measure(s) implemented to address La Grange powerhouse tailrace DO that does not meet Basin Plan objectives.

- Develop a spill prevention control and countermeasure management plan in consultation with the Water Board, California DFW, FWS, NMFS, and BLM to include: (1) a description of how oil, fuels, lubricant products, and other hazardous liquid substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of the equipment and procedures to be used to ensure containment and cleanup of any spilled hazardous substance; (3) a provision to notify the Water Board, California DFW, FWS, NMFS, and BLM within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure similar spills do not occur in the future.

Aquatic Resources

- Maintain a maximum downramping rate of 2 inches per hour as measured at the La Grange gage with exceptions allowed in the case of emergencies and as needed to meet flood control requirements.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in any license issued for the projects.
- Develop an aquatic invasive species management plan to include: (1) a provision to educate recreational users on ways to reduce the spread of aquatic invasive species by providing signage and information pamphlets at designated public access sites and on websites that provide the public with information on project facilities; (2) identification of project operation and maintenance activities that could result in the introduction, spread, or proliferation of aquatic invasive species, and the measures that would be used to control each species for which there is at risk of spread or introduction; (3) a provision to consult with California DFW and BLM if aquatic invasive species are discovered within the project boundary; and (4) a provision to record and communicate incidental observation of aquatic invasive species to BLM, FWS, and California DFW.

Terrestrial Resources

- Develop a TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operation and maintenance activities within the La Grange Project boundary to include:
  - Conducting a noxious weed survey of the La Grange Project in the first year of license issuance and every five years, with noxious weed surveys focusing on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control methods where feasible (instead of pesticides), in areas with sensitive resources.
  - Implementing BMPs to minimize potential for pesticides to affect non-target species and avoidance and minimization measures where project-related ground disturbance authorized by the license would involve heavy machinery within 300 feet of wetlands and riparian areas.
  - Conducting a survey for special-status plants on project lands following California DFW protocols (California DFW, 2018e) at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and preparing a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance.
  - Conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c; California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.
  - Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, and BLM for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.
  - Conducting a bat survey of the La Grange Project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting.

- Reporting any sick or dead bat found at the La Grange Project to California DFW and FWS as soon as possible; following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).
- Recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a).
- Recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project boundary, and developing protective measures.
- Decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.
- Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, in accordance with FWS protocols (FWS, 2011) prior to any ground disturbance activities that could destroy potential burrows; implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox during other biological surveys for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures
- Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander;
- Implementing the following BMPs to protect California tiger salamander during project-related construction in suitable habitat: (1) conduct project-related ground disturbance or vegetation management within 300 feet of suitable salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions); (2) conduct project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15; (3) provide training by a qualified biologist for all contractors, work crews, and on-site personnel; (4) inspect all construction pipe, culverts, or similar structures that are stored at the construction site for one or more overnight periods before the pipe is subsequently moved, buried, or capped, and if

during inspection a salamander is discovered inside a pipe, refrain from moving that section of pipe until the biological monitor follows FWS protocols to safely move the animal; (5) inspect all vehicles and equipment for the presence of salamanders prior to moving, and if a salamander is found, follow FWS relocation protocols; (6) at the end of each work day, cover all excavated, steep-walled holes or trenches with plywood or similar materials or provide one or more escape ramps constructed of wooden planks, inspect such holes or trenches for trapped animals prior to filling, and if at any time a trapped salamander is located, cease all work in the immediate area until the biological monitor follows FWS protocols to safely move the animal; (7) refrain from using monofilament netting for erosion control measures in suitable habitat, and instead, use tightly woven (less than 0.25-inch diameter) biodegradable fiber netting or biodegradable coconut coir matting; and (8) provide a qualified biological monitor to monitor work sites to ensure BMPs are implemented.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys on suitable habitat within 0.25 mile of the project boundary, conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004), to identify areas where limited operating periods[23] are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project lands are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

[23] Limited operating periods include seasonal restrictions on vegetation maintenance or other activities that result in loud noises that would have potential to disturb nesting or winter roosting bald eagles, as described in the National bald eagle management guidelines (FWS, 2007).

Land Use and Aesthetics

- Develop a fire prevention and response management plan to ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.

Cultural Resources

- Implement the HPMP filed on July 10, 2018. However, any disputes regarding cultural resources would be resolved in accordance with the dispute resolution stipulation of the PA (filed on September 30, 2019) and not the process specified in the HPMP.

Staff Alternative with Mandatory Conditions—Don Pedro Project

In this final EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the ready for environmental analysis (REA) notice. We recognize that the Commission is required to include valid section 4(e) and section 401 conditions in any license issued for the project; however, Commission staff must still consider and evaluate each environmental measure pursuant to section 10(a) of the FPA.

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) annually perform employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundary (BLM Don Pedro revised 4(e) condition 2); (2) annually consult with BLM to review lists of special-status plant and wildlife species (BLM Don Pedro revised 4(e) condition 9); (3) develop a Ward's Ferry/Tuolumne River take-out management plan (BLM Don Pedro revised 4(e) condition 13); (4) implement pesticide use restrictions on BLM land (BLM Don Pedro revised 4(e) condition 32); (5) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM Don Pedro revised 4(e) condition 35); (6) provide minimum instream flows to be specified by the Water Board (Water Board preliminary 401 conditions 1 and 2); (7) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (8) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (9) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by the project (Water Board preliminary 401 condition 9).

In any license issued for the project, these mandatory conditions would replace the following environmental measures that we include in the staff alternative: (1) implement the staff-recommended minimum flows, floodplain rearing pulse flows, spring outmigration pulse flows, fall pulse flows, gravel mobilization flows, and boating flows for the duration of any license; (2) develop a water temperature monitoring plan; and (3) improve and maintain shoreline access trails on each side of Ward's Ferry Bridge.

Staff Alternative with Mandatory Conditions—La Grange Project

In this final EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the REA notice. We recognize that the Commission is required to include valid section 4(e) and section 401 conditions in any license issued for the project; however, Commission staff must still consider and evaluate each environmental measure pursuant to section 10(a) of the FPA.

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) provide for annual environmental training of employees and contractors, rather than bi-annual as proposed (BLM La Grange preliminary 4(e) condition 2); (2) annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM in the project area (BLM La Grange preliminary 4(e) condition 6); (3) implement pesticide use restrictions on BLM land (BLM La Grange preliminary 4(e) condition 23); (4) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM La Grange preliminary 4(e) condition 26); (5) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (6) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (7) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the project's operation and maintenance (Water Board preliminary 401 condition 9).

In any license issued for the project, these mandatory conditions would replace the following environmental measure that we include in the staff alternative: develop a plan in consultation with the Water Board, California DFW, FWS, and NMFS to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.

No-Action Alternative

Under the no-action alternative, the Districts would continue to operate the Don Pedro Project and the La Grange Project as they currently do, and no new environmental measures would be implemented.

Environmental Effects of the Staff Alternative

The primary issues associated with licensing the Don Pedro and La Grange Projects are effects of continued project operation on instream flows, water supply, flood storage, sediment transport, water quality, fishery resources and fish passage, terrestrial resources, threatened and endangered species, recreation, land use, cultural resources, and socioeconomics. Below, we briefly discuss the anticipated environmental effects of issuing a new license for the project under the staff alternative.

Don Pedro Project

Geology and Soils

Construction activities proposed for the Don Pedro Project include extending the existing riprap protection on the upstream face of Don Pedro Dam, constructing a fish counting/barrier weir, installing a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge, constructing a new boat launch facility just upstream of old Don Pedro Dam, creating a foot path trail along the river-right shoreline of the La Grange Reservoir, and enhancing existing recreational facilities. Although several of these proposed activities are not included in the staff alternative, any construction activities involving vegetation removal or ground disturbance could lead to erosion, increased turbidity in adjacent waterways, and siltation of aquatic habitats. The staff-recommended soil erosion and sediment control plan would include BMPs that should limit any adverse effects of erosion on terrestrial and aquatic habitats.

Under current conditions, river sediment settles in the reservoir behind Don Pedro Dam with the result that there is limited recruitment of coarse sediment downstream of the dam. Implementing the Districts' proposed coarse sediment augmentation program, as modified by staff, would benefit aquatic resources in the Tuolumne River downstream of La Grange Diversion Dam by replenishing fish spawning habitat, increasing the likelihood of riparian woody species establishment, and improving habitat for sensitive amphibians and other wildlife.

Aquatic Resources

Project operation can require the use and storage of hazardous materials and pesticides to maintain project facilities. Such materials could pass into ground and surface water at the project via inadvertent spills. Implementing the proposed Spill Prevention Control and Countermeasure Management Plan, with staff-recommended modifications to include descriptions of spill containment measures and cleanup protocols, would ensure proper storage facilities and cleanup supplies are available and that spill prevention and cleanup protocols are in place, which would help mitigate the risk of a spill that could adversely affect water quality, fisheries, and wildlife.

In drought years, temporary changes in flow or water level requirements may be warranted to meet water supply or environmental concerns. Implementing the

staff-recommended drought management plan would allow any such temporary changes that may be required under drought conditions to be determined in consultation with the appropriate resource agencies and stakeholders. In addition, staff's recommendation to monitor water temperatures in the lower Tuolumne River and in Don Pedro Reservoir when reservoir levels fall below 700 feet, and to identify any actions proposed to enhance water temperature conditions to benefit Chinook salmon and *O. mykiss*, if needed, would address any effects of low reservoir elevations on biota in the lower Tuolumne River.

Implementing the draft Voluntary Agreement minimum flows would protect and enhance aquatic habitat conditions during low-water periods by ensuring suitable habitat for multiple life stages of fish and macroinvertebrates. The staff-recommended fall pulse flow plan with its provision for fall pulse flows in wet, above normal, and below normal water years would help to ensure the timely migration of adult Chinook salmon into the Tuolumne River, and the proposed spring outmigration pulse and floodplain rearing pulse flows would facilitate outmigration of juvenile fall-run Chinook salmon and floodplain rearing. Developing an operation compliance monitoring plan would help to ensure that the project is operated in conformance with the flow and water level requirements included in the license. Implementing the Districts' proposed spill management plan along with the staff-recommended modification for annual consultation with resources agencies to determine the timing of spill events would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing and may also be used to benefit outmigration, in-channel rearing, riparian recruitment, and survival or temperature management.

The Districts' proposed coarse sediment management program, as modified by staff, and the proposed experimental gravel cleaning program and gravel mobilization flows of 6,000 to 7,000 cfs would enhance the gravel supply in the lower Tuolumne River. In addition, the proposed LTRHIP, as modified by staff, would improve floodplain rearing habitat and increase the amount of large woody material (LWM) in the lower Tuolumne River.

Invasive aquatic organisms can reduce habitat quality for native species. Implementing the proposed Aquatic Invasive Species Management Plan, with staff-recommended modifications to include provisions for additional signage and information at the project to educate the public on ways to reduce the spread of invasive species, continuation of boat inspections, implementation of BMPs for controlling invasive species, and temporary prevention of access to certain areas on project land where needed to stop the spread of invasive species, would help to limit the spread and occurrence of invasive species on project lands and waters and to protect habitat for native fish and plants.

Terrestrial Resources

Construction and maintenance of project recreation sites, campgrounds, roads, and trails could affect plants and animals through mortality, injury, or displacement as a result

of habitat removal, modification, or fragmentation. The Districts' proposed Don Pedro TRMP provides for noxious weed management, special-status plant management, valley elderberry longhorn beetle host plant management, and revegetation following ground-disturbing activities. The staff-recommended modification to include pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat would help to minimize these effects.

Changes in flow magnitude due to project operation and maintenance could affect riparian vegetation along the lower Tuolumne River. The Districts propose to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph in the Tuolumne River. This measure would promote seed dispersal and germination of cottonwoods and willows, which provide important ecological structure and function to riparian ecosystems.

Changes in project vegetation management, human disturbance (e.g., recreation), reservoir water level fluctuations, and facility maintenance could alter the composition of vegetation communities by increasing the establishment and spread of noxious weeds. Project operation and maintenance activities could also affect several special-status plants, especially at the project's developed recreational areas, including project areas within the Red Hills ACEC. Over half of the known special-status plant occurrences on Don Pedro Project lands had noxious weeds growing in their proximity. The Districts' proposed Don Pedro TRMP includes: (1) BMPs to prevent the introduction, establishment, and spread of noxious weeds; (2) surveys for noxious weeds every 10 years; and (3) management guidelines for existing and newly established infestations. As proposed, the Districts' surveys would track the extent and limit the spread of noxious weeds at the Don Pedro Project. Staff's recommended modifications to the TRMP would reduce adverse effects by using manual control in areas with sensitive resources, where feasible; focusing the Districts' noxious weed surveys on areas that support occurrences of special-status or threatened and endangered plants; and controlling a giant reed population along the Don Pedro Powerhouse access road. Staff's modifications would further protect special-status plants by providing for: (1) pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat; (2) establishing 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities; and (3) installing interpretive signs about the unique plant communities of the Red Hills ACEC. In addition, rather than the Districts' proposal to survey only known occurrences of special-status plants every fifth year, staff's recommended modification would help prevent project effects on all special-status plant populations by including surveys for special-status plants following California DFW protocols within the Red Hills ACEC every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, roads and trails that are

predominately used for project-related purposes, and where project-related disturbance is reasonably expected to occur.

Human activity near project facilities that provide roosting habitat for special-status bats could disturb these species. The Districts' proposed Don Pedro TRMP provides guidelines for managing bats, including humane exclusion devices at project facilities with routine staff presence. Staff's recommended modifications to the TRMP would minimize adverse effects on special-status bats by: (1) installing and annually inspecting bat exclusion devices at all project facilities with evidence of bat roosting; (2) conducting an updated survey of project facilities for more accurate decisions about where to install bat exclusion devices; and (3) performing surveys every five years of project facilities with potential for bat occurrence, including facilities without installed exclusion devices. To identify and prevent the spread of white-nose syndrome in bats, staff also recommends including reporting any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015) when entering areas with potential bat occurrence.

Project activities that could affect nesting or winter-roosting bald eagles on Don Pedro Reservoir include woody debris management, helicopter use for project inspections, road and recreation area maintenance, and recreational uses (e.g., camping, hiking, boating, and off-highway vehicle use). The Districts' Don Pedro TRMP provides for surveys and protective measures to prevent disturbance during bald eagle mating and rearing. However, a stand-alone bald eagle and special-status bird management plan would better provide for agency consultation and compliance monitoring. Staff recommends including the following additional measures: (1) annual surveys for bald eagle nesting, wintering, and night roosting, in accordance with California DFW and FWS guidelines to identify areas where limited operating periods are needed; (2) establishing 0.25-mile protective buffers on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installing signs on project lands to inform recreationists of temporary project land closures during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project lands are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffer distances on project lands around any active nests of other special-status birds. These additional protective measures would further reduce project effects on bald eagles and other special-status birds. Project operation and maintenance and recreation activities could also disturb other birds of prey that potentially nest and forage at the Don Pedro Project, including the American peregrine falcon, white-tailed kite, osprey, golden eagle, and Swainson's hawk. Staff's recommended modification would provide for collecting incidental observations of all

raptor species at the project, including burrowing owl, while performing other activities at the Don Pedro Project, and consulting with FWS and California DFW to identify suitable protective buffer distances on project lands around any active nests of these special-status birds. This measure would avoid or minimize project effects on these special-status birds.

Vegetation management or other project activities such as construction or maintenance of recreation areas that involve project-related ground disturbance or pesticide use near wetlands or aquatic habitats could result in adverse effects on sensitive amphibians. Staff's recommended modification to the Don Pedro TRMP would provide BMPs to minimize potential for pesticides to affect non-target species and avoidance and minimization measures where project-related ground disturbance authorized by the license would involve heavy machinery within 300 feet of wetlands and riparian areas. Such BMPs could include limiting these activities to times of year when non-target species are less likely to be present, buffers around sensitive habitats, or modified application procedures to minimize risk of unintentional broadcasting of pesticides. These measures would ensure that wetlands and riparian habitats are not negatively affected by project activities.

Water level fluctuations of the Don Pedro Reservoir could affect western pond turtle habitat downstream within the La Grange Project area by affecting water temperatures. Project effects on the species could be avoided or minimized by our staff-recommended measure to include provisions in a La Grange TRMP to include protective measures for western pond turtles, which include recording incidental observations of western pond turtles, evaluating habitat suitability for the species in the La Grange Project area, and consulting with FWS and California DFW to develop protective measures for the species.

The Districts' periodic use of smoke and carbon monoxide to control rodents around developed recreation areas could affect burrowing wildlife, including burrowing owl, a California species of special concern. Staff's modification to the Districts' Don Pedro TRMP would reduce project effects on burrowing owl by providing for incidental observations of burrowing owls, describing specific locations where rodent control activities could occur, conducting surveys of ground squirrel burrows for occupancy by burrowing owls in accordance with California DFW protocols prior to any rodent control or ground disturbance activities that could destroy potential burrows, and implementing avoidance measures for any occupied or potentially occupied burrows.

Threatened and Endangered Species

Proposed construction activities at the Don Pedro Project include extending the existing riprap protection on the upstream face of Don Pedro Dam, constructing a fish counting/barrier weir, installing a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge, constructing a new boat launch facility just upstream of old Don Pedro Dam, creating a foot trail along the river-right shoreline of La Grange

Reservoir, and enhancing existing recreational facilities. Construction and maintenance activities associated with these measures could result in water quality-related impacts on federally listed fish species and their designated critical habitat. The staff-recommended soil erosion and sediment control plan would include measures to limit any adverse effects of erosion on terrestrial and aquatic habitats, and the proposed Spill Prevention Control and Countermeasure Management Plan, with staff-recommended modifications, would minimize the extent of any hazardous material spill and include protocols to prevent adverse effects on federally listed species in the event of a spill.

Although it is uncertain whether any *O. mykiss* in the Tuolumne River are the progeny of anadromous parents (and therefore members of the listed population), measures that improve habitat conditions for *O. mykiss* could benefit the listed population. The draft Voluntary Agreement minimum flow regime (base flows) in the Tuolumne River is expected to improve aquatic habitat and temperature conditions for *O. mykiss* downstream of La Grange Diversion Dam, and our recommended ramping rate restrictions with a provision allowing deviations for flood control and other emergencies would reduce any risk of stranding juvenile *O. mykiss* while allowing the Districts to maintain public safety.

Although designed to increase rearing habitat and the survival rate of fall-run Chinook smolts during outmigration, the proposed spring pulse flows and the draft Voluntary Agreement floodplain rearing pulse flows would reduce water temperatures and extend the beneficial plume of colder water provided by base flows farther downstream relative to that provided by the base flows alone, which would benefit *O. mykiss*.

The Districts' proposed coarse sediment management program, as modified by staff, and proposed experimental gravel cleaning program would maintain the availability of high-quality *O. mykiss* spawning habitat, and placing the gravel following the *O. mykiss* fry rearing period would minimize any risk of smothering *O. mykiss* fry within substrate interstices. Furthermore, the Districts' proposed gravel mobilization flows of 6,000 to 7,000 cfs would likely reduce fine sediment storage in the river channel and in spawning gravels, which could increase *O. mykiss* egg-to-emergence survival and fry production and benthic macroinvertebrate production; increase fine sediment storage on floodplains, which could improve regeneration of native riparian plant species in wetter water years; and increase lateral channel migration, bar formation, and large wood introduction, which together could create new floodplain habitat and complex hydraulic environments for improved adult *O. mykiss* holding, spawning, and juvenile rearing. Although these mobilization flows could cause localized, short-duration pulses in turbidity, no significant adverse effects on *O. mykiss* are anticipated. These flows would be released at a time when seasonal high flows occur (i.e., March–June in wet and above normal water years) and would have effects similar to what would take place on a river with no flow regulation during a minor channel-forming event.

Shaping the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years is expected to provide soil moisture conditions that allow seeds to take up water, germinate, and form roots. Increasing natural recruitment of snowmelt-dependent hardwoods would likely increase the number of stands of trees that could contribute large wood to the channel over the long-term and provide cover and shade for aquatic species, which could have a beneficial cooling effect on water temperature in localized areas. Benefits to the overall ecosystem could translate into benefits for *O. mykiss* occupying the lower river.

Implementing the proposed LTRHIP would improve microhabitats for *O. mykiss* by increasing structural and hydraulic complexity. Habitat enhancement measures to be implemented under the LTRHIP may include LWM augmentation, which would improve spawning habitat for *O. mykiss* as localized scour displaces fines from gravel beds. In addition, LWM augmentation would lead to pool formation, provide protection from predation, and create visual isolation that lowers interspecies competition. The restoration of side channels through the LTRHIP would also create high quality habitat for *O. mykiss.*

Based on the above analysis, the aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to California Central Valley steelhead relative to the environmental baseline. However, it is likely that some individual *O. mykiss* could be injured or killed during the placement of gravel or habitat restoration actions that would be undertaken under the LTRHIP. Although we consider it to be unlikely, we are not able to rule out the possibility that some *O. mykiss* in the Tuolumne River could be the offspring of anadromous steelhead, which are federally listed as threatened. Considering the potential for incidental take of individuals associated with the proposed action,[24] we determine that issuing a new license for the Don Pedro Project as proposed with staff-recommended measures is "likely to adversely affect" the California Central Valley steelhead, and "may affect, but is not likely adversely affect" the designated critical habitat for this species.

The Evolutionarily Significant Unit (ESU) for Central Valley spring-run Chinook salmon and its critical habitat do not include the San Joaquin River or the Tuolumne River, even though attempts to introduce the species into the San Joaquin River and its tributaries were initiated in spring 2014 under the San Joaquin River Restoration Settlement Act. The settlement act specifies that Central Valley spring-run Chinook salmon ESU introduction into the Tuolumne River, if it were to occur, would be as a non-essential experimental population. Therefore, the proposed action would have "no effect" on the Central Valley spring-run Chinook salmon ESU and its critical habitat.

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[24] If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made (FWS and NMFS, 1998).

North American green sturgeon are not known to occur in the Tuolumne or San Joaquin Rivers. Designated critical habitat for the Southern Distinct Population Segment (DPS) of North American green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Sacramento-San Joaquin River Delta (Delta), and San Francisco Estuary. The staff alternative would result in some slight increases in flow within the Delta during certain periods of the year. Considering that the Tuolumne River is part of a much larger San Joaquin River Watershed and that the Sacramento River Watershed also contributes to Delta inflow, the minor increase in flow contributed from the Tuolumne River would have no detectable effects on habitat conditions within portions of the Delta that are occupied by Southern DPS of North American green sturgeon or its designated critical habitat. Therefore, the proposed action would have "no effect" on the Southern DPS of North American green sturgeon and its critical habitat.

Project maintenance, including control of ground squirrels with smoke and carbon monoxide, could affect San Joaquin kit fox and California tiger salamander, both of which use ground-squirrel burrows as sheltering habitat. Use of pesticides during vegetation management near project waters could also affect California tiger salamander. Staff-recommended measures for protocol-level surveys for San Joaquin kit fox and California tiger salamander prior to conducting ground squirrel control activities and implementing avoidance measures for any occupied or potentially occupied burrows, would minimize these potential effects. The staff recommendation would reduce potential effects on California tiger salamander through modification of the Districts' Don Pedro TRMP to no-use pesticide buffer zones of 60 feet from aquatic features and California red-legged frog aquatic breeding habitat, non- breeding aquatic habitat, and upland habitat and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas. Therefore, relicensing the project, as proposed with the staff-recommended measures, "may affect, but is not likely to adversely affect" the San Joaquin kit fox and the California tiger salamander.

Damage to elderberry plants resulting from project construction and maintenance activities could affect valley elderberry longhorn beetles, which use the plants for reproduction. The staff-recommended surveys for elderberry plants and establishing protective buffers prior to activities that result in vegetation disturbance would help protect the valley elderberry longhorn beetle from project-related activities. Staff also recommends modifying the TRMP to apply FWS's *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* for future project activities in order to update the Districts' management based upon the latest understanding of the species' ecology. This includes recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants within 165 feet of project-related ground disturbances activities with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. Therefore, relicensing the project, as proposed with the staff-recommended measures, "may affect, but is not likely to adversely affect" the valley elderberry longhorn beetle.

Adverse effects on Layne's butterweed and Red Hills vervain within the Don Pedro Project could be caused by project-related activities that include recreation on lands within the Red Hills ACEC and the treatment of noxious weeds in their vicinity. Staff-recommended measures for surveying and flagging sensitive plants prior to noxious weed control and using manual control measures rather than herbicides near sensitive plants, would reduce the potential for adverse effects on Layne's butterweed and Red Hills vervain. Staff's recommended measure for installing signage that informs visitors of potential effects of recreation on special-status plants in the Red Hills ACEC would further reduce effects on these species. We conclude relicensing the project, as proposed with the staff-recommended measures, "may affect, but is not likely to adversely affect" the Layne's butterweed and the Red Hills vervain.

Continued project operation, as proposed with staff-recommended measures, would have "no effect" on California red-legged frog because this species is not known to occur at or near the project. Staff's recommended modification to the TRMP would limit effects on suitable aquatic habitat for the species by providing avoidance and minimization measures when project-related ground disturbances involving heavy machinery are planned within 300 feet of wetlands and riparian areas.

Recreation, Land Use, and Aesthetics

Numerous recreation opportunities exist at the project. Implementing the Districts' proposed RRMP with staff-recommended modifications would: (1) expand recreation opportunities by adding new project recreation facilities and providing pedestrian access to La Grange Reservoir[25]; (2) improve the current recreation experience by scheduling and accomplishing deferred maintenance and accessibility upgrades at project recreation facilities; (3) provide for public safety by ensuring recreation facilities are properly operated and maintained through the license term; (4) address effects of recurrent dispersed recreation use on natural resources; (5) provide necessary coordination with BLM to ensure recreation facilities are designed and resources are managed consistent with agency requirements; (6) minimize the potential for trespassing on private land and at project infrastructure (e.g., install signs, fencing); and (7) ensure that information on the schedule for planned boating flow releases is available to the public. Implementing the staff-recommended measure to include operation and maintenance of the visitor center as a project recreation facility, within the scope of the RRMP, would address the need to provide public information (e.g., locations of project recreation facilities, points of public access, wildlife viewing) and education (e.g., explaining project operation, preventing spread of invasive species, and protecting environmental resources as described in various project resource management plans) to

[25] The Districts propose this measure as part of the La Grange Project; however, the staff alternative recommends this measure as part of the Don Pedro Project because the trailhead is within the Don Pedro Project boundary.

project visitors. Providing the staff-recommended shoreline access trails with appropriate slope, width, and tread at the project reservoir shoreline near Ward's Ferry Bridge would improve footing for whitewater boaters at the take-out and for those accessing the shoreline, and reduce erosion potential. Implementing a Fire Prevention and Response Management Plan would ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.

The staff-recommended increased minimum flows consistent with the draft Voluntary Agreement would increase boating opportunities in the reach of the lower Tuolumne River from La Grange Diversion Dam to the location of the proposed infiltration galleries from June through October 15, and boating flows would be improved downstream of the infiltration galleries during March, April, and May in all water year types, and during several proposed pre-scheduled weekend releases in wet, above normal, and below normal water years, and during a single weekend release in dry water years.

Expectations about maintenance standards and responsibilities for project roads among the various landowners and managing agencies is currently uncertain. Implementing the staff-recommended measure to develop, in consultation with BLM and Tuolumne County, a transportation system management plan for all project roads and trails would ensure that project roads and trails are maintained to current agency standards, allowing continued and improved public access to and through project.

Revising the Districts' Fire Prevention and Response Plan, in consultation with BLM, would improve public safety by ensuring that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires, and guiding the response should wildfires occur.

Activities such as constructing new facilities, vegetation clearing, and painting project infrastructure change the visual appearance of the landscape. Developing the staff-recommended visual resources management plan would address effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities. Monitoring visual resources over the license term would provide a basis for determining whether additional treatments would be necessary to achieve visual quality objectives.

Cultural Resources

Project-related effects on cultural resources within the area of potential effects could occur from project operation, recreational use, new construction, and mitigation measures associated with other environmental resources. These cultural resources include 105 archaeological resources, a number of historic structures, and one traditional cultural property that are eligible or potentially eligible for listing in the National Register of Historic Places. The HPMP filed on February 14, 2019, includes measures that are consistent with most of the Commission and Advisory Council on Historic Preservation's 2002 guidelines. To meet the requirements of section 106 of the National Historic

Preservation Act of 1966, the Commission intends to issue a final PA for execution with the California State Historic Preservation Officer for the project for the protection of historic properties that would be affected by project construction, operation, and maintenance activities. The terms of the PA would require the Districts to implement the HPMP.

Socioeconomic Resources

The Districts' proposed construction of recreational amenities including building a new visitor center, constructing a new non-motorized trail to La Grange Reservoir, and constructing the staff-recommended shoreline access trails at Ward's Ferry would require employing a small number of construction personnel for two years. Employment in the study area would only temporarily increase and would not be readily noticeable during the duration of construction of the proposed facilities. The construction of recreation amenities is unlikely to have any noticeable effect on population, housing, or income in the study area. Improved recreational facilities could attract increased recreation use and therefore increased recreation spending resulting in minor, beneficial effects within the three-county service area of the Districts.

The flow regime proposed by the Districts would increase the amount of water that is released past La Grange Diversion Dam to meet environmental objectives, but this would reduce the total amount of water available for consumptive uses. Modeling performed by the Districts indicates that their flow proposal would not affect the number of years in which water supply rationing occurs; however, the magnitude of rationing would increase. The San Francisco Public Utilities Commission is expected to acquire new water resources to avoid sustaining major economic losses to jobs and businesses in the supply area. The expected annual cost to replace maximum water deficits under a critically dry year under the Districts' proposal would be $57 million compared to $18 million under current conditions. The staff-recommended drought management plan would create a process for the Districts to identify any temporary operational changes that may be needed under extreme drought conditions, which would reduce adverse socioeconomic impacts to water users in the San Francisco Public Utilities Commission regional water system service area.

Irrigation water from the project directly supports agricultural production and other industries in the study area. The percent of demand met for irrigation water under the Districts' proposed flow regime would be nearly identical to current conditions except under a critical water year, when only 88 percent of irrigation demand would be met compared to 92 percent under current conditions.

The Districts' economic analysis indicates the economic effects on agriculture within the three-county area of the Districts' proposed flow regime as modified in the draft Voluntary Agreement, which is included in the staff alternative, could be substantial in critical water years and may include the loss of jobs and income that would affect the overall economic conditions in the area. Compared to the interim flow regime that we

recommended in the draft EIS, the draft Voluntary Agreement flow regime would make more water available to agriculture because it incorporates the proposed infiltration galleries, which would allow flow to be removed from the river at a downstream location, after it passes through the reach that provides the most important habitat for aquatic species.

Over time, individual farmers may react to shortages of water and increased cost of replacement water, if available, in a number of ways that may temper some of the socioeconomic impacts of the staff-recommended flow regime. Additionally, some decline in land value associated with agricultural and water supply losses is expected.

La Grange Project

Aquatic Resources

Possible effects on anadromous fish could include reductions in availability of spawning or rearing habitat or stranding downstream of La Grange when river flows are reduced by project operation or seasonal changes in minimum flow requirements. Implementing the staff-recommended streamflows, flow recession rates, and other measures discussed for the Don Pedro Project would ultimately protect fishery resources downstream of the La Grange Project. The staff recommendation to include a ramping rate requirement for the La Grange Project would minimize the risk of fish stranding by ensuring that any changes in the rate of flow releases from Don Pedro Reservoir, and diversions from La Grange Reservoir for consumptive use, do not cause rapid reductions in the flow released into the Tuolumne River downstream of the La Grange Project. The recommended operation compliance monitoring plan would help to ensure that project operation meets requirements related to flow releases downstream of the La Grange Project.

In response to periodic low DO levels observed downstream of the La Grange Powerhouse, the Districts propose DO monitoring in the vicinity of the La Grange Powerhouse. Expanding the Districts' proposal, as recommended by staff, to develop a monitoring plan to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace would help to maintain DO levels that are supportive of aquatic resources in the project vicinity.

Terrestrial Resources

The Districts have not performed surveys for noxious weeds, special-status plants, or any special-status terrestrial wildlife at the La Grange Project. Surveys and management guidelines for noxious weeds and special-status plants would help to ensure that continued project operation does not result in the spread of noxious weeds or the decline of special-status plant populations. Staff recommends developing a La Grange TRMP that would include: (1) a noxious weed survey during the first year of license issuance and every five years, focusing on areas that support occurrences of special-status or threatened and endangered plants, and an emphasis on the use of manual control of

noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources species; (2) a survey for special-status plants following California DFW protocols at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes, and a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance; (3) pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat; and (4) establishing 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities in their vicinity. These measures would help to prevent the spread and proliferation of noxious weeds and protect special-status plants.

The Districts did not mention special-status bats in their license application for the La Grange Project, although several of the same species of bats documented at the Don Pedro Project may occur at the La Grange Project. Staff recommends including provisions in a La Grange TRMP to protect special-status bats, including a bat survey of all areas with potential for conflict with humans. The survey would determine whether bat exclusion measures are needed and, if so, require installing and annually inspecting bat exclusion devices. Additionally, because bat roosting behavior and human activities could change, resurveying project facilities with potential for bat occurrence every five years for evidence of bat use would afford greater protection for special-status bats. To identify and prevent the spread of white-nose syndrome in bats, we also recommend reporting any sick or dead bat found at the La Grange Project to California DFW and FWS as soon as possible and following accepted decontamination protocols (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015) when entering areas with potential bat occurrence.

Water level fluctuations of the Don Pedro Reservoir could affect western pond turtle habitat by affecting water temperatures and the availability of both basking substrates and vegetated, shallow shoreline areas that are necessary for juvenile western pond turtles. Project effects on the species could be avoided or minimized by the staff-recommended measure to include protective measures for western pond turtles in a La Grange TRMP, which include recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project, and consulting with FWS and California DFW to develop protective measures for the species, if necessary.

Potential project effects on California tiger salamanders, as well as California red-legged frogs and other sensitive amphibians, could most effectively be avoided or mitigated by limiting adverse effects on their aquatic habitat. To protect sensitive amphibians, staff recommends including provisions in a La Grange TRMP for BMPs no-use pesticide buffer zones of 60 feet from aquatic features and California red-legged frog aquatic breeding habitat, non-breeding aquatic habitat, and upland habitat, and avoidance and minimization measures when project-related ground disturbance involving heavy

machinery is planned within 300 feet of wetlands and riparian areas to avoid adverse effects on sensitive aquatic species.

The Districts did not conduct surveys for bald eagles at the La Grange Project. However, because of the abundance of fish, the La Grange Reservoir likely supports bald eagles, at least occasionally. Human recreation, primarily fishing, could affect bald eagle foraging in the La Grange Reservoir and farther downstream on the lower Tuolumne River. Our analysis supports the resource agencies' recommendations and mandatory conditions to minimize potential project effects through the development of a bald eagle management plan for the La Grange Project. Staff recommends that the Districts develop a La Grange bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys of project lands to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS, and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffer distances on project lands around any active nests of other special-status birds.

Threatened and Endangered Species

The Districts' proposal to provide a minimum flow of at least 5 cfs[26] would support favorable water quality and maintain a stable flow regime for fish present in the plunge pool, which would minimize the potential for adverse effects on *O. mykiss*. Installing a fish exclusion barrier at the sluice gate channel entrance, as proposed by the Districts, and implementing the staff-recommended ramping rates would minimize the potential for salmonid stranding and mortality. Developing a plan to monitor DO in the vicinity of the La Grange Powerhouse and mitigate any adverse project effects on DO, as recommended by staff, would protect any *O. mykiss* in the vicinity of the project tailrace from adverse effects from low DO concentrations.

Routine project maintenance and non-routine ground-disturbing activities have the potential to result in water quality-related impacts on federally listed fish species and their designated critical habitat. The staff-recommended soil erosion and sediment control plan would include BMPs that would limit any adverse effects of erosion on terrestrial and aquatic habitats. Additionally, staff's recommended spill prevention

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[26] The Districts propose a minimum flow of 5 to 10 cfs. However, we see no need to recommend an upper limit to the minimum flow as a condition of any license issued.

control and countermeasure management plan would minimize the extent of any hazardous material spill and include protocols to prevent adverse effects on federally listed species in the event of a spill.

The staff-recommended pulse flows, coarse sediment management program, experimental gravel cleaning program, gravel mobilization flows, and LTRHIP recommended for the Don Pedro Project would benefit *O. mykiss* through reductions in water temperature, expansion of rearing habitat, and increases in habitat diversity. However, it is possible that some individual *O. mykiss* could be injured or killed during installation of the fish exclusion barrier at the entrance to the sluice gate channel or during activities associated with the staff-recommended water quality monitoring. As noted above, we are not able to rule out the possibility that some *O. mykiss* in the Tuolumne River could be the offspring of anadromous steelhead, which are federally listed as threatened. Considering the potential for incidental take of individuals associated with the proposed action, we determine that issuing a license for the La Grange Project as proposed with staff-recommended measures is "likely to adversely affect" the California Central Valley steelhead, and "may affect, but is not likely to adversely affect" the designated critical habitat for this species.

Designated critical habitat for Central Valley spring-run Chinook salmon occurs within a small part of the Delta portion of the action area, and the staff alternative would not affect this portion of the Delta. Therefore, the proposed action would have "no effect" on the Central Valley spring-run Chinook salmon ESU and its critical habitat. Although designated critical habitat for North American green sturgeon includes all portions of the Delta, the minor increase in flow contributed from the Tuolumne River under the staff alternative would have no detectable effects on habitat conditions within the Delta. Therefore, the proposed action would have "no effect" on the Southern DPS of North American green sturgeon and its critical habitat.

Licensing the La Grange Project, as proposed with staff-recommended measures, would have "no effect" on Hartweg's golden sunburst, succulent owl's clover, colusa grass, hairy orcutt grass, Chinese camp brodiaea, Red Hills vervain, Layne's butterweed, or Green's tuctoria because suitable habitat for these species does not occur at the La Grange Project. Project operation, as proposed with staff-recommended measures, would have "no effect" on California red-legged frog because this species does not occur in the area of project effects.

It is not likely that the San Joaquin kit fox occurs within the La Grange Project boundary. The Districts do not perform rodent control or any other activities that would adversely affect ground squirrel burrows or other suitable San Joaquin kit fox habitat within the project boundary. Project maintenance activities that result in ground disturbance or include the use of pesticides could affect habitat for valley elderberry longhorn beetle and California tiger salamander. The staff recommendation would reduce potential effects on these species through the preparation of a La Grange TRMP that includes BMPs to minimize potential for pesticide use to affect non-target species

and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas. To manage elderberry shrubs for the conservation of the valley elderberry longhorn beetle, staff recommends including provisions in a La Grange TRMP for recording the locations of elderberry plants during special-status plant surveys, and surveying for elderberry plants in accordance with FWS protocols within 165 feet of project-related ground disturbances activities with potential to remove elderberry shrubs.

We conclude that licensing the La Grange Project, as proposed with staff-recommended measures, "may affect, but is not likely to adversely affect" the San Joaquin kit fox, the Central Valley DPS of California tiger salamander, and the valley elderberry longhorn beetle.

Recreation, Land Use, and Aesthetics

Developing the staff-recommended fire prevention and response plan, in consultation with BLM, would improve public safety by ensuring that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires, and by guiding the response should wildfires occur.

Cultural Resources

Project-related effects on cultural resources within the area of potential effects could occur from project operation, recreational use, new construction, and mitigation measures associated with other environmental resources. These cultural resources include two historic structures that are eligible for listing in the National Register of Historic Places. The HPMP filed on July 10, 2018, includes measures that are consistent with the Commission and the Advisory Council on Historic Preservation's 2002 guidelines. To meet the requirements of section 106 of the National Historic Preservation Act of 1966, the Commission intends to issue a final PA for execution with the California State Historic Preservation Officer for the protection of historic properties that would be affected by project construction, operation, and maintenance activities. The terms of the PA would require the Districts to implement the HPMP.

Socioeconomic Resources

The La Grange Project does not store water for consumptive use, provides no flood control benefits, and has no recreation facilities associated with the project. Therefore, the Districts' proposal would not result in any adverse effects on socioeconomic resources.

License Conditions

Staff recommendations for conditions for any licenses for the projects are based on the analysis presented in this final EIS. Draft license articles for the Don Pedro and La Grange Projects are attached in appendices B and C, respectively.

Conclusions

Based on our analysis, we recommend licensing the projects as proposed by the Districts, with some staff modifications and additional measures.

In section 4.2 of this final EIS, we estimate the likely cost of alternative power for each of the three alternatives identified above. For the Don Pedro Project, our analysis shows that, during the first year of operation under the no-action alternative, project power would cost $31,338,650, or $51.13 per MWh, less than the likely alternative cost of power. Under the proposed action alternative, project power would cost $25,670,970, or $40.50/MWh, less than the likely alternative cost of power. Under the staff alternative, project power would cost $27,486,200, or $43.38/MWh, less than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $25,495,470, or $39.04/MWh, less than the likely alternative cost of power.

For the La Grange Project, our analysis shows that, during the first year of operation under the no-action alternative, project power would cost $321,900, or $17.81 per MWh, less than the likely alternative cost of power. Under the proposed action alternative, project power would cost $483,960, or $21.58/MWh, less than the likely alternative cost of power. Under the staff alternative, project power would cost $438,710, or $19.76/MWh, less than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $478,210, or $19.46/MWh, less than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the projects would provide a dependable and inexpensive source of electrical energy for the region (655,886 MWh annually); (2) the 224.70 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by the Districts, as modified by staff, would adequately protect and enhance environmental resources affected by the projects. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

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FINAL ENVIRONMENTAL IMPACT STATEMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Don Pedro Hydroelectric Project
FERC Project No. 2299-082—California

La Grange Hydroelectric Project
FERC Project No. 14581-002—California

1.0 INTRODUCTION

1.1 APPLICATION

1.1.1 Don Pedro Project

On April 28, 2014, Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, Districts or applicants) filed an application for a new major license with the Federal Energy Regulatory Commission (Commission or FERC) to continue to operate and maintain the Don Pedro Hydroelectric Project (FERC No. 2299-082). Subsequently, the Districts filed an amended application on October 11, 2017. The 168-megawatt (MW) project is located at river mile (RM) 54.8 on the Tuolumne River in Tuolumne County, California (figure 1.1.1-1). The Don Pedro Project currently occupies 4,802 acres of federal land administered by the U.S. Department of the Interior, Bureau of Land Management (BLM). BLM administers the federal lands occupied by the project under the Sierra Resource Management Plan. The project generated an average of about 550,000 megawatt-hours (MWh) of energy annually from 1997 through 2016.

1.1.2 La Grange Project

On October 11, 2017, the Districts filed an application for an original license with the Commission to continue to operate and maintain the La Grange Hydroelectric Project (FERC No. 14581-002). In an order issued by Commission staff on December 19, 2012, this existing, unlicensed project was required to be licensed because the project is located on a navigable river and occupies federal lands.[27] The 4.7-MW project is located at RM 52.2 on the Tuolumne River in Stanislaus and Tuolumne Counties, California,

[27] *Turlock Irrigation Dist. and Modesto Irrigation Dist.*, 141 FERC ¶ 62,211 (2012), *order on reh'g*, 144 FERC 61,051 (2013), *aff'd sub nom., Turlock Irrigation Dist. v. FERC*, 786 F.3d 18 (D.C. Cir. 2015).

immediately downstream of the Don Pedro Project (figure 1.1.1-1). The proposed project boundary for the La Grange Project would occupy 14 acres of federal land administered by BLM. BLM administers the federal lands occupied by the project under the Sierra Resource Management Plan. The project generated an average of about 18,077 MWh of energy annually from 1997 through 2016.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Don Pedro Project is to continue to provide: (1) water supply for irrigation of more than 200,000 acres of Central Valley farmland and municipal and industrial uses, (2) flood control benefits along the Tuolumne and San Joaquin Rivers, (3) a water-banking arrangement for the City and County of San Francisco (CCSF), and (4) a source of hydroelectric power. The purpose of the La Grange Project is to provide water supply for irrigation and municipal and industrial uses and a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue to the Districts a new license for the Don Pedro Project and an original license for the La Grange Project and what conditions should be placed on any licenses issued.

In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreation opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a new license for the Don Pedro Project and an original license for the La Grange Project would allow the Districts to generate electricity at the projects for the terms of the licenses, making electrical power from a renewable resource available to their customers.

This final environmental impact statement (final EIS) assesses the effects associated with operation of the projects and alternatives to the proposed projects. It also includes recommendations to the Commission on whether to issue a new license for the Don Pedro Project and an original license for the La Grange Project, and if so, includes recommended terms and conditions to become a part of any licenses issued.

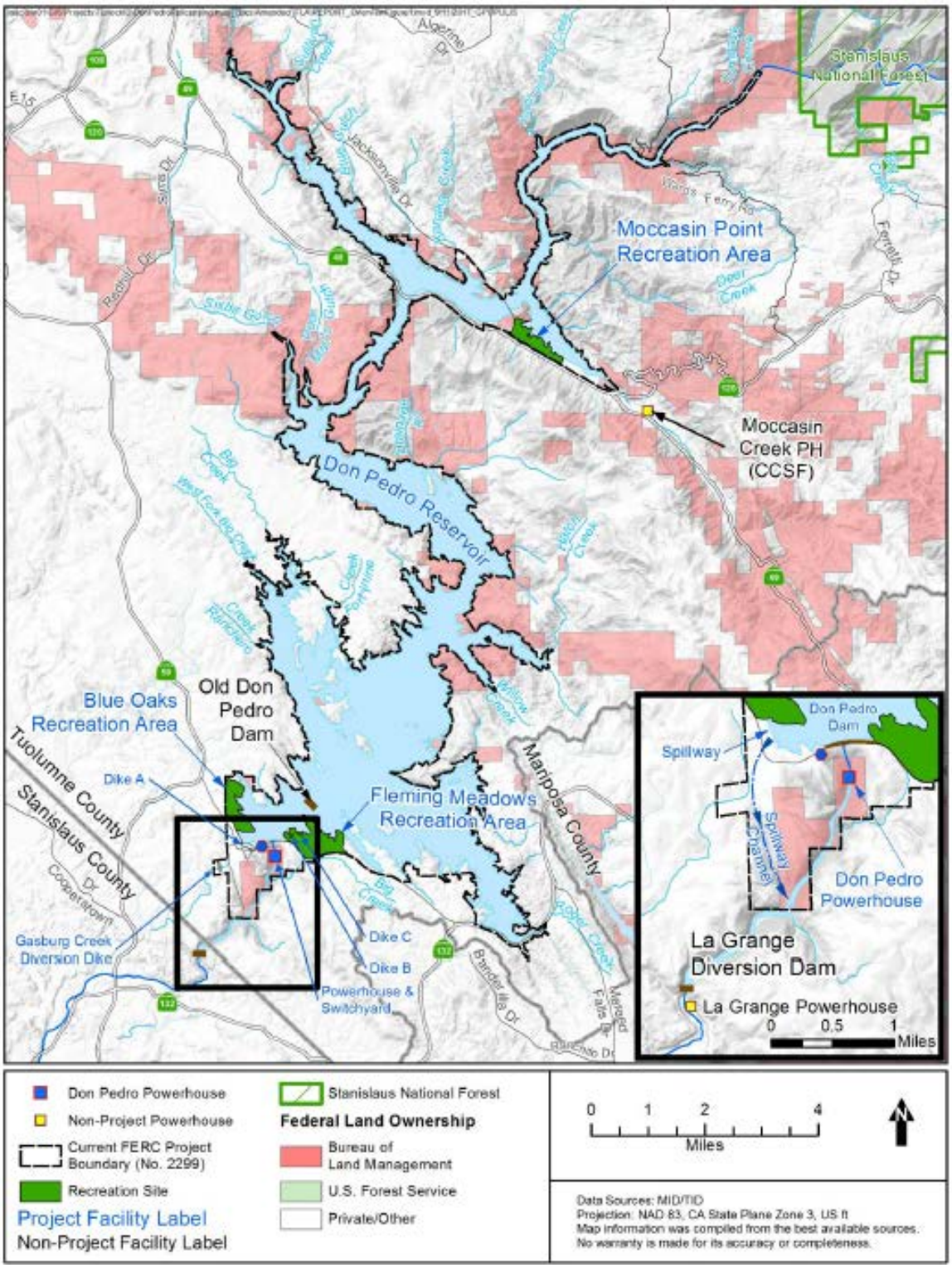

Figure 1.1.1-1. Don Pedro and La Grange Projects vicinity map, showing locations of major facilities and existing project boundary for the Don Pedro Project (Source: Districts, 2017a).

In this final EIS, we assess the environmental and economic effects of continuing to operate the projects: (1) as proposed by the applicants; (2) with our recommended measures; and (3) with any mandatory conditions prescribed by state and federal agencies. We also consider the effects of the no-action alternative. Important issues that are addressed include the effects of continued project operation on instream flows, water supply, flood storage, sediment transport, water quality, fishery resources and fish passage, terrestrial resources, threatened and endangered species, recreation, land use, cultural resources, and socioeconomics.

1.2.2 Need for Power

The Don Pedro and La Grange Projects would continue to provide hydroelectric generation to meet part of California's power requirements, resource diversity, and capacity needs. The Don Pedro Project has an installed capacity of 168.015 MW and generates about 550,000 MWh per year. The La Grange Project has an installed capacity of 4.7 MW and generates about 18,077 MWh per year.

The North American Electric Reliability Corporation annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The projects are located in the California/Mexico subregion of the Western Electric Coordinating Council of North American Electric Reliability Corporation. According to North American Electric Reliability Corporation's 2017 forecast, anticipated resources are expected to be greater than the required reserve margin between 2018 and 2027 (NERC, 2017).

We conclude that power from the projects would continue to meet a need for power in the California/Mexico subregion in both the short and long term. The projects provide low-cost power that displaces generation from non-renewable resources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Licenses for the Don Pedro and La Grange Projects are subject to numerous requirements under the FPA and other applicable statutes, as summarized below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA provides that the Commission must require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or the U.S. Department of the Interior. The U.S. Department of the Interior and the U.S. Department of Commerce's National Marine Fisheries Service (NMFS), by letters filed on January 29, 2018, request that a reservation of authority to prescribe fishways under section 18 be included in any licenses issued for the projects.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation must be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. BLM filed preliminary conditions for the Don Pedro and La Grange Projects on January 29, 2018, and revised conditions for the Don Pedro Project on August 23, 2018 (appendices D and E), pursuant to section 4(e) of the FPA. These conditions are described under section 2.2.5, *Modifications to Applicants' Proposal—Mandatory Conditions*.

Alternative Section 4(e) Conditions under the Energy Policy Act of 2005

The Energy Policy Act of 2005 provides parties to this licensing proceeding the opportunity to propose alternatives to preliminary conditions. On February 28, 2018, the Commission received a copy of the Districts' filing to BLM disputing issues of material fact with respect to Don Pedro preliminary 4(e) condition nos. 4, 12, and 13; filing two alternative 4(e) conditions in response to BLM preliminary section 4(e) condition 13; and requesting a trial-type hearing. On August 23, 2018, BLM filed a revised set of conditions for the Don Pedro Project, withdrawing preliminary condition 12 and modifying conditions 4 and 13. On August 28, 2018, the Districts withdrew their request for a trial-type hearing and the two alternative 4(e) conditions.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

U.S. Department of the Interior, Fish and Wildlife Service (FWS) timely filed, on January 29, 2018, recommendations under section 10(j) for both projects. FWS filed revised 10(j) recommendations 2, 3 and 4 for the Don Pedro Project, withdrew recommendation 7 for the Don Pedro Project, and withdrew recommendations 2, 3, 4 and 7 for the La Grange Project on October 2, 2018. California Department of Fish and Wildlife (California DFW) and NMFS also filed recommendations on January 29, 2018, but they did not specifically identify which terms and conditions were filed pursuant to FPA section 10(j).

On February 11, 2019, the Commission issued a draft EIS for the projects. In the draft EIS, we noted that although NMFS's and California DFW's January 29, 2018,

filings stated generally that they were submitting measures pursuant to both section 10(j) and section 10(a) of the FPA, the agencies' letters did not specify which of the recommendations were submitted specifically for section 10(j) consideration and which of the recommendations were submitted specifically for section 10(a) consideration. Therefore, as is our practice in instances where an agency does not specify which FPA section applies to each recommendation, we considered all of NMFS's and California DFW's recommendations under section 10(a) of the FPA.

On February 12, 2019, we sent FWS a letter regarding our preliminary determination of inconsistencies for the recommendations and requesting concurrence, comments, or alternative recommendations. NMFS and California DFW filed letters on March 6, 2019, and March 7, 2019, respectively, stating that their intent was that all their recommendations were filed pursuant to both sections 10(a) and 10(j), and staff should have also considered all the recommendations as section 10(j) recommendations.

On March 21, 2019, the Commission issued letters to NMFS and California DFW revising the assessment of which recommendations were found to be within the scope of section 10(j) and whether they were adopted in the draft EIS. These recommendations are summarized in table 5.3.1-1 for the Don Pedro Project and table 5.3.1-2 for the La Grange Project. By letters filed April 4, 2019, NMFS and California DFW requested a meeting to attempt to resolve inconsistencies. By letter filed April 12, 2019, FWS also requested a meeting to attempt to resolve inconsistencies. On September 19, 2019, Commission staff conducted a meeting with NMFS, FWS, and California DFW, in Sacramento, California. In section 5.3.1, *Fish and Wildlife Agency Recommendations*, we discuss how we address the agencies' recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), the Commission may not issue a license for a hydroelectric project unless the license applicant obtains certification from the appropriate state pollution control agency verifying compliance with the CWA, or the state agency waives certification by failing to act within a reasonable time, not to exceed one year. On January 26, 2018, the Districts applied to the California State Water Resources Control Board (Water Board) for 401 water quality certification (certification) for the Don Pedro and La Grange Projects. The Water Board received these requests on January 26, 2018. The Water Board denied the Districts' applications without prejudice on January 24, 2019. The Districts reapplied for certification for both projects on April 22, 2019 and the Water Board again denied the Districts' applications without prejudice on April 20, 2020.

On January 29, 2018, the Water Board filed preliminary certification conditions for the Don Pedro and La Grange Projects (appendix F) in response to the ready for analysis notice. These preliminary conditions would be mandatory if included in a final,

valid certification and are described in section 2.2.5, *Modifications to Applicants' Proposal—Mandatory Conditions*.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Ten federally listed species, subspecies, or distinct populations may occur in the Don Pedro and La Grange Project vicinity—Central Valley spring-run Chinook salmon (*O. tshawytscha*), the California Central Valley Distinct Population Segment (DPS) of steelhead (*Oncorhynchus mykiss irideus*), the Southern DPS of North American green sturgeon *(Acipenser medirostris*), San Joaquin kit fox (*Vulpes macrotis mutica*), California red-legged frog (*Rana draytonii*), the Central Valley DPS of the California tiger salamander (*Ambystoma californiense*), valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), vernal pool fairy shrimp (*Branchinecta lynchi*), Layne's butterweed (*Packera layneae*), and Red Hills vervain (*Verbena californica*).[28] Our analyses of project effects on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations are presented in section 5.1, *Comprehensive Development and Recommended Alternative*.

We conclude that relicensing the Don Pedro Project and licensing the La Grange Project, as proposed with staff-recommended measures, would have "no effect" on the Central Valley spring-run Chinook salmon, the Southern DPS of North American green sturgeon, California red-legged frog, and vernal pool fairy shrimp; the projects "may affect, but are not likely to adversely affect" San Joaquin kit fox, the Central Valley DPS of California tiger salamander, valley elderberry longhorn beetle, Layne's butterweed, and Red Hills vervain. Considering the potential for incidental take of individuals associated with the proposed action,[29] we conclude that the proposed action is "likely to adversely affect" the California Central Valley steelhead,[30] and "may affect, but is not likely to adversely affect" the designated critical habitat for this species.

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[28] The updated species lists (letters from FWS, Sacramento Fish and Wildlife Office, filed October 19, 2018) identified 11 threatened, endangered, or candidate species that may be present within the Don Pedro Project area and 8 threatened, endangered, or candidate species within the La Grange Project area. Ten of those species are addressed in this EIS; however, the Delta smelt, conservancy fairy shrimp, vernal pool fairy shrimp, Chinese camp Brodiaea, and Hartweg's golden sunburst have not been identified within the project boundaries and are not considered further.

[29] If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made (FWS and NMFS, 1998).

[30] Although the occurrence of an anadromous population of steelhead in the

By letter dated March 19, 2019, FWS disagreed with the conclusions outlined in our February 12, 2019 request for concurrence and provided additional recommendations to reduce potential effects on the San Joaquin kit fox, Central Valley DPS of California tiger salamander, valley elderberry longhorn beetle, Layne's butterweed, and Red Hills vervain. Because we were unable to recommend adopting all FWS's recommendations for these species, we will request formal consultation with FWS with issuance of this final EIS.

By letter dated February 12, 2019, we requested concurrence from NMFS with our finding on the California Central Valley steelhead and its critical habitat. By letter dated April 1, 2019, NMFS requested additional information within 45 days to initiate formal consultation. By letter dated May 23, 2019, NMFS closed the consultation request due to inactivity and considered the request withdrawn. We will request formal consultation with NMFS with issuance of this final EIS.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act, 16 United States Code (U.S.C.) § 1456(3)(A), the Commission may not issue a license for a project within or affecting a state's coastal zone unless the state Coastal Zone Management Act agency concurs with a license applicant's certification of consistency with the state's Coastal Zone Management Act program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The Don Pedro and La Grange Projects are not located within the state-designated Coastal Management Zone, which extends inland to the crest of the Coast Mountain Range. The projects, which are located east of the Coast Mountain Range, would not affect California's coastal resources. Therefore, the projects are not subject to California coastal zone program review, and no consistency certification is needed for the action. By email dated May 29, 2018,[31] the California Coastal Commission concurred.[32]

Tuolumne River is uncertain, the possibility that some *O. mykiss* in the Tuolumne River could be the offspring of anadromous steelhead cannot be ruled out.

[31] Filed on June 21, 2018.

[32] The email from the Coastal Commission stated that San Francisco Bay Conservation and Development Commission (BCDC) is the downstream coastal program decision maker for rivers that flow into the San Francisco Bay. The Districts consulted with BCDC, and filed documentation on October 9, 2018, that BCDC only regulates activities in the San Francisco Bay or within 100 feet of the shoreline, and that the Don Pedro and La Grange Projects are not under BCDC's jurisdiction.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on the undertaking.[33] Historic properties are those that are listed or eligible for listing on the National Register of Historic Places (National Register). In this document, we also use the term "cultural resources" for properties that have not been evaluated for eligibility for listing on the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic. Section 106 also requires that the Commission seek concurrence with the state historic preservation officer (SHPO) on any finding involving effects or no effects on historic properties and consult with interested Indian tribes or Native Hawaiian organizations that attach religious or cultural significance to historic properties that may be affected by an undertaking.

To meet the requirements of section 106, on September 30, 2019, the Commission issued separate draft Programmatic Agreements (PAs) for the protection of historic properties from the effects of the operation of the Don Pedro and La Grange Projects. The terms of the PAs would ensure that the Districts address and treat all historic properties identified within each project area of potential effects (APE) through the implementation of the Historic Properties Management Plans (HPMPs) for each project.

1.3.6 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to determine whether the operation of a project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. Public Law 98-425 (September 28, 1984) designated the Tuolumne River as a Wild and Scenic River, from its source to Don Pedro Reservoir for 83 miles. BLM, the National Park Service (Park Service), and the U.S. Department of Agriculture, Forest Service (Forest Service) manage three Wild and Scenic River segments of the Tuolumne River located on land within their respective jurisdictions to protect and enhance the free-flowing condition, water quality, and outstanding

[33] An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a federal permit, license, or approval" (36 CFR § 800.16(y)). Here, the undertaking is the potential issuance of new licenses for the Don Pedro and La Grange Projects.

remarkable values for which the river was designated, while providing for public recreation and resource uses that do not adversely affect or degrade those values.

The Forest Service manages the downstream segment of the designated Wild and Scenic River that terminates at Don Pedro Reservoir. In 1988, the Forest Service approved the Tuolumne Wild and Scenic River Management Plan, which established a 0.25-mile management corridor on each side of the designated river segment (Forest Service, 1988). The aliquot[34] parcel description of the corridor overlaps the Don Pedro Project lands at the upstream end of Don Pedro Reservoir.[35] Although the Don Pedro Project boundary includes land within the management corridor, Public Law 98-45 specifies that the Wild and Scenic River designation would not affect previously granted rights, obligations, privileges, or benefits. Because the Don Pedro Project pre-dates the Wild and Scenic River designation, and no designated river segments are downstream of the Don Pedro Project, neither the Don Pedro Project nor the La Grange Project would affect any designated wild and scenic river segments.

1.3.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with the NMFS on all actions that may adversely affect Essential Fish Habitat (EFH). In the case of the Don Pedro and La Grange Projects, EFH consultation is required for Central Valley fall/late fall-run Chinook salmon because the EFH for this species is present in the Tuolumne River from the La Grange Diversion Dam downstream to the confluence with the San Joaquin River.

In the draft EIS, we concluded that the staff alternative would have only minor and, in most cases, beneficial effects on Chinook salmon EFH, and requested concurrence from NMFS. On April 1, 2019, NMFS filed a letter requesting additional analysis, modeling, and information that would support the final proposed action as described in the final EIS and Water Board's final certification. By letter dated May 23, 2019, NMFS closed the consultation request due to inactivity and considered the request withdrawn.

Based on our revised analyses in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, of this final EIS, we again conclude that the staff alternative

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[34] A location descriptor used in the public land survey system in which the townships and sections are indexed based on (1) the township's position relative to the initial point, (2) the section's location within the designated township, and (3) the principal meridian reference.

[35] The corridor description in the Tuolumne Wild and Scenic River Management Plan includes land within T.1N, R.16E, S1/2N1/2, and N1/2S1/2. Project land overlapping the management corridor is within T.1N, R.16E, S1/2NW1/4, and N1/2SW1/4.0.

would have only minor and, in most cases, beneficial effects on Chinook salmon EFH. In addition, we conclude that the staff-recommended measures would likely improve EFH over the long term. By way of this final EIS, we are providing NMFS with our EFH assessment and request that NMFS provide any EFH conservation recommendations.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], sections 5.1–5.16) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EIS, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) for the Don Pedro Project was distributed to interested agencies and others on April 8, 2011. It was noticed in the *Federal Register* (FR) on April 14, 2011 (72 FR 20,791). Two scoping meetings, both advertised in local newspapers, were held on May 11, 2011, where oral comments on the project were sought. The daytime meeting was held in Turlock, California, and the evening meeting was held in Modesto, California. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. We also conducted an environmental site review of the project on May 10, 2011. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Gordon Hollingsworth	May 12, 2011
Mrs. Dooley	May 24, 2011
Stanislaus County Board of Supervisors	May 31, 2011
City of Turlock (Municipal Services Department)	June 6, 2011
Foster Poultry Farms	June 6, 2011
Town of La Grange, California	June 6, 2011
Friends of the Tuolumne	June 7, 2011
Bob Hackamack	June 8, 2011
California Department of Fish and Game	June 8, 2011
City of Modesto	June 8, 2011
Deanna Lynn Wulff	June 8, 2011

Commenting Entity	Date Filed
Kristin Olsen of California State Assembly	June 8, 2011
Tuolumne River Relicensing Work Group	June 8, 2011
Robert Shipley	June 9, 2011
Water Board	June 9, 2011
Thomas H. Terpstra, A Professional Corporation	June 9, 2011
Turlock Chamber of Commerce	June 9, 2011
Acterra: Action for a Healthy Planet	June 10, 2011
Alfred M. Pirrone	June 10, 2011
Bay Area Water Supply and Conservation Agency	June 10, 2011
Bureau of Land Management	June 10, 2011
Bureau of Reclamation, Mid-Pacific Region	June 10, 2011
California Department of Fish and Game	June 10, 2011
CCSF, Public Utilities Commission	June 10, 2011
Elaine Gorman	June 10, 2011
Griffin Derryberry	June 10, 2011
Jennifer Clary	June 10, 2011
Jerry Cadagan	June 10, 2011
Karen Gardner	June 10, 2011
Lawrence Beard	June 10, 2011
Martin Blake	June 10, 2011
Maryann Moise Derwin	June 10, 2011
NMFS	June 10, 2011
National Park Service	June 10, 2011
Paul J Van Konynenburg	June 10, 2011
Ray Ratto Jr.	June 10, 2011
Restore Hetch Hetchy	June 10, 2011
Rose Beam	June 10, 2011
Ross Mirkarimi	June 10, 2011
Stanislaus County Farm Bureau	June 10, 2011

Commenting Entity	Date Filed
American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Inc., Central Sierra Environmental Resource Center, Environmental Defense Fund, Friends of the River, Golden West Women Flyfishers, Northern California Council Federation of Flyfishers, Merced Fly Fishing Club, Pacific Coast Federation of Fishermen's Associations, Pro-Troll Fishing Products, Trout Unlimited, and Tuolumne River Trust	June 10, 2011
Turlock Irrigation District and Modesto Irrigation District	June 10, 2011
U.S. Fish and Wildlife Service	June 10, 2011
Yosemite Farm Credit, ACA	June 10, 2011
Charlotte Allen	June 13, 2011
John Rosapepe	June 13, 2011
Landowners, Farmers, and Interested Parties	June 13, 2011
Ty McCartney	June 13, 2011
William J and E Mape Lyons	June 13, 2011
Water Board	June 14, 2011
Stanislaus County Farm Bureau	June 14, 2011
Tom Berryhill California Legislature	June 14, 2011
Bill Berryhill California Legislature	June 16, 2011
Mayor Jim Ridenour City of Modesto	June 17, 2011
CCSF, Public Utilities Commission	July 13, 2011

A revised scoping document (SD2), addressing these comments, was issued on July 25, 2011.

An SD1 for the La Grange Project was distributed to interested agencies and others on May 23, 2014, and an errata was issued on June 11, 2014. It was noticed in the FR on June 2, 2014 (79 FR 31,318). Two scoping meetings, both advertised in local newspapers, were held on June 18, 2014, where oral comments on the project were sought. The daytime meeting was held in Turlock, California, and the evening meeting was held in Modesto, California. A court reporter recorded all comments and statements made at the scoping meetings, and these comments are part of the Commission's public record for the project. We also conducted an environmental site review of the project on June 19, 2014. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Water Board	July 22, 2014
American Rivers, American Whitewater, California Sportfishing Protection Alliance, California Trout, Central Sierra Environmental Resource Center, Friends of the River, Golden West Women Flyfishers, Merced Fly Fishing Club, Northern California Federation of Flyfishers, Pacific Coast Federation of Fishermen's Associations, Trout Unlimited, and the Tuolumne River Trust	July 22, 2014
NMFS	July 22, 2014
U.S. Fish and Wildlife Service	July 22, 2014
Bay Area Water Supply and Conservation Agency	July 22, 2014
Winston & Strawn	August 21, 2014

A revised scoping document (SD2), addressing these comments, was issued on September 5, 2014.

1.4.2 Interventions

On November 30, 2017, the Commission issued notices that the Districts' application to relicense the Don Pedro Project and application for an original license for the La Grange Project were accepted. The notices set January 29, 2018, as the deadline for filing protests and motions to intervene. In response to the notice for the Don Pedro Project, the following entities filed motions to intervene:

Intervenor	Date Filed
Tuolumne River Conservancy	December 27, 2017
U.S. Department of the Interior	January 19, 2018
ARTA Rafting	January 22, 2018
NMFS	January 22, 2018
Sierra Mac River Trips, Inc.	January 22, 2018
California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, and Central Sierra Environmental Resource Center	January 23, 2018
California DFW	January 24, 2018
O.A.R.S. West, Inc.	January 24, 2018

Intervenor	Date Filed
All Outdoors Inc.[36]	January 26, 2018
County of Tuolumne	January 26, 2018
CCSF	January 29, 2018
Merced Irrigation District	January 29, 2018
The Bay Institute	January 29, 2018

On January 30, 2018, The Bay Area Water Supply and Conservation Agency (BAWSCA) filed a petition for late intervention. The Commission granted the petition on March 19, 2019.

In response to the notice for the La Grange Project, the following entities filed motions to intervene:

Intervenor	Date Filed
Tuolumne River Conservancy	December 26, 2017
U.S. Department of the Interior	January 19, 2018
ARTA Rafting	January 22, 2018
NMFS	January 22, 2018
Sierra Mac River Trips, Inc.	January 22, 2018
California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, and Central Sierra Environmental Resource Center	January 23, 2018
California DFW	January 24, 2018
O.A.R.S. West, Inc.	January 24, 2018
All Outdoors Inc.	January 26, 2018
City and County of San Francisco	January 29, 2018
Merced Irrigation District	January 29, 2018
The Bay Institute	January 29, 2018
BAWSCA	January 30, 2018*

* Late intervention granted on March 19, 2019.

[36] Also referred to as All Outdoors or All Outdoors Whitewater Rafting.

1.4.3 Comments on the Application

The November 30, 2017, notices also stated that the applications were ready for environmental analysis and solicited comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions. The following entities commented regarding the Don Pedro Project:

Commenting Agency and Other Entity	Date Filed
County of Tuolumne	January 17, 2018
Tuolumne River Conservancy	January 19, 2018
Stanislaus Regional Water Authority	January 22, 2018
All Outdoors Inc.	January 25, 2018
O.A.R.S. West Inc.	January 25, 2018
Sierra Mac River Trips, Inc.	January 25, 2018
Stanislaus and Tuolumne Rivers Groundwater Basin Association	January 26, 2018
State Senator Anthony Cannella	January 26, 2018
12th Assembly District of California	January 26, 2018
21st Assembly District of California	January 26, 2018
City of Ceres	January 26, 2018
Hughson City Council	January 26, 2018
City of Turlock	January 26, 2018
Manufacturers Council of the Central Valley	January 26, 2018
Stanislaus County Board of Supervisors	January 26, 2018
American River Touring Association	January 26, 2018
West Turlock Subbasin Groundwater Sustainability Agency	January 29, 2018
Forest Service	January 29, 2018
ECHO: The Wilderness Company	January 29, 2018
Congressman Jeff Denham	January 29, 2018
Congressman Jim Costa	January 29, 2018
Congressman Tom McClintock	January 29, 2018

Commenting Agency and Other Entity	Date Filed
Conservation Groups[37]	January 29, 2018
NMFS	January 29, 2018
Bay Institute	January 29, 2018
U.S. Department of the Interior (including conditions and recommendations from BLM, FWS, and the Park Service)	January 29, 2018 October 2, 2018[38]
California DFW	January 29, 2018
Water Board	January 29, 2018

The applicants filed reply comments on March 15, 2018, in response to the January 2018 comments, and on October 17, 2018, in response to the FWS comments filed on October 2, 2018.

The following entities commented regarding the La Grange Project:

Commenting Agency and Other Entity	Date Filed
Stanislaus and Tuolumne Rivers Groundwater Basin Association	January 26, 2018
West Turlock Subbasin Groundwater Sustainability Agency	January 29, 2018
Conservation Groups	January 29, 2018
NMFS	January 29, 2018
California DFW	January 29, 2018
Water Board	January 29, 2018

[37] California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, Central Sierra Environmental Resource Center and Tuolumne River Conservancy.

[38] On October 2, 2018, FWS filed a letter supplementing its January 29, 2018 filing, by withdrawing its Don Pedro 10(j) conditions 2, 3, 4, and 7, and replacing them with revised 10(j) conditions 2, 3, and 4.

Commenting Agency and Other Entity	Date Filed
U.S. Department of the Interior (including conditions and recommendations from BLM and FWS)	January 29 and October 2, 2018[39]

In addition to the commenting entities listed above for the Don Pedro and La Grange Projects, 198 comment letters were filed by individuals with no agency or non-governmental organization (NGO) affiliation. Of these, 96 expressed interest in improving safety and access at the Ward's Ferry whitewater take-out, 43 expressed support for increased flows for fish and wildlife as well as improved access and safety measures at Ward's Ferry for whitewater boaters, 39 expressed interest and concern for maintaining sufficient instream flow downstream of the projects for restoration of fish, wildlife, vegetation, and recreational resources, 17 expressed concern for adequate instream flows for salmon and their spawning habitat, two expressed concern for the preservation of water for agricultural interests, and one expressed concern for invasive species and predation of salmon smolts in the lower Tuolumne River.

The applicants filed reply comments on March 15, 2018, in response to the January 2018 comments, and on October 17, 2018, in response to the FWS comments filed on October 2, 2018.

1.4.4 Comments on the Draft Environmental Impact Statement

The draft EIS was issued on February 11, 2019, and sent to the U.S. Environmental Protection Agency (EPA) and made available to the public on February 22, 2019. Written comments on the draft EIS were due April 12, 2019. In addition, oral testimony on the draft EIS was received during two public meetings held in Modesto, California, on March 26, 2019.[40] Appendix A summarizes the substantive comments that were provided, includes staff responses to those comments, and indicates where we made modifications to this final EIS, as appropriate.

[39] On October 2, 2018, FWS filed a letter supplementing its January 29, 2018 filing, by withdrawing its La Grange 10(j) conditions 2, 3, 4, and 7.

[40] The transcripts from the meetings were filed on May 3, 2019 (accession nos. 20190503-4000 and 20190503-4001).

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives that are assessed in the environmental document. Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license and the current flow regime, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative as the baseline environmental condition for comparison with other alternatives.

For the currently unlicensed but operating La Grange Project, the no-action alternative would be continuation of current operation. Thus, the no-action alternative would include the existing facilities and current project operation.

2.1.1 Existing Project Facilities

The primary features of the projects are on figures 2.1.1-1 and 2.1.1-2, and the following sections provide more details about these facilities.

2.1.1.1 Don Pedro Project

The Don Pedro Project consists of the following existing facilities: (1) a 580-foot-high, 1,900-foot-long, earth and rockfill dam; (2) a reservoir with a gross storage capacity of 2,030,000 acre-feet and a usable storage capacity of 1,721,000 acre-feet; (3) a 30-foot-high, 45-foot-wide, 135-foot-long, gated spillway including three 45-foot-wide by 30-foot-high radial gates; (4) a 995-foot-long, ungated ogee emergency spillway with a crest elevation of 830 feet National Geodetic Vertical Datum of 1929;[41] (5) a set of outlet works, which are located at the left abutment of the dam and consist of three individual gate housings in the diversion tunnel, each containing two 4-foot-by-5-foot slide gates; (6) a 3,500-foot-long, concrete-lined diversion tunnel with a total hydraulic capacity of 7,500 cubic feet per second (cfs); (7) a 2,960-foot-long power tunnel located in the left abutment of the dam that transitions from an 18-foot-diameter, concrete-lined section to a 16-foot-diameter, steel-lined section; (8) a 21-foot-high, 12-foot-wide, emergency closure fixed-wheel gate; (9) a powerhouse located immediately downstream of the dam containing a 72-inch hollow jet valve and four Francis turbine-generator units with a total nameplate capacity of 168,015 kilowatts and a maximum hydraulic capacity of 5,500 cfs; (10) a switchyard located on top of the powerhouse; (11) a 75-foot-high, earth and rockfill dike (Gasburg Creek Dike) with a slide-gate controlled 18-inch-diameter conduit located near the downstream end of the spillway; (12) three small embankment dikes—dike A located between the main dam and spillway and dikes B and C located east of

[41] All elevation data in this final EIS are given in National Geodetic Vertical Datum of 1929.

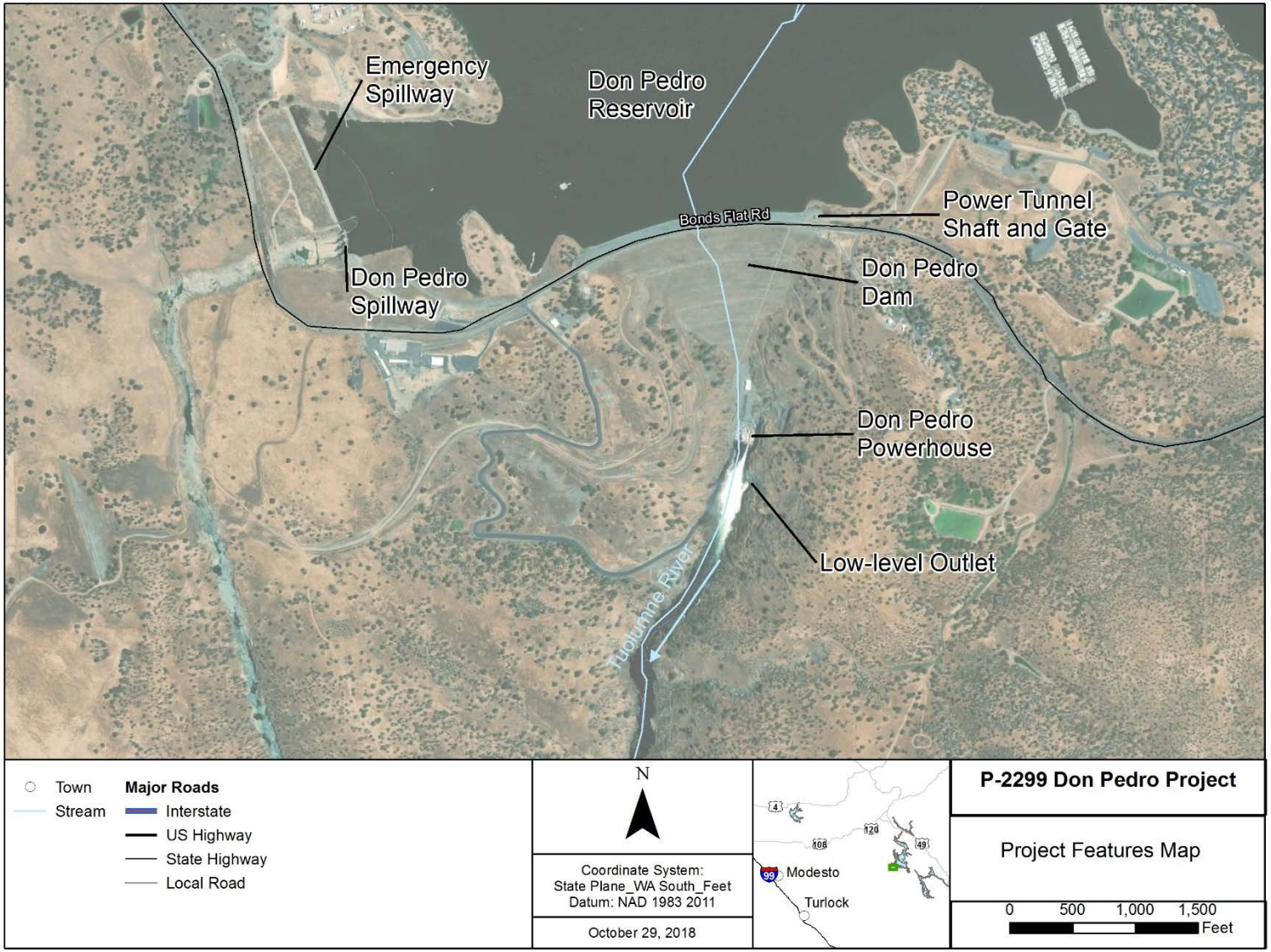

Figure 2.1.1-1. Location of major facilities for the Don Pedro Project (Source: staff).

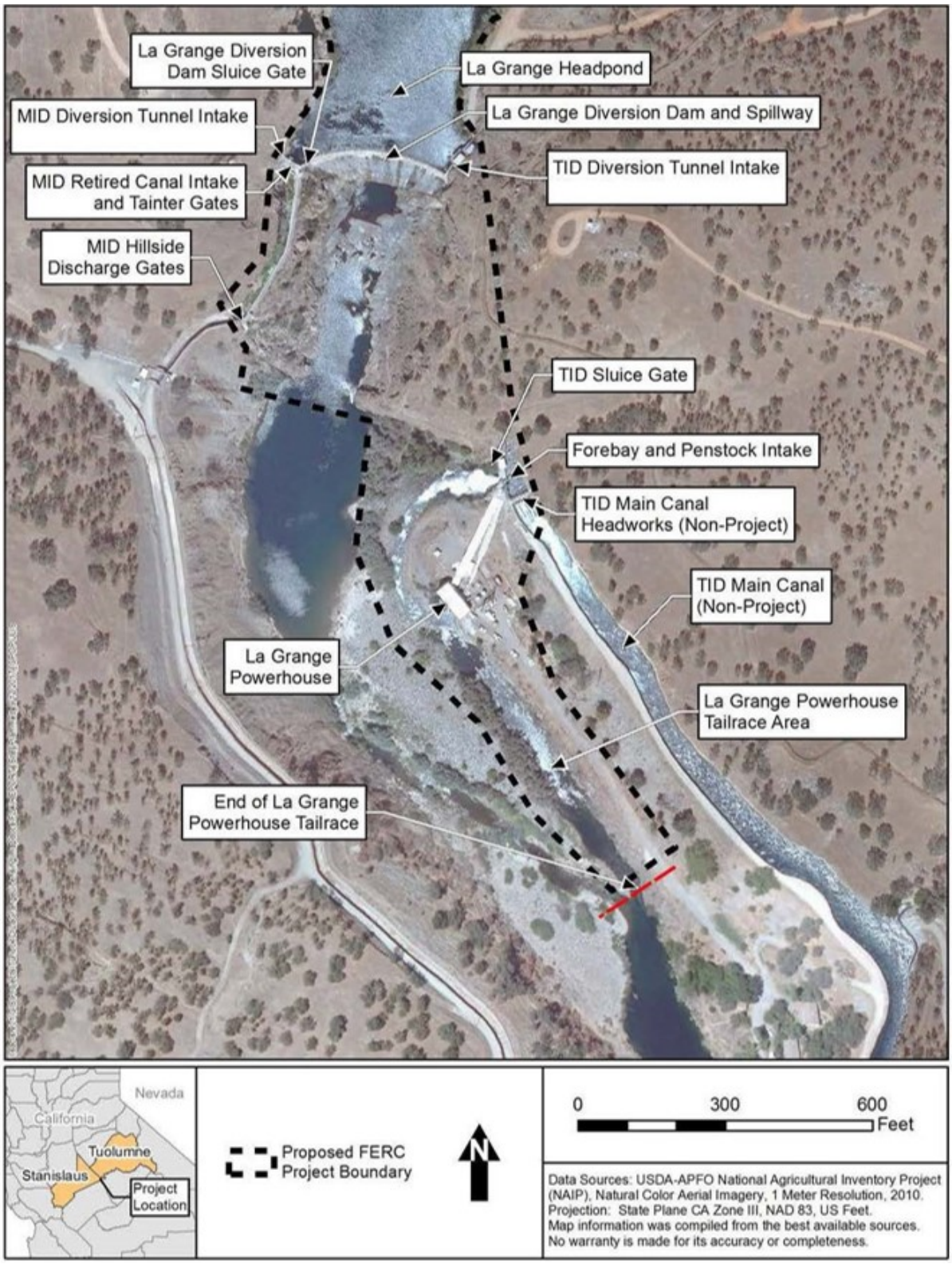

Figure 2.1.1-2. Location of major facilities and proposed project boundary for the La Grange Project (proposed boundary also includes the La Grange Reservoir) (Source: Districts, 2017b, as modified by staff).

the main dam; (13) recreational facilities on Don Pedro Reservoir, including Fleming Meadows, Blue Oaks, and Moccasin Point; and (14) appurtenant facilities and features including access roads.

2.1.1.2 La Grange Project

The La Grange Project consists of the following existing facilities: (1) a 310-foot-long, 131-foot-high, masonry arch diversion dam (La Grange Diversion Dam; (2) a reservoir with a total storage capacity of 400 acre-feet and a usable storage capacity of about 100 acre-feet; (3) the MID canal headworks, first 400 feet of the MID canal and "hillside" discharge gates (two 42-inch-diameter and one 60-by-60-inch) that are part of MID's retired irrigation canal facilities and are currently used to provide flows to the plunge pool downstream of the dam; (4) the TID irrigation intake and tunnel, which provides flow to the penstock intake structure and the headworks of the TID upper main canal; (5) a penstock intake structure containing a trashrack and three 7.5-foot-wide by 14-foot-tall concrete intake bays with manually operated gates and two automated 5-foot-high by 4-foot-wide sluice gates that can be used to discharge flow to the river via a sluice channel; (6) two penstocks leading to a powerhouse with two Francis turbine-generator units with a maximum combined generating capacity of 4.7 MW and a maximum combined hydraulic capacity of approximately 580 cfs; (7) a 700-foot-long excavated tailrace; and (8) a substation.

Because of maintenance and repair issues along the MID upper main canal, MID abandoned the upper portion of the canal on the west side of the dam and constructed a new intake and diversion tunnel to bypass this upper section. The new intake is located in the face of a cliff on the west bank, about 100 feet upstream of La Grange Diversion Dam. The intake and tunnel are not part of the La Grange Project. The first 400 feet of the MID canal is currently used to provide minimum flows to the pool below the La Grange Diversion Dam spillway.

2.1.2 Existing Project Boundary

2.1.2.1 Don Pedro Project

The existing project boundary for the Don Pedro Project encompasses all the project features and all lands necessary for the safe operation and maintenance of the project, and other project purposes, such as recreation, shoreline control, and protection of environmental resources. The existing project boundary slightly overlaps the proposed project boundary for the La Grange Project, and the Districts are proposing to correct that overlap (see section 2.2.2.1, *Proposed Project Boundary, Don Pedro Project*).

2.1.2.2 La Grange Project

The La Grange Project is currently unlicensed, and its project boundary will be established in any license that is issued for the project.

2.1.3 Project Safety

2.1.3.1 Don Pedro Project

The Don Pedro Project has been operating for more than 46 years under the existing license,[42] and during this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, every five years, the project has been inspected and evaluated by an independent consultant and a consultant's safety report has been submitted for Commission review. As part of the relicensing process, the Commission staff would evaluate the continued adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to ensure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.3.2 La Grange Project

As part of the licensing process for the previously unlicensed La Grange Project, the Commission would prepare a Safety and Design Assessment covering the adequacy of the project facilities. Special articles would be included in any license issued, as appropriate. Operational inspections would focus on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every five years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.1.4 Existing Project Operation

2.1.4.1 Don Pedro Project

Inflows to the Don Pedro Reservoir originate in 22 tributary rivers and creeks. Fourteen of the tributaries enter the Tuolumne River upstream of the project boundary and reservoir and eight flow directly into the reservoir within the project boundary.

The Don Pedro Reservoir provides 2,030,000 acre-feet of total water storage. The project uses that water storage to serve the following primary purposes and functions: irrigation, municipal and industrial water supply, and flood control. These uses are critical functions of the project. Other uses supported by the water storage and water

[42] The project was licensed in 1964 and commercial operation began in 1971.

supply of the project are: recreation; power generation; and protection of the downstream anadromous fishery.

The following sections provide more detail regarding the irrigation, municipal and industrial water supply, flood control functions, and fishery protection flows.

Irrigation

The project provides water for irrigation of over 200,000 acres of farmland in California's Central Valley served by the Districts. Combined, the Districts supply, on average, more than 900,000 acre-feet of irrigation water per year to their customers.

Municipal and Industrial Water Supply

MID provides treated water to the City of Modesto (population 210,000), and TID and MID jointly provide treated water to the community of La Grange. The Districts provide up to a maximum of 67,500 acre-feet of water per year for municipal and industrial use.

The Don Pedro Project receives inflow from CCSF's upstream Hetch Hetchy Water and Power System (Hetch Hetchy System), a series of reservoirs, diversion conduits, and powerhouses located on the upper Tuolumne River.[43] Consistent with the requirements of the Raker Act[44] and agreements between the Districts and CCSF, the project provides a "water bank" of up to 570,000 acre-feet of storage. The water bank allows CCSF to meet its need to satisfy the Districts' senior water rights by using the Don Pedro Reservoir to store water released from its upstream facilities. By using the allotted reservoir storage, CCSF can then divert water at times releases would have been required to satisfy the Districts' water rights. CCSF's water bank within Don Pedro Reservoir provides water for its 2.4 million customers in the Bay Area.

Flood Control

The project provides storage for flood management on the Tuolumne and San Joaquin Rivers. Following U.S. Army Corps of Engineers (Corps) guidelines, the Don Pedro Project provides up to 340,000 acre-feet of storage for flood control and adheres to

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[43] The Hetch Hetchy System, which is not a part of the licensed project, is owned and operated by CCSF pursuant to authority conferred in the Raker Act (38 Stat. 242 (1913)) and provides hydroelectric power and water supply. The Raker Act requires the Hetch Hetchy system to release a specified amount of water to the Districts. Section 29 of the FPA (16 U.S.C. § 823 (2006)) prohibits the Commission from modifying or repealing any provisions of the Raker Act.

[44] The Raker Act, passed by Congress in 1913, authorizes CCSF to build certain water and power facilities on federal lands and addresses the allocation of the waters of the Tuolumne River between the Districts and CCSF.

a flood control operations guideline in the Tuolumne River at Modesto of not exceeding 9,000 cfs. The Districts' most recent agreement with the CCSF for the storage of water in Don Pedro Reservoir, the Fourth Agreement, allows allocation of a portion of the 340,000-acre-foot flood control storage volume not reserved for flood control at any time to be available for conservation storage, split equally between the Districts and CCSF.

Fishery Protection Downstream of Don Pedro Dam

In 1995, the Districts entered into a settlement agreement (1995 Settlement Agreement) with the California DFW, FWS, CCSF, and four NGOs that provided for increasing flow releases from the Don Pedro Dam to improve conditions in the lower Tuolumne River for fall-run Chinook salmon. The Commission incorporated the flow provisions of the agreement into the Don Pedro Project license by order dated July 31, 1996.[45] The Districts agreed that certain flows released at the Don Pedro Dam would not be diverted at the La Grange Diversion Dam into the Districts' water supply conveyances, therefore allowing those flows to pass downstream of the La Grange Diversion Dam into the lower Tuolumne River.

Powerhouse Operations

Flow releases from the project are scheduled based on requirements for: (1) flood flow management, including pre-releases in advance of anticipated high flows in wet years, (2) the Districts' irrigation and municipal and industrial demands, (3) storage of up to 570,000 acre-feet of water to manage flow releases from the Hetch Hetchy System in compliance with agreements with CCSF, and (4) protection of aquatic resources in the lower Tuolumne River in accordance with the terms of the FERC license. Scheduled flow releases are generally provided first through the four turbine-generator units (up to 5,500 cfs) located in the Don Pedro Powerhouse. Flows are delivered to the powerhouse via the power tunnel, which has an inlet centerline elevation of 534.3 feet and connects to a manifold that feeds each unit. A bifurcation in the manifold passes flow to Unit 4 and/or to a hollow jet discharge valve. The valve discharge is limited to 800 cfs when Unit 4 is operating, but the valve can release up to 3,000 cfs when Unit 4 is not operating. Units 1, 2, and 3 discharge to the Tuolumne River directly from the powerhouse. Unit 4 discharges through a 190-foot-long, 13-foot horseshoe-shaped tunnel to the diversion tunnel, which discharges downstream of the powerhouse. An additional 7,500 cfs can be passed through the low-level outlet works tunnel that discharges downstream of the powerhouse. The gated spillway can release up to 172,500 cfs if reservoir water levels approach elevation 830 feet. If the reservoir water elevation exceeds 830 feet, up to 300,000 cfs can pass over the crest of the emergency ungated spillway (based on maximum elevation 850 feet).

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[45] *Turlock Irrigation Dist. and Modesto Irrigation Dist.*, 76 FERC ¶ 61,117 (1996).

When electrical demand is high, flow releases at the project may be increased to generate more electricity, subject to meeting the flow schedule requirements. These flow releases are limited by the small amount of usable storage available in the La Grange Reservoir, which is not sufficient to allow it to re-regulate variations in hourly outflows, and also by the capacity of the TID main canal. Outflows from the Don Pedro Powerhouse may vary by about 1,200 cfs between on-peak and off-peak periods, which can result in daily water fluctuations of about 1.8 inches in Don Pedro Reservoir.

During the winter, inflows are stored for water supply and only limited hydropower generation occurs. The releases during this period consist of releases to satisfy minimum flows to the lower Tuolumne River, provide water to fill downstream irrigation storage reservoirs, or to manage flood storage.

2.1.4.2 La Grange Project

The La Grange Project generates power using part of the flows released from the Don Pedro Project. Water released from Don Pedro Reservoir flows into La Grange Reservoir and is diverted into the TID and MID intakes and tunnels or passes over the spillway. Part of the flow that passes into the TID tunnel intake is then diverted at the forebay through the penstocks, leading to the powerhouse, which has an operating range of 100 to 580 cfs. The sluice gates adjacent to the penstock intakes can also be used to release flow into the tailrace. The rest of the flow to the forebay passes through the TID main canal intake structure at the forebay and flows through the canal. The Districts normally release a flow of about 5 to 10 cfs about 400 feet downstream of the La Grange Diversion Dam via hillside gates at the end of the retired MID intake canal.

2.1.5 Existing Environmental Measures

The Commission issued an order on July 31, 1996,[46] amending the Don Pedro Project license to incorporate the lower Tuolumne River minimum flow provisions contained in the 1995 Settlement Agreement. The revised summertime minimum flows range from 50 to 250 cfs, a substantial increase over the prior summertime minimum flow of 3 cfs; fall through winter minimum flows vary from 150 to 300 cfs, depending on water year type. The 10 water year type classifications are re-calculated each year to maintain approximately the same frequency distribution of water year types. The 1995 Settlement Agreement and license order also provide for the release of pulse flows, the volume of which also varies with water year type. The flow schedule provided for by the 1995 Settlement Agreement and subsequent license amendment is shown in table 2.1.5-1, and the volume of pulse flows provided by year are shown in table 2.1.5-2.

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[46] *Turlock Irrigation Dist. and Modesto Irrigation Dist.*, 76 FERC ¶ 61,117 (1996).

Table 2.1.5-1. Schedule of flow releases to the lower Tuolumne River by water year type contained in the Commission's 1996 order (Source: Districts, 2017a).

Schedule	Units	Critical and Below	Median Critically Dry	Interm. Critically Dry	Median Dry	Interm. Dry-BN	Median below Normal	Interm. BN-AN[a]	Median above Normal	Interm. AN-Wet	Median Wet/Max.
Occurrence[b]	%	6.4%	8.0%	6.1%	10.8%	9.1%	10.3%	15.5%	5.1%	15.4%	13.3%
October 1–15	cfs	100	100	150	150	180	200	300	300	300	300
	acre-feet	2,975	2,975	4,463	4,463	5,355	5,950	8,926	8,926	8,926	8,926
Attraction pulse	acre-feet	None	None	None	None	1,676	1,736	5,950	5,950	5,950	5,950
October 16–May 31	cfs	150	150	150	150	180	175	300	300	300	300
	acre-feet	67,835	67,835	67,835	67,835	81,402	79,140	135,669	135,669	135,669	135,669
Out-migration pulse flow	acre-feet	11,091	20,091	32,619	37,060	35,920	60,027	89,882	89,882	89,882	89,882
June 1–September 30	cfs	50	50	50	75	75	75	250	250	250	250
	acre-feet	12,099	12,099	12,099	18,149	18,149	18,149	60,496	60,496	60,496	60,496
Volume (total)	acre-feet	94,000	103,000	117,016	127,507	142,502	165,003	300,923	300,923	300,923	300,923

Note: BN – below normal, AN – above normal

[a] Between a median critical water year and an intermediate below normal-above normal water year, the precise volume of flow to be released by the Districts each fish flow year is to be determined using accepted methods of interpolation between index values.

[b] Actual occurrence of water year type over a 42-year period of record.

Table 2.1.5-2. Spring and fall pulse flow releases, 1996–2017 (Source: staff).

	Spring Pulse Flow		Fall Pulse Flow	
Year	**Acre-feet**	**Peak Flow (cfs)**	**Acre-feet**	**Peak Flow (cfs)**
1996	48,590	2,403	5,949	800
1997	89,882	1,511	5,950	600
1998	89,907	1,511	5,949	228
1999	84,928	4,500	6,302	226
2000	89,891	2,000	5,950	600
2001	36,367	1,085	2,331	200
2002	42,684	1,300	2,225	140
2003	32,619	420	1,736	235
2004	35,514	2,800	0	N/A
2005	43,225	1,417	5,950	200
2006	74,175	1,417	5,950	200
2007	14,365	392	0	N/A
2008	52,340	1,300	0	N/A
2009	39,887	930	9,352	700
2010	53,653	1,400	5,950	500
2011	48,887	1,417	5,950	800
2012	39,722	2,050	3,228	557
2013	20,091	1,150	5,482	600
2014	11,091	1,022	0	N/A
2015	11,091	1,372	0	N/A
2016	35,920	2,438	1,676	106
2017	89,882	2,993	5,950	600

The Districts have actively participated in studying, monitoring, protecting, and enhancing the fall-run Chinook salmon in the lower Tuolumne River. In accordance with the 1995 Settlement Agreement, the Districts have continued to monitor the fall-run Chinook salmon population and provided annual reports to all parties. The Tuolumne River Technical Advisory Committee (TRTAC)—consisting of the Districts, CCSF, environmental groups, California DFW, and FWS—was designated under the terms of the 1995 Settlement Agreement to be responsible for coordinating portions of the 1995 Settlement Agreement, reviewing annual studies on the fall-run Chinook salmon and *O. mykiss*[47] fisheries, and advising the Districts on adjustments to fisheries studies. TRTAC meetings are open to the public, allowing any interested party to participate. Numerous additional aquatic resource monitoring and evaluation studies have been undertaken from 1996 to the present time. In March 2005, the Districts prepared and filed a 10-year summary report covering environmental studies conducted from 1995 to 2004 (Districts, 2005). Annual studies and reports have been filed each year since then.

2.2 APPLICANTS' PROPOSAL

2.2.1 Proposed Project Facilities

2.2.1.1 Don Pedro Project

The Districts propose to install and operate two in-river infiltration galleries (IG-1 and IG-2) at approximately RM 25.9[48] just downstream of Fox Grove Park on the lower Tuolumne River. TID installed IG-1 in 2001 during the restoration of special-run pool-9 at RM 25.8 located below the Geer Road Bridge. IG-2 would be installed just upstream of IG-1. IG-1 has a design capacity of approximately 100 cfs, and IG-2 would have a capacity of 100 to 125 cfs. Water withdrawn at the infiltration galleries would be pumped to the TID water supply system via TID's Ceres Canal or other non-project facilities, reducing the amount that needs to be diverted at the La Grange Diversion Dam and allowing the Districts to provide additional summer flows to the 26-mile-long reach between the La Grange Powerhouse and the infiltration galleries (which provides important habitat for salmonids) without reducing water supplies.

The Districts also propose to upgrade the turbines and generators for units 1, 2, and 3. The existing authorized capacity of the project is 168,015 kilowatts (kW) and the

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[47] The term *O. mykiss* is used to represent both resident and anadromous (steelhead) life history forms of the species *Oncorhynchus mykiss*.

[48] Various locations are given for the infiltration galleries in Exhibit E and subsequent filings provided by the Districts (responses to additional information requests and reply comments), ranging from RM 25 to RM 26. Throughout this EIS we use RM 25.9 based on the location shown in figure 5.5-1, located on page 5-15 of the amended final license application for the Don Pedro Project.

proposal would increase the authorized capacity to 220,000 kW. The upgrades would increase the total maximum hydraulic capacity of the project from 5,530 cfs to 6,100 cfs. The upgrades would increase the average annual generation by about 20,000 MWh.

2.2.1.2 La Grange Project

The Districts do not propose to construct any new project facilities at the La Grange Project other than those proposed as environmental measures, described below.

2.2.2 Proposed Project Boundary

2.2.2.1 Don Pedro Project

The Districts propose to revise the project boundary to include some additional land associated with proposed structures and to remove other lands that are not needed for project purposes. On November 27, 2017, the Districts filed a modified Exhibit G-1 map to remove lands from the Don Pedro Project boundary that overlap with the proposed La Grange Project boundary. The Districts noted that the removed lands are not needed for project purposes of the Don Pedro Project.

2.2.2.2 La Grange Project

The Districts propose a project boundary that encompasses all project features and all lands necessary for the safe operation and maintenance of the project, and other project purposes, such as recreation, shoreline control, and protection of environmental resources.

2.2.3 Proposed Project Operation

2.2.3.1 Don Pedro Project

Proposed operation of the Don Pedro Project would be generally consistent with existing operations, although the Districts are proposing some flow-related measures to enhance aquatic and recreational resources. IG-1 has a design capacity of approximately 100 cfs. Proposed IG-2 would have a flow capacity of 100 to 125 cfs. The infiltration galleries would be operational starting June 1, except in years with high flows, and extend through October 15. The infiltration galleries would be turned off during certain summer weekends and holidays to provide greater recreational boating opportunities.

2.2.3.2 La Grange Project

Other than the minimum flow release of 5 to 10 cfs to the plunge pool downstream of the La Grange Diversion Dam described below, the Districts do not propose to make substantive changes to the operation of the La Grange Project.

2.2.4 Proposed Environmental Measures

2.2.4.1 Don Pedro Project

The Districts propose the following environmental measures:

- Reduce the minimum reservoir level for Don Pedro Reservoir from elevation 600 to 550 feet to make an extra 150,000 acre-feet of water available to meet water needs during extended drought conditions.
- Implement the Spill Prevention Control and Countermeasure Management Plan (filed as appendix E-3 of the Don Pedro amended final license application).
- Maintain the following minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources and accommodate recreational boating.

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)**
Water Year/Period	**RM 51.7 (La Grange Gage)[a]**	**RM 25.5**	**RM 51.7 (La Grange Gage)[a]**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[b]	150
July 1 through October 15	350	150[c]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75[c]	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)[a]	RM 25.5	RM 51.7 (La Grange Gage)[a]
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[a] U.S. Department of the Interior, Geological Survey (USGS) gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] Cease irrigation gallery withdrawals for one pre-scheduled weekend to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

[c] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July, or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

- Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7, with infiltration galleries shut off to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would be provided in wet, above normal, and below normal water years only.[49]
- Provide spring pulse flows in the following amounts to facilitate the outmigration of juvenile fall-run Chinook salmon from the lower Tuolumne River. The timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application.
    - Wet and above normal water years: 150,000 acre-feet
    - Below normal water years: 100,000 acre-feet
    - First dry water year: 75,000 acre-feet

[49] Flushing flows are proposed to occur only in these water year types, when they would have less effect on the amount of water available for consumptive use than they would in dry or critical water years.

- Dry water years following a dry or critical water year:[50] 45,000 acre-feet
- First critical water year: 35,000 acre-feet
- Critical water year following a dry or critical water year: 11,000 acre-feet

- Develop a spill management plan to maximize the benefits from the release of water that would be spilled or is in excess of other project needs, subject to the constraints of flood control, project safety, and water demands, to benefit fall-run Chinook salmon floodplain rearing, juvenile outmigration or adult upstream migration; in-channel rearing; riparian recruitment; and/or temperature management. The spill management plan would identify the preferred timing of releases, minimum durations, and preferred flow rates.
- Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5[51] to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat.
- Implement a predator control and suppression plan that includes sponsoring fishing derbies; reward-based angling; public outreach programs in local communities to promote fishing for black bass and striped bass; educational programs on the effects of predation on native salmonid populations; and removal and/or isolation of predatory fish via electrofishing, seining, fyke netting, and other collection methods to control and suppress striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir.
- Conduct a coarse sediment management program in the lower Tuolumne River between RM 39 and RM 52 over a 10-year period, including annual surveys of fall-run Chinook salmon and *O. mykiss*[52] spawning use of new gravel patches for five years following completion of gravel augmentation, and a spawning

[50] In their April 12, 2019 comments on the draft EIS, the Districts modified their proposal to reduce the flow volume allocated for spring pulse flows from 75,000 acre-feet to 45,000 acre-feet in dry years following a dry or critical water year (Districts, 2019a).

[51] The location of this facility is also stated as RM 25.7 at some places in the Don Pedro amended final license application.

[52] The term *O. mykiss* is used to represent both resident and anadromous life history forms of rainbow trout/steelhead, *Oncorhynchus mykiss*.

gravel evaluation in year 12, to improve spawning conditions for fall-run Chinook salmon and *O. mykiss*.

- Provide gravel mobilization flows of 6,000 to 7,000 cfs in the lower Tuolumne River downstream of La Grange Diversion Dam, during years when sufficient spill is projected to occur, to improve salmonid spawning habitat.
- Implement a fall-run Chinook salmon spawning superimposition[53] reduction program that includes the annual installation of a temporary barrier weir downstream of the new La Grange Bridge after November 15 to encourage spawning on less used suitable habitat.
- Conduct a five-year program of experimental gravel cleaning using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology, including monitoring interstitial fines before and after gravel cleaning, to improve the quality of salmonid spawning gravel in the lower Tuolumne River. Gravel cleaning would be conducted at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (RM 50.3) and Peaslee Creek (RM 45.5).
- Develop a plan to implement the Lower Tuolumne River Habitat Improvement Program (LTRHIP) and associated $38 million capital fund and annual funding accounts. The plan would address establishment of the fund account, management of the funds in the account, administration of the Tuolumne Partnership Advisory Committee (TPAC), guidance for selection of recommended enhancement projects by the committee, and the Districts' obligations with respect to the operation, maintenance, monitoring, and reporting associated with enhancement projects.
- Create the above-noted TPAC to provide recommendations on development and implementation of the spill management plan and the LTRHIP. The committee would consist of the Districts, FWS, and CCSF. Other parties, including NMFS and California DFW would be encouraged to participate in the committee as full members.
- Implement the Aquatic Invasive Species Management Plan (filed as appendix E-4 of the Don Pedro amended final license application) that includes measures to prevent the introduction and spread of aquatic invasive species.
- Make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years, subject to other

[53] Redd superimposition occurs when later arriving female salmonids dig redds on top of existing redds, which can result in mortality to incubating eggs.

requirements and constraints including flood control, water supplies, spill management, project safety, and rapidly changing weather patterns.

- Implement the Terrestrial Resources Management Plan (TRMP) (filed as appendix E-6 of the Don Pedro amended final license application) that includes measures for controlling non-native plant species, protecting special-status species, revegetating disturbed areas, protecting bald eagles from disturbance, excluding bats from project facilities, and reporting incidental observations of western pond turtles.
- Implement the Recreation Resource Management Plan (RRMP) (filed as appendix E-7 of the Don Pedro amended final license application) that includes measures to address existing and future recreation resource needs within the project boundary.
- Construct a new boat launch facility to provide boating access upstream of old Don Pedro Dam when reservoir levels are low.[54]
- Implement the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) that includes measures for the collection, storage, and disposal of woody material to minimize hazards to boating and other recreational uses in Don Pedro Reservoir.
- Provide a new boat take-out/put-in facility at RM 25.5 at the location of the fish counting/barrier weir.
- Install a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge.
- Annually notify BLM about the location and type of any project road maintenance projects on BLM lands and convene a meeting to confer on project details if requested by BLM.
- Implement the Fire Prevention and Response Management Plan (filed as appendix E-2 of the Don Pedro amended final license application) that includes procedures for fire prevention, reporting, and safe fire practices for project facilities.

[54] The final license application does not identify the proposed location; however, we assume the boat launch would be located on the northeast shoreline in the vicinity of the location of old Don Pedro Dam shown in figure 1.1.1-1. Old Don Pedro Dam, which was inundated when the new Don Pedro Dam was constructed, is located 1.6 miles upstream of new Don Pedro Dam.

- Implement the HPMP (filed as appendix E-8 of the Don Pedro amended final license application) that includes specific actions and processes to manage historic properties.

2.2.4.2 La Grange Project

The Districts propose the following environmental measures:

- Conduct dissolved oxygen (DO) monitoring in the La Grange Project forebay, immediately downstream from the powerhouse and at the lower end of the tailrace channel, from September 1 to November 30 each year for the first two years after license issuance. If results indicate that a specific cause for low DO exists, the Districts would develop and file an action plan in year 3 of the license.
- Provide a minimum flow of approximately 5 to 10 cfs from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam at all times to ensure consistent and adequate flow to support aquatic resources.
- Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice channel during powerhouse outages.
- Construct a foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir, including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow and reservoir elevation changes).
- Implement the HPMP filed on July 10, 2018, to manage potential effects on historic properties.

2.2.5 Modifications to Applicants' Proposal—Mandatory Conditions

In this final EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the ready for environmental analysis (REA) notice. We recognize that the Commission is required to include valid section 4(e) and section 401 conditions in any license issued for the project.

Section 4(e) Land Management Conditions

Don Pedro Project

The following revised mandatory conditions have been provided by BLM under section 4(e) and are included in appendix D. We consider conditions 1, 5, 10, 12, 19 through 31, 33, 34, 36 through 42, and 44 to be administrative, and BLM withdrew preliminary condition 12 on August 23, 2018; therefore, these conditions are not analyzed in this EIS. The remaining conditions are resource-specific and are analyzed in this EIS.

- Condition 2: Annually perform employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants,[55] and sensitive areas known to occur within or adjacent to the project boundary.
- Condition 3: Develop a BLM-approved soil erosion and sediment control plan for actions affecting BLM-managed land within or adjacent to the project boundary.
- Condition 4: Develop a BLM-approved burn plan for any large woody material (LWM) stored and burned on BLM-administered lands and make all reasonable efforts to prevent LWM from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry.
- Condition 6: Implement a BLM-approved Aquatic Invasive Species Management Plan.
- Condition 7: Implement a BLM-approved TRMP.
- Condition 8: Implement a BLM-approved Bald Eagle Management Plan.
- Condition 9: Annually consult with BLM to review lists of special-status plant and wildlife species.
- Condition 11: Coordinate an annual recreation meeting with interested resource groups to discuss the management, public safety, protection, and use of project recreational facilities and resources.
- Condition 13: Develop a BLM-approved Ward's Ferry/Tuolumne River Take-Out Management Plan.
- Condition 14: Implement a BLM-approved RRMP.
- Condition 15: Upon Commission approval, implement the final HPMP.[56]
- Condition 16: Develop a BLM-approved transportation system management plan for BLM-managed land within the project boundary.
- Condition 17: Develop a BLM-approved Fire Prevention and Response Management Plan.

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[55] The term non-native invasive plant is synonymous with invasive weeds, which is the term we use throughout this EIS.

[56] BLM condition refers to the "Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC." A final HPMP was filed on February 14, 2019.

- Condition 18: Develop a BLM-approved visual resources management plan for BLM-managed land within the project boundary.
- Condition 32: Implement pesticide use restrictions on BLM land.
- Condition 35: Consult with BLM if ground-disturbing activities on or directly affecting BLM land are proposed if such activities are not covered in this National Environmental Policy Act (NEPA) document.
- Condition 43: Develop a BLM-approved hazardous substances plan.

La Grange Project

The following preliminary mandatory conditions have been provided by BLM under section 4(e) and are included in appendix E. We consider conditions 1, 4, 10 through 22, 24, 25, 27 through 33, and 35 to be administrative and therefore not analyzed in our EIS. The remaining conditions are resource-specific and analyzed in this EIS.

- Condition 2: Annually perform employee awareness training to familiarize the Districts' Don Pedro Recreation Agency (DPRA) and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundary.
- Condition 3: Develop a BLM-approved soil erosion and sediment control plan for actions affecting BLM-managed land within or adjacent to the project boundary.
- Condition 5: Implement a BLM-approved TRMP.
- Condition 6: Annually consult with BLM to review lists of special-status plant and wildlife species.
- Condition 7: Upon Commission approval, implement the final amended HPMP that was included in the Districts' letter filed on July 10, 2018.[57]
- Condition 8: Construct and maintain the following recreational facilities on BLM land: (1) trail from parking area of La Grange Headquarters to the Tuolumne River; (2) kiosk near beginning of trail; and (3) two picnic tables located above floodplain near shore of the river.
- Condition 9: Develop a BLM-approved Bald Eagle Management Plan.
- Condition 23: Implement pesticide use restrictions on BLM land.

[57] BLM condition refers to the "Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC." A revised HPMP was filed on July 10, 2018.

- Condition 26: Consult with BLM if ground-disturbing activities on or directly affecting BLM land are proposed if such activities are not covered in this NEPA document.
- Condition 34: Develop a BLM-approved hazardous substances plan.

Water Quality Certification Conditions

The following preliminary mandatory certification conditions have been provided by the Water Board and are included in appendix F. These preliminary conditions apply to both the Don Pedro and La Grange Projects. We consider preliminary condition 11 to be administrative and therefore not analyzed in our EIS. The remaining conditions are resource-specific and analyzed in this EIS.

- Condition 1: The Water Board reserves the right to condition the project with minimum instream flows in light of the whole record.
- Condition 2: The Water Board reserves the right to determine criteria to classify water year types for the projects-affected reaches. Water year type classification criteria for affected waters downstream of La Grange Diversion Dam will likely be based on the San Joaquin Valley 60-20-20 Index.
- Condition 3: Develop a streamflow and reservoir level compliance plan to document compliance with streamflow and reservoir level requirements.
- Condition 4: Develop an LWM management plan to increase the amount of LWM downstream of La Grange Diversion Dam.
- Condition 5: Develop a sediment management plan to facilitate coarse and fine sediment transport past La Grange Diversion Dam in the Tuolumne River to improve downstream habitat.
- Condition 6: Develop a water quality monitoring plan.
- Condition 7: Develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects.
- Condition 8: Develop an aquatic invasive species management plan to minimize the spread and impact of aquatic invasive species on native fauna and habitats.
- Condition 9: Develop a soil erosion and sediment control plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by projects' operation and maintenance.
- Condition 10: Develop a hazardous material plan for storage, use, transportation, and disposal of hazardous materials in the projects' area.

2.3 STAFF ALTERNATIVE

2.3.1 Don Pedro Project

Under the staff alternative, the project would include many of the Districts' proposed measures with the exception of the following: the early-October annual flushing flow, the permanent fish counting/barrier weir, the predator control and suppression plan, the fall-run Chinook salmon spawning superimposition reduction program, the establishment of an LTRHIP fund account, the TPAC, the new whitewater boat take-out facility upstream of the Ward's Ferry Bridge, the new boat launch facility to provide boating access upstream of old Don Pedro Dam, and the new boat take-out/put-in facility at the proposed fish counting/barrier weir.

We do not recommend the early-October annual flushing flow because the volume of water proposed (1,000 cfs) is not likely sufficient to achieve the intended purpose of improving spawning gravel quality, and the proposed timing could cause adult Chinook salmon to migrate into the Tuolumne River before water temperatures are suitable. Instead, we recommend that this water be used later in the fall to promote the timely upstream migration of adult fall-run Chinook salmon, with the timing and shaping of the flow release to be determined via annual consultation with the fisheries agencies.

We do not recommend the predator control and suppression plan because decisions related to the control of predatory fish, which support recreational fisheries, are fishery management activities under the responsibility of state and federal resource agencies and not the Districts. We also do not recommend installation of the permanent barrier/counting weir, which could result in increased predation if measures to reduce the populations of predatory fish are not undertaken. Implementation of other habitat-related measures recommended by the resource agencies and staff (i.e., flow and gravel augmentation measures), however, would decrease the amount of available predator habitat (by providing flows above the most suitable range for predatory species) and increase the quality and quantity of available salmonid spawning habitat.

We do not recommend implementing the proposed fall-run Chinook spawning superimposition program because of the potential for injury to adult Chinook salmon from contact with the temporary barrier, which could also result in the "take" of federally listed California Central Valley steelhead (if present), and because other measures recommended by staff, including flows, gravel augmentation and cleaning, and implementation of habitat enhancement measures under the LTRHIP would increase the amount of available spawning habitat and reduce the risk of redd superimposition.

We do not recommend requiring the Districts to create a TPAC to guide implementation of the proposed spill management plan and LTRHIP because the Commission has no authority to require other agencies to participate in such a committee. Instead, we recommend that the Districts consult with appropriate federal, state, and local agencies in preparation of the spill management plan and the LTRHIP. We also do not recommend requiring that the Districts establish an LTRHIP funding account because the

Commission is concerned with protecting resources with specific enforceable provisions towards that end rather than requiring a licensee to provide a general funding source to be used at least in part, by entities over which the Commission has no authority and to fund unspecified measures and actions to which the Commission may or may not have control through a license. Instead, we recommend that the Districts identify and implement specific measures under the LTRHIP in consultation with federal, state, and local agencies and approved by the Commission. As license conditions, implementation of these measures would be the responsibility of the Districts and would be under the jurisdiction of the Commission.

We do not recommend the installation of a whitewater boat take-out facility upstream of Ward's Ferry as a license requirement because the proposed lifting platform does not address safety concerns related to hoisting heavy rafts in a confined area where they could be blown into each other while being hoisted and potentially swing into or fall onto recreationists in the narrow river canyon area below the platform. Instead, we recommend that the existing trails on both sides of the river be improved to facilitate hand-carrying rafts from the river. We also do not recommend construction of a new boat launch at Don Pedro Reservoir upstream of old Don Pedro Dam. The existing boat launches provide adequate boating access to Don Pedro Reservoir unless hydrologic conditions drier than those that occurred during the 42-year period of record occur in the future, which would likely be very infrequent. We also do not recommend that the Districts provide a new boat take-out/put-in to facilitate boat passage past the proposed fish counting/barrier weir, because we do not recommend construction of the weir.

The staff alternative also includes the following recommended modifications of the Districts' proposal and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project-related construction involving ground-disturbing activities authorized by the license that includes: (1) a description of best management practices (BMPs) to reduce the quantity of soil and sediment entering the river during construction; (2) provisions for inspecting erosion control measures; (3) emergency protocols for erosion and sedimentation control measure failure; (4) stabilization techniques that would be used once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during ground-disturbing activities and thereafter until soil conditions have stabilized.
- Modify the Districts' proposed coarse sediment management program to: (1) expand the reach where potential gravel augmentation sites would occur to extend downstream to RM 24.5; (2) require 75,000 tons of gravel to be placed at sites between RM 52 and RM 39, and 25,000 tons of gravel to be placed at sites between RM 39 and RM 24.5, for a total not to exceed 100,000 tons over

the duration of any license; (3) require filing of an implementation plan for the first group of gravel augmentation sites within one year of license issuance, after review and input from California DFW, NMFS, and FWS; (4) require filing of a summary report with the Commission in year 12 after license issuance presenting monitoring, mapping, and evaluation of projects conducted in the first 10 years, and based on the results of the monitoring, any recommendations for additional gravel augmentation at the initial sites or new augmentation sites; and (5) if any new gravel augmentation sites are recommended, require filing of a plan for Commission approval for the new gravel augmentation sites identified in the summary report.

Aquatic Resources

- Modify the proposed Spill Prevention Control and Countermeasure Management Plan in consultation with the Water Board, California DFW, FWS, NMFS, and BLM to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of equipment and procedures to be used to ensure containment and cleanup of any spilled hazardous substance; (3) a provision to notify the Water Board, California DFW, FWS, NMFS, and BLM within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.
- Develop a plan to monitor water temperatures at five sites in the lower Tuolumne River, in consultation with the Water Board, California DFW, FWS, and NMFS, to include: (1) real-time monitoring at the La Grange gage and a site near the temporary fish counting weir; (2) periodic monitoring in Don Pedro Reservoir near the dam whenever the reservoir elevation is lower than 700 feet; (3) a provision to make available to these agencies water temperature data from the La Grange gage and temporary fish counting weir in real time and Don Pedro Reservoir temperature according to the schedule defined in the plan; (4) a provision to file annual summary reports of all temperature monitoring conducted in each year; and (5) a provision to file a summary report after five years that includes any recommendations for adjusting future monitoring and any measures recommended to enhance water temperature conditions to benefit Chinook salmon and *O. mykiss* in the lower Tuolumne River.
- Develop a fall pulse flow release plan that would include provisions for: (1) the annual release of 5,950 acre-feet of water downstream of La Grange Diversion Dam to promote the upstream migration of Chinook salmon during

favorable instream thermal conditions; (2) annual consultation with the fisheries agencies to determine the timing and magnitude of flow releases; (3) annual monitoring of upstream passage at the temporary fish counting weir to assist the determination on the timing of the fall pulse flow releases to coincide with the upstream migration; (4) notification of the selected pulse flow release timing and magnitude to the Commission, and (5) a summary report after 10 years of monitoring to evaluate effectiveness and any recommended changes to the fall pulse flow release plan. These flows would be provided in wet, above normal, and below normal water years only.

- Modify the proposed spring pulse flows to include the floodplain rearing pulse flows provided in the draft Voluntary Agreement[58] to be implemented via the proposed spring pulse flow adaptive management plan (AMP)[59] in consultation with California DFW, NMFS, FWS and CCSF. The floodplain pulse flows would be timed to coincide with Chinook salmon springtime rearing, and would provide a flow of 2,750 cfs for 20 days in wet and above normal water years, 18 days in below normal water years, 14 days in dry water years, and 9 days in critical water years. When one or two below normal water years follow a single dry or critical water year, the duration of the floodplain rearing pulse flows would be reduced from 18 days to 14 days. In successive dry or critical water years, no floodplain rearing pulse flows would be provided, and floodplain rearing pulse flows would not resume until an above normal or wet water year occurs. Finally, if three successive below normal water years occur following a wet or above normal water year, the Districts, CCSF and California DFW would confer to determine whether any water is available for a floodplain rearing pulse flow.
- Modify the proposed spill management plan to include a provision for annual consultation with resource agencies to determine the preferred magnitude, duration, and timing of releases made under the plan and specific criteria for

[58] California DFW and California DWR submitted the draft Voluntary Agreement to the Water Board on March 1, 2019. The agreement would serve as a Tuolumne River-specific alternative to the Water Board's update to the Bay-Delta Plan.

[59] The AMP would use estimates of run timing based on counts from the temporary adult counting weir in conjunction with temperature monitoring data to model fish growth and estimate the timing of smoltification, and rotary screw traps would be used monitor effectiveness. After a period of 7 years, the results of the pulse flow management program would be assessed to determine adjustments in pulse flow triggers and duration, as well as whether other pulse flow management options should be considered.

evaluating whether project operations during the descending limb of the spring snowmelt runoff period reasonably mimic the natural hydrograph.

- Develop a drought management plan to include: (1) a definition of drought conditions based on available data specific to the project (e.g., current and projected storage in Don Pedro Reservoir, watershed snowpack and precipitation conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); (2) identification of license requirements (e.g., required flow-related measures) that may need a temporary variance to meet any critical shortfalls in water available for consumptive uses during drought conditions; and (3) a description of how available cool-water storage and instream temperatures would be incorporated into the proposed operational variances.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in any license issued for the projects.
- Modify the proposed LTRHIP to require incorporating a minimum of 6,535 cubic feet of large woody material into the design of the first group of habitat enhancement projects, anchored in a manner designed to provide the maximum sustained habitat benefit, and to eliminate the associated $38 million capital fund, annual funding accounts, and guidance of the plan by the TPAC.
- Modify the proposed Aquatic Invasive Species Management Plan to include: (1) educating recreational users on ways to reduce the spread of invasive species by providing signage and information pamphlets at designated public access sites and on websites used to provide the public with information on project facilities; (2) continuing the boater self-inspection permit program; (3) identifying project operation or maintenance activities that could result in the introduction, spread, or proliferation of aquatic invasive species, and the measures that would be used to control each species for which there is risk of spread or introduction; and (4) recording and communicating incidental observations of aquatic invasive species to BLM, FWS, and California DFW.

Terrestrial Resources

- Modify the proposed TRMP to include:
  - Conducting noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants and using manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources.
  - Implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road.

- Implementing BMPs to minimize potential for pesticides[60] to affect non-target species where project-related ground disturbance authorized by the license would involve heavy machinery within 300 feet of wetlands and riparian areas.
- Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, and BLM for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.
- Conducting surveys for special-status plants following California DFW protocols on project lands within the Red Hills Area of Critical Environmental Concern (ACEC) every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and where project-related disturbance is reasonably expected to occur.
- Installing interpretive signs about the unique plant communities on project lands within the Red Hills ACEC requesting recreationists to stay on trails.
- Conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c, and California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.
- Conducting a bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance; and resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting.

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[60] Pesticide refers to many kinds of chemicals intended to control, destroy, repel, or attract pests, including insecticides, herbicides, and rodenticides. The Districts use herbicides annually for vegetation management and rodenticides occasionally for ground squirrel management. The resource agency recommendations frequently reference "pesticides," which we interpret as meaning both herbicides and rodenticides. For the purposes of this EIS, the use of the term "pesticide" includes both herbicides and/or rodenticides.

- Reporting any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).
- Recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a).
- Describing specific project locations where the Districts' proposed rodent control activities could occur.
- Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols (FWS, 2011; FWS, 2003; and California DFW, 2008) prior to any rodent control or ground disturbance activities that could destroy potential burrows and implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox, burrowing owl, and California tiger salamander during other biological surveys for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.
- Implementing BMPs to protect California tiger salamander from project-related activities, which include conducting project-related ground disturbance or vegetation management within 300 feet of suitable California tiger salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions) and conducting project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15.
- Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander.
- Decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys on on all lands

within 0.25 mile of the shoreline of Don Pedro Reservoir, conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004) to identify areas where limited vegetation management operating periods[61] are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project lands are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

Recreation Resources

- Modify the proposed RRMP to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) a provision to invite BLM and other interested parties to an annual coordination meeting to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) conceptual drawings and descriptions of project recreation facilities that are consistent with the outcome of design review by BLM and would be constructed, reconstructed, or rehabilitated on BLM-managed land; (6) consultation with BLM to design visitor use surveys, to ensure data are collected about topics relevant to visitor use of project facilities on BLM-managed lands; (7) designation of the Fleming Meadows Visitor Center as a project recreational facility and a description of its operation and

[61] Limited operating periods include seasonal restrictions on vegetation maintenance or other activities that result in loud noises that would have potential to disturb nesting or winter roosting bald eagles, as described in the National bald eagle management guidelines (FWS, 2007)

maintenance; (8) identification of the access designation (i.e., public versus non-public) of adjacent non-project lands on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (9) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (10) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors, provide safe egress from the river for hand-carrying rafts, and reduce erosion and vegetation damage caused by user-created trails; (11) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir; (12) consultation with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day) and making information on the planned boating releases and the minimum flow schedule available to the public; and (13) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of project recreation facilities, including restrooms, that are currently in poor condition or do not meet accessibility guidelines, which includes proposed accessibility upgrades. The schedule should allow adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities.

- Modify the proposed Woody Debris Management Plan to include provisions requiring the Districts to maintain a valid burn plan for any woody material stored and burned on project land that is BLM-administered land and a description of the coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge. This measure would prevent large concentrations of wood from accumulating and becoming boating hazards and obstructing water surface and shoreline use.

Land Use and Aesthetics

- Modify the Fire Prevention and Response Management Plan to include information on fire history, references, results of fire occurrence analysis, permits, and use and storage of explosives, to ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.

- Develop a transportation system management plan to ensure proper annual and long-term maintenance of project roads and trails over the license term.

- Develop a visual resources management plan that addresses effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities.

Cultural Resources

- Implement the HPMP filed on February 14, 2019. However, any disputes regarding cultural resources will be resolved in accordance with the dispute resolution stipulation of the Programmatic Agreement (PA; filed on September 30, 2019) and not the process specified in the HPMP.

2.3.2 La Grange Project

Under the staff alternative, the project would include all the Districts' proposed measures, except for constructing a foot trail to the La Grange Reservoir as a license condition for the La Grange Project. Instead, we recommend this measure as a license condition for the Don Pedro Project because: (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway.

Under the staff alternative, the La Grange Project would include the following revisions to the proposed project and some additional measures:

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project-related construction involving ground-disturbing activities authorized by the license that includes: (1) a description of BMPs to reduce the quantity of soil and sediment entering the river during construction; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during ground-disturbing activities and thereafter until soil conditions have stabilized.

Water Quality

- Develop a plan in consultation with Water Board, California DFW, FWS, and NMFS to determine and effectively mitigate the La Grange Project's contribution to not meeting the Basin Plan DO objectives in the La Grange Powerhouse tailrace, which would include monitoring of DO and water temperature at 15-minute intervals supplemented with weekly observations of

aquatic vegetation and algae, providing annual reports and a final report after three years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objectives, proposed mitigation to address these low DO concentrations, and plans for monitoring the effectiveness for any measure(s) implemented to address La Grange powerhouse tailrace DO that does not meet Basin Plan objectives.

- Develop a spill prevention control and countermeasure management plan in consultation with the Water Board, California DFW, FWS, NMFS, and BLM to include: (1) a description of how oil, fuels, lubricant products, and other hazardous liquid substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of the equipment and procedures to be used to ensure containment and cleanup of any spilled hazardous substance; (3) a provision to notify the Water Board, California DFW, FWS, NMFS, and BLM within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure similar spills do not occur in the future.

Aquatic Resources

- Maintain a maximum downramping rate of 2 inches per hour as measured at the La Grange gage with exceptions allowed in the case of emergencies and as needed to meet flood control requirements.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in any license issued for the projects.
- Develop an aquatic invasive species management plan to include: (1) a provision to educate recreational users on ways to reduce the spread of aquatic invasive species by providing signage and information pamphlets at designated public access sites and on websites that provide the public with information on project facilities; (2) identification of project operation and maintenance activities that could result in the introduction, spread, or proliferation of aquatic invasive species, and the measures that would be used to control each species for which there is at risk of spread or introduction; (3) a provision to consult with California DFW and BLM if aquatic invasive species are discovered within the project boundary; and (4) a provision to record and communicate incidental observation of aquatic invasive species to BLM, FWS, and California DFW.

Terrestrial Resources

- Develop a TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operation and maintenance activities within the La Grange Project boundary to include:
  - Conducting a noxious weed survey of the La Grange Project in the first year of license issuance and every five years, with noxious weed surveys focusing on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control methods where feasible (instead of pesticides), in areas with sensitive resources.
  - Implementing BMPs to minimize potential for pesticides[62] to affect non-target species where project-related ground disturbance authorized by the license would involve heavy machinery within 300 feet of wetlands and riparian areas.
  - Conducting a survey for special-status plants on project lands following California DFW protocols (California DFW, 2018e) at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and preparing a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance.
  - Conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c, and California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.
  - Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, and BLM for the purpose of tracking the status of occurrences in areas where project

[62] Pesticide refers to many kinds of chemicals intended to control, destroy, repel, or attract pests, including insecticides, herbicides, and rodenticides. The Districts use herbicides annually for vegetation management and rodenticides occasionally for ground squirrel management. The resource agency recommendations frequently reference "pesticides," which we interpret as meaning both herbicides and rodenticides. For the purposes of this EIS, the use of the term "pesticide" includes both herbicides and/or rodenticides.

operation and maintenance occur and inform the need for additional protection measures.

- Conducting a bat survey of the La Grange Project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance, to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting.
- Reporting any sick or dead bat found at the La Grange Project to California DFW and FWS as soon as possible; following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).
- Recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a).
- Recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project boundary, and developing protective measures.
- Decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.
- Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, in accordance with FWS protocols (FWS, 2011) prior to any ground disturbance activities that could destroy potential burrows; implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox during other biological surveys for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures
- Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander.

- Implementing the following BMPs to protect California tiger salamander during project-related construction in suitable habitat: (1) conduct project-related ground disturbance or vegetation management within 300 feet of suitable salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions); (2) conduct project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15; (3) provide training by a qualified biologist for all contractors, work crews, and on-site personnel; (4) inspect all construction pipe, culverts, or similar structures that are stored at the construction site for one or more overnight periods before the pipe is subsequently moved, buried, or capped, and if during inspection a salamander is discovered inside a pipe, refrain from moving that section of pipe until the biological monitor follows FWS protocols to safely move the animal; (5) inspect all vehicles and equipment for the presence of salamanders prior to moving, and if a salamander is found, follow FWS relocation protocols; (6) at the end of each work day, cover all excavated, steep-walled holes or trenches with plywood or similar materials or provide one or more escape ramps constructed of wooden planks, inspect such holes or trenches for trapped animals prior to filling, and if at any time a trapped salamander is located, cease all work in the immediate area until the biological monitor follows FWS protocols to safely move the animal; (7) refrain from using monofilament netting for erosion control measures in suitable habitat, and instead, use tightly woven (less than 0.25-inch diameter) biodegradable fiber netting or biodegradable coconut coir matting; and (8) provide a qualified biological monitor to monitor work sites to ensure BMPs are implemented.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys on suitable habitat within 0.25 mile of the project boundary, conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004) to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project lands are needed; and (6) consultation with FWS and California DFW to

identify suitable protective buffers on project lands around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a fire prevention and response management plan to ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.

Cultural Resources

- Implement the HPMP filed on July 10, 2018. However, any disputes regarding cultural resource wouls be resolved in accordance with the dispute resolution stipulation of the PA (filed on September 30, 2019) and not the process specified in the HPMP.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

In this final EIS, we analyze revised conditions filed by BLM and preliminary conditions filed by the Water Board in response to the REA notice. We recognize that the Commission is required to include valid section 4(e) conditions and section 401 conditions in any license issued for the project.

2.4.1 Don Pedro Project

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) annually perform employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundary (BLM Don Pedro revised 4(e) condition 2); (2) annually consult with BLM to review lists of special-status plant and wildlife species (BLM Don Pedro revised 4(e) condition 9); (3) develop a Ward's Ferry Ward's Ferry/Tuolumne River take-out management plan (BLM Don Pedro revised 4(e) condition 13); (4) implement pesticide use restrictions on BLM land (BLM Don Pedro revised 4(e) condition 32); (5) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM Don Pedro revised 4(e) condition 35); (6) provide minimum instream flows to be specified by the Water Board (Water Board preliminary 401 conditions 1 and 2); (7) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (8) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (9) develop a plan to minimize undesirable erosion or sedimentation

conditions near river reaches and reservoirs caused by the project (Water Board preliminary 401 condition 9).

In any license issued for the project, these mandatory conditions would replace the following environmental measures that we include in the staff alternative: (1) implement the staff-recommended minimum flows, floodplain rearing pulse flows, spring outmigration pulse flows, fall pulse flows, gravel mobilization flows, and boating flows for the duration of any license; (2) develop a water temperature monitoring plan; and (3) improve and maintain shoreline access trails on each side of Ward's Ferry Bridge.

2.4.2 La Grange Project

The staff alternative with mandatory conditions includes staff-recommended measures along with the mandatory conditions that we did not include in the staff alternative: (1) provide for annual environmental training of employees and contractors, rather than bi-annual as proposed (BLM La Grange preliminary 4(e) condition 2); (2) annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM in the project area (BLM La Grange preliminary 4(e) condition 6); (3) implement pesticide use restrictions on BLM land (BLM La Grange preliminary 4(e) condition 23); (4) if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity (BLM La Grange preliminary 4(e) condition 26); (5) develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches (Water Board preliminary 401 condition 6); (6) develop a water temperature monitoring plan to monitor potential effects on water temperature from the projects (Water Board preliminary 401 condition 7); and (7) develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the project's operation and maintenance (Water Board preliminary 401 condition 9).

In any new license issued for the project, these mandatory conditions would replace the following environmental measure that we include in the staff alternative: develop a plan in consultation with the Water Board, California DFW, FWS, and NMFS to determine and mitigate the extent of project-caused low DO in the La Grange Powerhouse tailrace.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We considered several alternatives to the applicants' proposals to relicense the Don Pedro Project and to issue an original license for the La Grange Project but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are: (1) issuing a non-power license; (2) federal government takeover of the projects; and (3) retiring the projects.

2.5.1 Issuing a Non-Power License

A non-power license is a temporary license that the Commission will terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license for either project, and we have no basis for concluding that the projects should no longer be used to produce power. Thus, we do not consider issuing a non-power license a realistic alternative to licensing either project in this circumstance.

2.5.2 Federal Government Takeover of the Projects

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the Don Pedro and La Grange Projects would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the projects.

2.5.3 Retiring the Projects

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of the relicense and original license applications and surrender or termination of the existing license for the Don Pedro Project with appropriate conditions. No participant has suggested that dam removal would be appropriate in this case, and we have no basis for recommending it. Don Pedro Dam and the La Grange Diversion Dam and associated reservoirs serve other important purposes including recreation, consumptive water supply, and flood control, regardless of whether power is produced. Thus, dam removal is not a reasonable alternative to licensing the projects with appropriate protection, mitigation, and enhancement measures.

The second project retirement alternative would involve retaining the dams and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the power supplied by the projects is needed, a source of replacement power would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, historical and current conditions are first described. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[63]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Tuolumne River originates in the Sierra Nevada Mountains in Yosemite National Park and after nearly 8,600 feet of elevation drop converges with the San Joaquin River 150-miles downstream (see figure 3.1-1). The Tuolumne River Watershed covers 1,960 square miles and encompasses a range of climates and hydrologic conditions. Precipitation within the watershed varies from greater than 60 inches at the higher elevations to 12 inches in the lower valley. Within the Don Pedro Project boundary, annual precipitation ranges from 25 to 40 inches and the summer months are hot and dry.

Runoff from the upper basin into Don Pedro Reservoir occurs from April to July with an annual mean of 1.9 million acre-feet minus the out-of-basin diversions by CCSF for municipal and industrial purposes. The watershed's runoff experiences considerable variability and has varied from 382,000 acre-feet in water year 1977 to 4.6 million acre-feet in water year 1983.

The Tuolumne River has three major water diversions—O'Shaughnessy Dam (RM 118) and Early Intake Diversion Dam (RM 105), which are associated with CCSF's Hetch Hetchy System, which generates 1,700,000 MWh of electricity and provides 85 percent of its municipal and industrial water supply annually, and La Grange Diversion Dam (RM 52.2), which is owned by the Districts and diverts water flows downstream of Don Pedro Dam for irrigation, power, and municipal and industrial purposes.

[63] Unless otherwise indicated, our information is taken from the amended application for the Don Pedro Project and the final license application for the La Grange Project (Districts, 2017a,b) and additional information filed by the Districts (Districts, 2017e,f; 2018a,b).

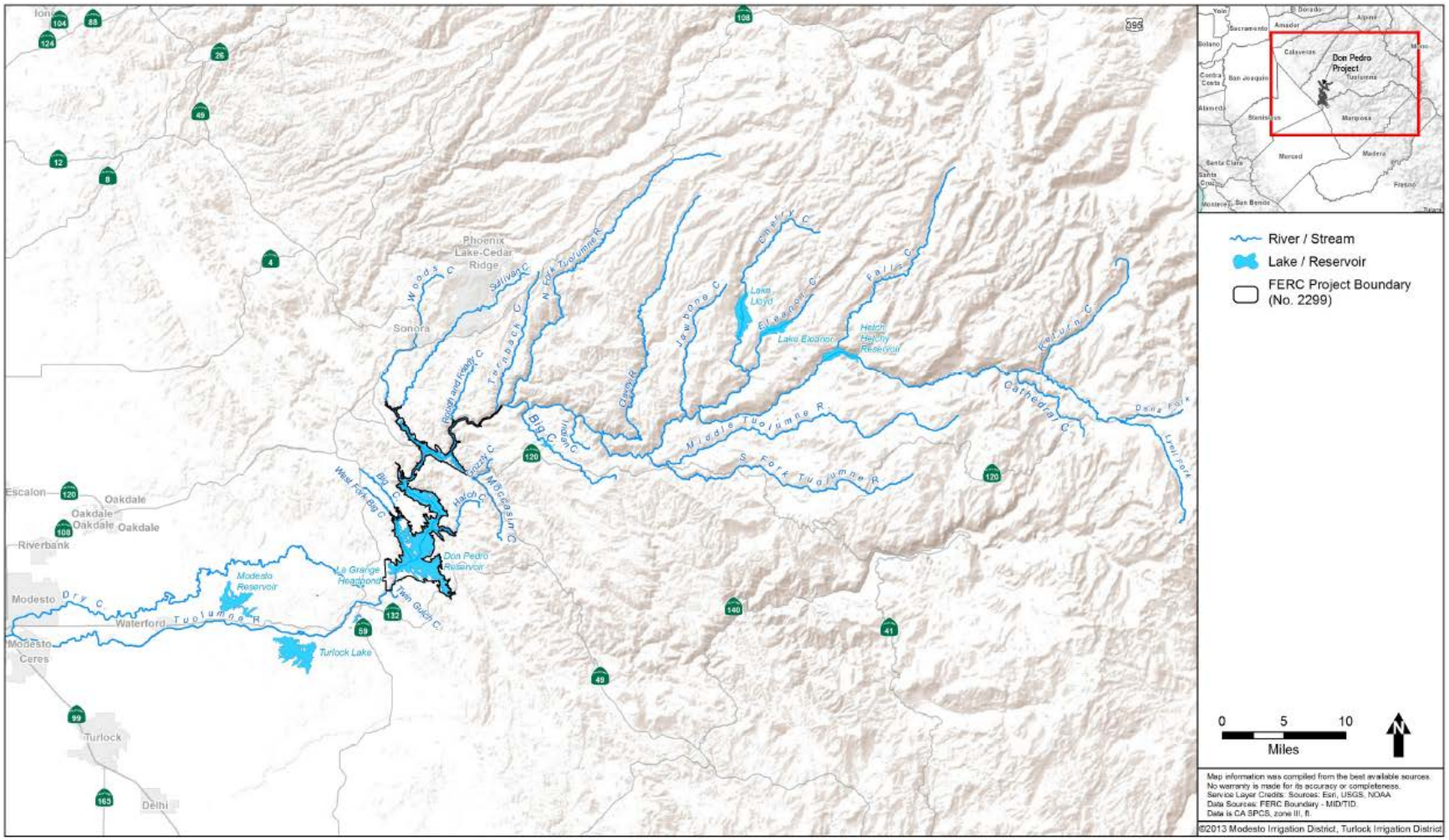

Figure 3.1-1. Tuolumne River Basin (Source: Districts, 2017a).

Lands within the Tuolumne River Basin vary by use and ownership. Above the Don Pedro Project, lands are primarily federally managed by the Park Service, Forest Service, and BLM with small communities and dispersed individual residences with non-irrigated farmland composing the private lands. Lands within and adjacent to the project boundary are primarily District owned, while the balance falls within BLM's Sierra Resource Management Area. Downstream of the Don Pedro Project to the Central Valley, lands are primarily private and used for agriculture, grazing, and residential purposes.

Within Tuolumne County, where the Don Pedro Project is located, the economy is driven by social services, recreation and tourism, retail trade, and construction. The main employers in the county are the Department of Corrections, Sonora Regional Convalescent Home, and Sonora Regional Hospital.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing NEPA (40 CFR § 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we identified geomorphology (including coarse sediment supply, substrate composition, and channel shape), water quantity, water quality, aquatic resources (including anadromous fish and EFH), recreation, and socioeconomics as having the potential to be cumulatively affected by the proposed projects in combination with other past, present, and foreseeable future activities.

The following past, current, and foreseeable actions or activities in the San Joaquin Basin may contribute to cumulative effects in the basin:

- historical gold mining and more recent aggregate mining activities in many tributaries, including the Tuolumne River and its tributaries;
- construction of dams and diversions to provide water for consumptive use, retention of sediment, and hydropower production;
- diversions of water for consumptive use, including upstream diversions to supply water to the City and County of San Francisco via the Hetch Hetchy System and large-scale diversions in the Delta;
- agricultural production (including irrigation diversions and return flows);
- historical levee construction along the lower Tuolumne River;

- planned facility improvements and actions of the State Water Project (SWP) and federal Central Valley Project that would affect environmental resources in the Bay Delta;[64] and
- proposed amendments to the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan), which would establish San Joaquin River flow objectives to protect fish and wildlife and southern Delta salinity objectives for the protection of agriculture.[65]

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively affected resources defines the physical limits or boundaries of the effects of the proposed action on the resources. Our geographic scope of analysis for cumulatively affected resources is defined by the physical limits or boundaries of: (1) the proposed action's effect on the resources, and (2) contributing effects from other hydropower and non-hydropower activities within the San Joaquin Basin including storage and diversion of water to CCSF at the upstream Hetch Hetchy Dam and reservoir and flow diversions in the Delta. Because the proposed action can affect resources differently, the geographic scope for each resource may vary.

For water quantity, water quality, aquatic resources, and socioeconomics, we define the geographic scope as extending from the upstream Hetch Hetchy Dam on the

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[64] California DWR is pursuing the Delta Conveyance Project for a single tunnel to modernize and rehabilitate the SWP distribution system, and the U.S. Bureau of Reclamation is considering an option to include this new system in the federal Central Valley Project.

[65] The Water Board released a final proposal to amend the Bay-Delta Plan and released a final substitute environmental document on July 6, 2018 (Water Board, 2018c); received oral public comments on the topic on August 21 and 22, 2018; and responded to them, and adopted amendments to the Bay-Delta Plan pursuant to Resolution No. 2018-0059 on December 12, 2018. These amendments include a requirement for 40 percent of unimpaired flow, within a range of 30 to 50 percent, and seek to incentivize agreements that offer habitat restoration and other measures that can benefit fish and wildlife with less water, rather than just water alone. The California Office of Administrative Law approved Water Board Resolution No. 2018-0059 on February 25, 2019; however, EPA has not yet approved this amendment. The documents referenced above are available through the combination of the Water Board web pages, available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2018_sed/ and https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/.

Tuolumne River downstream to San Francisco Bay. For geomorphology, we define the geographic scope as extending from the upstream Hetch Hetchy Dam on the Tuolumne River downstream to the confluence of the Tuolumne and San Joaquin Rivers. For recreational resources, we define the geographic scope as extending from the upper extent of Don Pedro Reservoir downstream to the confluence of the Tuolumne and San Joaquin Rivers.

3.2.2 Temporal Scope

The temporal scope of analysis includes a discussion of the past, present, and future actions and their effects on geomorphology, water quantity, water quality, aquatic resources, recreation, and socioeconomics. Based on the potential term of a license, the temporal scope looked 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion is limited, by necessity, to the amount of available information for each resource. We identified the present resource conditions based on the license application, agency comments on the draft license application, comprehensive plans, and other publicly available information.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the specific site-specific and cumulative environmental issues. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geologic and Soil Resources

3.3.1.1 Affected Environment

Geologic and Physiographic Setting

The Don Pedro and La Grange Projects are located near the western margin of the Sierra Nevada Mountains, a major mountain chain that is 400 miles long and runs south-southeast to north-northwest in eastern California. The Sierra Nevada crest forms the eastern limit of the Tuolumne River Basin. The projects are located in the Western Sierra Nevada Metamorphic Belt within the Sierra Nevada Block, a 400-mile-long, 40- to 80-mile-wide, tilted fault block, trending north-northwest. The block includes the broad region of foothills along the western slope of the Sierra Nevada Mountains.

The Western Sierra Nevada Metamorphic Belt is divided into three bedrock subunits—the Western, Central, and Eastern belts. The Don Pedro and La Grange

Projects overlie the Central Belt. The Central Belt is characterized by ultramafic[66] igneous rocks and metamorphosed volcanic and sedimentary sequences of the Paleozoic and Mesozoic eras. Surficial deposits overlie the bedrock units; they consist primarily of colluvial soils and local alluvium in the drainage areas.

Regional uplift and tilting of the Sierra Nevada Block reorganized the drainage networks of the western Sierra Nevada Mountains and initiated a period of sustained channel incision. The Tuolumne River Basin is characterized by high steep-sided ridges and a parallel drainage network consisting of narrow valleys and small tributaries with low sediment loads. The modern Tuolumne River began incising 5 million years ago with existing foothill channels striking perpendicular to ancient channels, leaving the deposits of ancient channels as upland gravels.

Faulting and Seismicity

The western margin of the Sierra Nevada Mountains contains the Foothills Fault System, a dominant structural feature that developed during the Jurassic and Cretaceous periods. The Foothills Fault System is a braided complex of north-northwest-striking fault segments with mineralized zones. Nearby fault segments were reactivated during the Cenozoic era; some were reactivated as recently as during the Quaternary period (1.8 million years ago to the present). The Cleveland Hill Fault, located about 134 miles northwest of the projects, was a previously unmapped fault zone that ruptured during the Oroville earthquake on August 1, 1975. The previously unmapped Cleveland Hill Fault is an extension of the Foothills Fault System (Corps, 1977).

Several faults and shear zones are present within the Foothills Fault System. These faults transect the vicinity of the projects and include, from southwest to northeast, the Bear Mountains Fault, the Bowie Flat fault, and the Melones Fault. All of these faults are classified by the California Divisions of Safety of Dams as *conditionally active*. Both the California Division of Mines and Geology and the California Geological Survey do not classify these faults as active because they have not displayed movement within Holocene time (i.e., 11,400 years). Several unnamed faults that are part of the Bear Mountains Fault Zone cross the Tuolumne River within the La Grange Project. The minor Bowie Flat Fault crosses the Don Pedro Reservoir.

A seismicity and ground motion study performed for Don Pedro Dam in November 1992 found that earthquakes from faults less than 6 miles from the dam control the maximum ground motion observed, rather than more distant (more than 50 miles from the dam) active regional faults such as the San Andreas and Sierra Nevada frontal faults (Bechtel Corporation, 1992). HDR and Geomatrix (2000) agree with that assessment but recommend that a maximum earthquake of magnitude 6.5 (compared to

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[66] Rocks with a low silica content and rich in minerals such as hypersthene, augite, and olivine.

magnitude 6.25 in the 1992 Bechtel Corporation report) be assigned to the fault traces in the Foothills Fault System. This report classifies all the faults in the system as *conditionally active* and considered the Gillman Gulch Fault, located within the Bear Mountains Fault Zone, as being the controlling fault source. Earthquake ground motions were estimated assuming a maximum earthquake of magnitude 6.5; median bedrock peak ground accelerations were estimated using two available ground motion attenuation models (Sadigh et al., 1997; Abrahamson and Silva, 1997). Using those models, the reported peak ground accelerations for the Don Pedro Project ranges from 0.50 g to 0.60 g.

The largest earthquake that has occurred along a segment of the Foothills Fault System was the August 1, 1975, Oroville earthquake (Richter magnitude of 5.7), 136 miles northwest of the La Grange Diversion Dam. No major earthquakes have occurred within 60 miles of the projects in recorded history.

Mineral Resources

Gold mining started in the mid-1800s and was the dominant mineral resource activity near the projects. After more accessible gold deposits in riverbeds and alluvial gravels were depleted, extensive hydraulic and dredge mining operations were introduced. The use of high-pressure jets to extract gold-bearing deposits transported sediment into river channels affecting their morphology and resulting in extensive deposits along the riverbanks. Gold mining declined sharply in the late 1940s. Many abandoned and active mines are scattered throughout the Tuolumne River Basin. Mercury, which was used for gold extraction at the time, remains sequestered in sediments within the region and continues to be a potential source of pollution to the Tuolumne River.

In addition to gold, marble and limestone products were also extensively mined in the vicinity of the projects. The Columbia marble beds northwest of the projects have had a long history of production prior to 1941; two operations are currently processing stone from these deposits. The area also contains deposits of copper, soapstone, scheelite, platinum, silver, sulfur, decorative stone, slate, sand, and gravel.

Large-scale, in-channel aggregate mining began in the Tuolumne River corridor in the 1940s, when aggregate mines extracted sand and gravel directly from large pits located within the active river channel. Legacy pits from these in-channel mining practices remain today. More recent aggregate mining operations have excavated sand and gravel from floodplains and terraces immediately adjacent to the main river channel. Floodplain and terrace pits are typically separated from the main river channel by berms. The gravel mining reach of the lower Tuolumne River (RM 40.3 to 34.2) is currently the focus of development by commercial aggregate producers.

Soils

Soils near the projects are shallow and excessively to well drained. The dominant soil associations are the Whiterock-rock outcrop-Auburn association (71 percent), the Rock outcrop-Henneke-Delpiedra association (18 percent), and the Sierra-rock outcrop-Auberry-Ahwahnee association (8 percent). The Whiterock-rock outcrop-Auburn association is one of the more extensive associations in the foothills of the Sierra Nevada Mountains; it typically develops in tilted slate, amphibolite schist, and partially metamorphosed sandstone formations.

Erosion hazards within the project boundary of the Don Pedro and La Grange Projects are low. Most of the slopes adjacent to the Don Pedro Reservoir and the downstream areas of the Tuolumne River above La Grange Diversion Dam are characterized by intact rock, rubble, or boulder that are not prone to erosion. The land surrounding the La Grange Reservoir is mostly undeveloped. The reservoir is contained within a canyon reach of the Tuolumne River with heavily armored or rock-outcrop shorelines.

Erosion from overland flow in the project vicinities typically occurs on steep soil slopes in excess of 30 degrees. The highest erosion hazards near the projects are associated with the large drainages upstream of the Don Pedro Reservoir (e.g., Hatch Creek and Big Creek). High seasonal flows (i.e., floods) can result in bank erosion along streambanks. Upstream of Don Pedro Reservoir, a large flood in 1997[67] resulted in substantial accumulation of sediment (30 feet deep) near Ward's Ferry Bridge (RM 78) in the upper end of the reservoir.

Stream Geomorphology

Coarse sediment supply and bedload transport capacity govern morphological responses in river channels, including sediment storage, channel form, and bed surface texture. The Tuolumne River channel upstream, within, and downstream of the Don Pedro and La Grange Projects has been substantially altered from its historical state by dredging associated with gold and aggregate mining, dam and reservoir construction, and reduction in peak river flows. Prior to these actions, the Tuolumne River in the project area was a complex river system consisting of single-thread and spilt channels that migrated and avulsed. Over time, these channels became simplified as sediment excavated from the river was placed alongside the river channel, raising the floodplain and depleting the channels of sediment. A large amount of aggregate mining, primarily of sand and gravel, has occurred within the active river channel, creating large in-channel pits, commonly referred to as special run pools (SRPs). These SRPs can be as much as 400 feet wide and 35 feet deep. Agricultural and urban encroachment, in combination

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[67] Peak outflow of the 1997 event was about 59,400 cfs (recurrence interval of 319 years).

with a reduction in coarse sediment supply and high flows, has resulted in a relatively static river channel downstream of the projects.

Most of the Tuolumne River channel upstream of Don Pedro Reservoir is transport-dominated.[68] The river's gradient is steep, and it generally flows through resistant parent material (exposed granitic bedrock) with lateral and vertical control provided by bedrock. The Tuolumne River Watershed upstream of CCSF's reservoirs does not appear to generate large amounts of sediment. As a result, the volume of trapped sediment in the reservoirs of the Hetch Hetchy System is comparatively low. For example, while sediment accumulation rates in upper Sierra Nevada lakes typically vary based on their size, Hetch Hetchy Reservoir likely accumulates no more than six inches of sediment per 1,000 years (Null, 2015). Lake Eleanor along Eleanor Creek was a natural lake prior to being enlarged by Eleanor Dam; therefore, the sediment accumulation rate in the reservoir is likely similar to pre-dam conditions. Coarse sediment also accumulates in the Poopenaut Valley downstream of Hetch Hetchy Dam because of low stream gradient and downstream valley constrictions. Further downstream, Early Intake Dam is not a permanent sediment trap, as sediment is allowed to pass through the dam via sluice gates. However, CCSF acknowledges that it is reasonable to conclude that only Cherry Valley Dam, which impounds Cherry Creek above the Eleanor Creek confluence, could meaningfully change pre- versus post-dam coarse sediment delivery below CCSF's impoundments and conceivably show a downstream geomorphic response, because there are no known natural coarse sediment sinks within pre-dam Cherry Valley.

Downstream of La Grange Diversion Dam, the Tuolumne River leaves the steep and confined bedrock valley and enters the eastern Central Valley, where hillslope gradients near the river corridor are typically less than 5 percent. From the La Grange Diversion Dam to the San Joaquin River, the Tuolumne River is divided into two broad geomorphic reaches defined by channel slope and bed composition—a gravel-bedded reach that extends from La Grange Diversion Dam (RM 52.2) to Geer Road Bridge (RM 24) and a sand-bedded reach that extends from Geer Road Bridge to the Tuolumne River's confluence with the San Joaquin River west of Modesto, California.

Channel surveys downstream of La Grange Diversion Dam indicate channel downcutting, widening, armoring, and localized depletion of sediment storage features (e.g., lateral bars and riffles). Bedload impedance reaches[69] were identified from

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[68] Transport-dominated channels refer to reaches in a stream where the gradient is usually high enough to supply the energy to transport sediment and where the transport capacity is greater than the sediment supply. As a result, sediment does not accumulate in such reaches, but is transported through them over time.

[69] Locations where current hydraulic conditions are insufficient to transport coarse bed material (typically material with a diameter greater than 0.16 inch).

La Grange Diversion Dam to the confluence of the San Joaquin River. These reaches are primarily associated with former instream aggregate extraction areas (e.g., SRPs) and gold dredger pits.

The Tuolumne River has been subject to large amount of levee construction along the lowermost river reaches between approximately RM 25 and the confluence with the San Joaquin River. These levees have contained the river to its channel except under the highest of flows.

Sediment Processes in the Tuolumne River upstream of La Grange Diversion Dam

The natural sources of fine and coarse sediment to the Tuolumne River are primarily erosion and hillslope processes in the upper watershed in the Sierra Nevada Mountains. Together, the project dams—Don Pedro Dam and La Grange Diversion Dam—on the Tuolumne River trap all coarse sediment larger than 0.08 inch (2 millimeters [mm]) in diameter (includes gravels, cobbles, and boulders), and most finer bed material (fine gravels, sand, silt, and clay).

An estimated 33 million tons (25 million cubic yards) of total sediment accumulated in Don Pedro Reservoir during the 88-year period from 1923 to 2011, which translates to an average total sediment deposition rate of approximately 375,000 tons per year (289,000 cubic yards per year). McBain and Trush (2004) estimate that the sediment contains on average approximately 10 to 15 percent coarse-grained material (i.e., bedload), which implies a coarse-grained sediment deposition rate of 38,000 to 57,000 tons per year (29,000 to 43,000 cubic yards per year). Since the closure of the new Don Pedro Dam in 1971, an estimated 15,700 acre-feet of storage has been lost because of sedimentation, which represents less than 1 percent of the original maximum storage volume of 2,030,000 acre-feet.

Sources for sediment entering La Grange Reservoir are bank erosion, surface erosion, debris flows, side channel development, and in-channel erosion during flood events in the watershed downstream of Don Pedro Dam. These sediment sources create gravel bars and floodplain features in the 2.6-mile river reach.

The largest erosion event after the construction of the new Don Pedro Dam occurred during the January 1997 flood. The Districts estimate that 650,000 tons (500,000 cubic yards) of sediment were eroded from the spillway of Don Pedro Dam to La Grange Reservoir. The spillway was eroded to bedrock, implying that the volume of sediment eroded from the spillway during future floods of similar magnitude will be substantially smaller.

The usable storage capacity of La Grange Reservoir is less than 100 acre-feet, and the current amount of sediment trapped by the dam is not well documented. During the January 1997 flood, it is estimated that most of the eroded sediment passed through

La Grange Reservoir and over the dam, ultimately depositing in downstream reaches of the Tuolumne River.

Sediment Processes in Tuolumne River downstream of La Grange Diversion Dam

Sediment transport flux in the lower Tuolumne River is a function of particle size and the magnitude and duration of peak flows downstream of La Grange Diversion Dam. High flows tend to scour the channel bed. As flows decrease, suspended and bedload sediments settle on the channel bed and in depositional features such as gravel and cobble point bars.

Fine-grained sediment is primarily supplied to the lower Tuolumne River by three tributaries downstream of La Grange Diversion Dam—Gasburg Creek (RM 50.3), Dominici Creek (RM 47.8), and Peaslee Creek (RM 45.5). Gasburg Creek alone supplies an estimated 1,600 tons (1,200 cubic yards) of fine sediment annually to the lower Tuolumne River. In the Tuolumne River reach immediately downstream of La Grange Diversion Dam, fine sediment deposits are most common from Basso Bridge (RM 47.5) to Roberts Ferry Bridge (RM 39.5).

Coarse sediment in the lower Tuolumne River ranges in diameter from 2 mm (0.08 inch – fine gravel) to 4 meters (13.1 feet – large boulders). Several indicators suggest a historical deficit in coarse sediment supply downstream of La Grange Diversion Dam. Specifically, McBain and Trush (2004) note the lower Tuolumne River channel lacked bankfull channel confinement and displayed cross-sectional dimensions that were not adjusted to the contemporary flow regime. Also, McBain and Trush (2004) indicate that bedforms such as lateral bars and riffles lacked coarse sediment, and riffles throughout the gravel-bedded zone have progressively diminished in size. SRPs, which occupy 32 percent of the entire gravel-bedded reach between RM 52.2 and RM 24, continue to trap coarse sediment and further deprive downstream reaches of gravel and cobbles.

Erosion occurs primarily during high-flow events. Between 2005 and 2012, an estimated 6,000 to 8,700 tons (about 4,600 to 6,700 cubic yards) of coarse bed material was eroded from the lower Tuolumne River channel between RMs 52.2 and RM 45.8. McBain and Trush (2004) estimated a flow above 5,500 cfs is required to mobilize sediment particles in the size range of 2 to 8 mm (0.08 to 0.31 inch) in the lower Tuolumne River, above 7,000 cfs to mobilize sediment particles in the size range of 8 to 128 mm (0.08 to 5 inches), and above 8,200 cfs to mobilize sediment particles in the size range of 128 to 160 mm (5 to 6.3 inches). Figure 3.3.1-1 shows the exceedance probability of peak flow events in the lower Tuolumne River at the La Grange gage from 1971 through 2017. A flow of 5,500 cfs has a recurrence interval of 3.2 years, a flow of 7,000 cfs has a recurrence interval of 4.4 years, and a flow of 8,200 cfs has a recurrence interval of 5.4 years. McBain and Trush (2004) estimated that for the lower Tuolumne River, sediment particles for optimal aquatic habitat substrate range in diameter from 8 to 128 mm (0.08 to 5 inches, medium gravel to large cobbles).

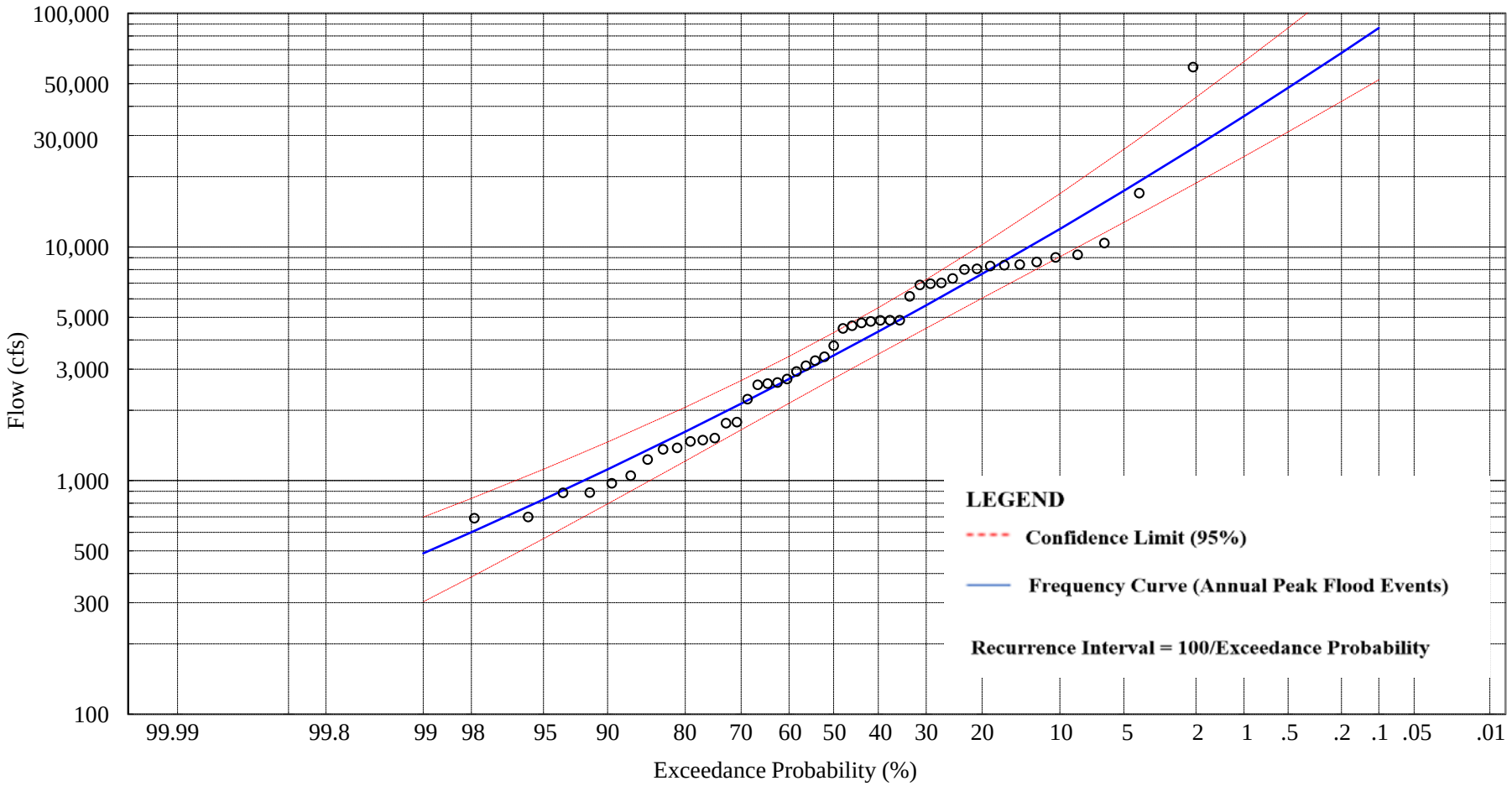

Figure 3.3.1-1. Flood frequency curve (peak annual flood) for the La Grange gage, 1971–2017 (Source: USGS, 2018a).

Long-term gravel attrition and a large 1997 flood event decreased spawning gravel habitat in the lower Tuolumne River. However, as presented by the Districts in their amended final license application, comparing the results of riffle surveys from 1988 and 2012 suggest riffle areas increased by 606,200 square feet (21 percent) during that period. Apparent gains in spawning gravel following the 1997 flood event appear to have been partially provided by gravel restoration projects completed under the Gravel Mining Reach Phase I, SRP 9 Predator Isolation Project, and the Coarse Sediment Management Plan Phases I and II (California DFW gravel additions). In addition, as part of the 1995 Settlement Agreement, TRTAC developed 10 priority habitat restoration projects[70] separated into three classes based on the project goals and type of restoration activity: (1) channel and riparian restoration, (2) predator isolation, and (3) sediment management. Augmentation projects implemented by California DFW and other resource agencies through 2016 have placed an estimated 104,325 tons of gravel (80,250 cubic yards) in the lower Tuolumne River channel between RM 50 to RM 43. Results from these augmentation projects indicate that gravel augmentation efforts and restoration projects associated with the 1995 Settlement Agreement increased the level of coarse sediment in the lower Tuolumne River, and that most of this coarse sediment has been retained.

3.3.1.2 Environmental Effects

Construction of new recreational facilities, modification of existing recreational facilities, or other ground-disturbing activities could increase soil erosion and fine sediment delivery to project waterways. Fine sediment can adversely affect water quality and associated aquatic habitat by increasing turbidity and total suspended solids. Accumulation of fine sediment in aquatic substrate can adversely affect fish spawning success and limit habitat suitability for many aquatic invertebrates.

Specifically, the Districts propose the following construction activities with the potential to contribute to erosion within the Don Pedro and La Grange Project areas: (1) extending the existing riprap protection on the upstream face of Don Pedro Dam from the current elevation of 585 feet down to elevation 535 feet; (2) installing two in-river infiltration galleries at approximately RM 25.9 on the lower Tuolumne River (one of which has been partially constructed); (3) constructing a fish counting/barrier weir in the lower Tuolumne River at RM 25.5; (4) constructing a whitewater boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge; (5) constructing a new boat launch facility located just upstream of old Don Pedro Dam; (6) creating a foot path trail along the river-right shoreline of the La Grange Reservoir; and (7) enhancing existing recreational facilities. The Districts also propose to lower the minimum operating pool of Don Pedro Reservoir from the current elevation of 600 feet to an elevation of 550 feet.

[70] As reported in the Districts' 2018 Lower Tuolumne River annual report (Districts, 2019b), only four out of the 10 projects have been completed through 2018.

The only erosion control measure the Districts propose is to extend the existing riprap protection on the upstream face of Don Pedro Dam from the current elevation of 585 feet to an elevation of 535 feet. The purpose of this proposal is to limit the potential for erosion if the reservoir is drawn down lower than the current minimum elevation of 600 feet. Areas potentially affected by riprap placement, including staging areas, would be surveyed prior to ground-disturbing activities to assess the need for erosion control measures.

BLM Don Pedro revised 4(e) condition 3 and La Grange preliminary 4(e) condition 3 specify that within one year of license issuance, the Districts develop a soil erosion and sediment control plan for ground-disturbing activities on or affecting BLM lands that are within or adjacent to the project boundaries. BLM approval would be required before submitting the final plan to the Commission. BLM states that an effective plan should include: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting installed erosion control measures; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Additionally, BLM's Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 specify that the Districts would work with BLM to address any ground-disturbing activities on or directly affecting BLM lands not specifically addressed in this EIS. The Districts, in consultation with BLM, would determine the scope of work and potential for Project-related effects and whether additional information is required to proceed with the planned activity. In their comments on the draft EIS, the Districts comment that they reached an agreement with BLM whereby the Districts will not be required to fund any portion of BLM staff time or expenses. BLM filed modified its 4(e) conditions in August 2018 to withdraw condition 12, which originally called for payments to BLM for staff time and expenses.

The Water Board's preliminary 401 condition 9 for the projects specifies that the Districts develop a soil erosion and sediment control plan in consultation with the relevant resource agencies to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the projects' operations and maintenance. The Water Board specifies that this plan should also contain erosion and sediment reduction protocols for ground-disturbing activities that could result in erosion or sediment discharges to surface waters including, but not limited to, any new construction and recreational improvements.

In their reply comments, the Districts propose to work in consultation with BLM to identify BMPs for any ground-disturbing activities on or affecting BLM land that is within the Don Pedro and La Grange Project boundaries. The Districts also propose to consult with the Water Board regarding details of proposed erosion and sedimentation control requirements.

The Districts indicate that they do not expect future project operations to have a measurable adverse impact on the shoreline resources of Don Pedro Reservoir or the La Grange Reservoir. The Districts note that erosion hazards within the project boundaries are low. Most of the shoreline adjacent to the Don Pedro Reservoir is characterized by intact rock, rubble, or boulder that is not prone to erosion, and the land surrounding Don Pedro Reservoir and the La Grange Reservoir is mostly undeveloped. The La Grange Reservoir is contained within a canyon reach of the Tuolumne River with mostly rocky shorelines. To prevent erosion of soil material into La Grange Reservoir during flood events, the Districts would continue the existing practice of removing the portion of road crossing the Don Pedro spillway when extreme high flow conditions necessitate the use of the spillway, which has only happened twice since the project was constructed.

Our Analysis

The Districts propose to rehabilitate existing recreational facilities, construct new recreational facilities, and construct additional project features (i.e., fish counting/barrier weir) at the projects. Construction of any type would likely result in ground-disturbing activities that could cause short-term, localized erosion and associated water quality and habitat effects in Don Pedro Reservoir, La Grange Reservoir, and in the Tuolumne River downstream of the proposed project facilities. The Districts' proposal to establish BMPs for erosion control for any ground-disturbing activity on BLM-administered lands within the Don Pedro and La Grange Project boundaries could serve as an effective tool to minimize potential erosion and sedimentation; however, the Districts provide few details about their proposed BMPs and the Districts' proposal and BLM's Don Pedro revised 4(e) condition 3 and La Grange preliminary 4(e) condition 3 are limited to ground-disturbing activities on BLM-managed land. Any ground-disturbing activity, including non-routine maintenance, has the potential to result in erosion and sedimentation. Consequently, developing soil erosion and sediment control plans would be appropriate for project construction activities authorized by the licenses of both projects.

An effective site-specific soil erosion and sediment control plan would include, at a minimum, the five provisions described above for the BLM recommendation and procedures for submitting each plan to the appropriate agencies (e.g., the Water Board, BLM, California DFW, and FWS) and to the Commission at least 90 days in advance of initiating ground-disturbing activities to ensure that all appropriate erosion control measures are included.

Developing a soil erosion and sediment control plan that identifies the BMPs to be used for specific construction activities, inspection protocols, techniques that would be used to stabilize sites once construction is completed, and monitoring protocols for potentially affected surface waters before any ground-disturbing activity occurs would minimize the potential for degradation of water quality from erosion during construction.

During project operation, erosion of soil may occur during stormwater runoff from exposed surfaces such as dirt roads, trails, and other unpaved areas. Project operation may also result in some shoreline erosion along the Don Pedro Reservoir. However, effects of project operation on shoreline erosion is limited because much of the shoreline consists of rock outcrop and shallow soil. Erosion from waves on the reservoir is limited because the irregular shaped reservoir keeps the fetch[71] relatively short and therefore limits wave heights.

During daily operations and maintenance, erosion related to the use of the Don Pedro and La Grange Project spillways and dam outlet facilities is minimal and not likely to result in adverse effects on the lower Tuolumne River. The Don Pedro spillway, founded on rock, discharges directly to a bedrock-confined channel (Twin Gulch), and the outlet works tunnel discharges into a bedrock-lined portion of the Tuolumne River downstream of the Don Pedro Powerhouse. The spillway channel and Twin Gulch are kept dry, except occasionally during seasonal rainy periods. Since the completion of the new Don Pedro Dam in 1971, the Don Pedro Project spillway has been used only twice (1997 and 2017) to discharge flood flows to the lower Tuolumne River.

Although normal project operation and maintenance (i.e., non-flood conditions) would not substantially contribute to erosion downstream of Don Pedro Reservoir, large flood events can result in substantial sediment movement into the La Grange Reservoir and the lower Tuolumne River. During the 1997 flood, peak inflow to Don Pedro Reservoir was estimated to be 121,000 cfs, and peak outflow was estimated to be about 59,400 cfs (recurrence interval of 319 years), as measured at the La Grange gage. The 1997 flood eroded 500,000 cubic yards of sediment from the Twin Gulch channel, resulting in the deposition of sediment at the confluence of the Twin Gulch channel with the Tuolumne River above the La Grange Reservoir, within the La Grange Reservoir, and in the lower Tuolumne River. On February 20, 2017, the Don Pedro Reservoir spilled for the second time, and the maximum release was 19,100 cfs (recurrence interval of 24 years).

Based on current conditions, flood events smaller than the 1997 flood event are not expected to result in significant erosion in the Twin Gulch channel and significant sediment movement into the La Grange Reservoir and lower Tuolumne River. A review of Google Earth aerial imagery from 1998 to 2017 shows that following the 1997 flood event, the Twin Gulch channel below the Don Pedro Project spillway accumulated minimal erodible sediment and maintained a bedrock substrate. As such, the volume of sediment moved during the 2017 is not known, but it was probably much lower than the amount of sediment eroded during the 1997 flood event. However, in both flood events,

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[71] The term “fetch” is the straight-line distance across a waterbody that is subject to the forces of wind. The fetch is a factor used in determining wave heights in a reservoir.

high flood waters would have completely eroded Bonds Flat Road, which crosses the Twin Gulch channel just downstream of the spillway release, resulting in the deposition of sediment in the La Grange Reservoir and lower Tuolumne River. Any future flood events requiring the use of the emergency spillway would likely have the same effect on Bonds Flat Road if it is constructed in the same location. However, the Districts' existing practice of removing the portion of Bonds Flat Road that crosses the Don Pedro Project spillway during extreme flood conditions when use of the spillway is anticipated prevents this material from flowing into the Tuolumne River and the La Grange Reservoir.[72]

3.3.1.3 Cumulative Effects

The geomorphology of the lower Tuolumne River has been affected by past gold mining practices, aggregate mining, and trapping of sediments in reservoirs within and upstream of the projects. Don Pedro Dam and La Grange Diversion Dam would continue to trap coarse sediment, and O'Shaughnessy Dam, located about 40 miles upstream of Don Pedro Reservoir, also traps sediment bedload transported by the Tuolumne River into the Hetch Hetchy System during high-flow events. In addition, aggregate mining has removed large volumes of coarse sediment from the lower Tuolumne River downstream of La Grange Diversion Dam, reducing the amount of gravel suitable for salmon spawning and creating deep pool (e.g., SRPs), which provide favorable habitats for predatory fish. The Districts' proposed gravel augmentation program (discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Spawning Habitat Improvement*) would help to restore the quantity of gravel suitable for salmon spawning in the reach downstream of La Grange Diversion Dam (RM 52.2) and RM 39 and would begin to fill a small proportion of the SRP areas.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

Water Storage

Don Pedro Reservoir is located on the Tuolumne River between RM 80.8 and Don Pedro Dam at RM 54.8. Water released from the Don Pedro Project enters the La Grange Reservoir created by the La Grange Diversion Dam located on the Tuolumne River at RM 52.2. The Districts divert and convey water from the river at the La Grange Project for irrigation and municipal and industrial water supply. Water released from the Don

[72] The Districts' practice of removing Bonds Flat Road is referenced in the County of Tuolumne REA response letter filed with the Commission on January 17, 2018.

Pedro Project, and not diverted by the Districts at the La Grange Project, passes through the La Grange Reservoir to the lower Tuolumne River.

The Don Pedro Project attenuates high flows in the Tuolumne River from winter storms and spring runoff and stores the water in Don Pedro Reservoir. At the normal maximum water surface elevation of 830 feet, Don Pedro Reservoir has a surface area of 12,960 acres, a gross storage capacity of 2,030,000 acre-feet, and a usable storage capacity of 1,721,000 acre-feet. The current minimum operating water surface elevation of Don Pedro Reservoir is 600 feet. The Don Pedro Project typically reaches its usable storage capacity of at the end of the spring runoff season in June and is gradually drawn down through the irrigation season, which typically extends through September. The drainage area upstream of Don Pedro Dam is about 1,533 square miles.

In accordance with Corps regulations, the Districts reserve 340,000 acre-feet of usable capacity in Don Pedro Reservoir for flood storage from October through April for conditional flood space thereafter, depending on the anticipated snowmelt runoff during April, May, and June. Consistent with agreements between the Districts and CCSF, the Don Pedro Project also provides a water bank of 570,000 acre-feet of storage that CCSF uses to help manage the water supply of its Hetch Hetchy System while meeting the Districts' senior water rights. Figure 3.3.2-1 shows the operational rule curves for the Don Pedro Project in representative wet, normal, and dry water years. The flood storage curve is defined by the Corps for flood management operations and the storage curves represent average monthly storage levels for each water year.

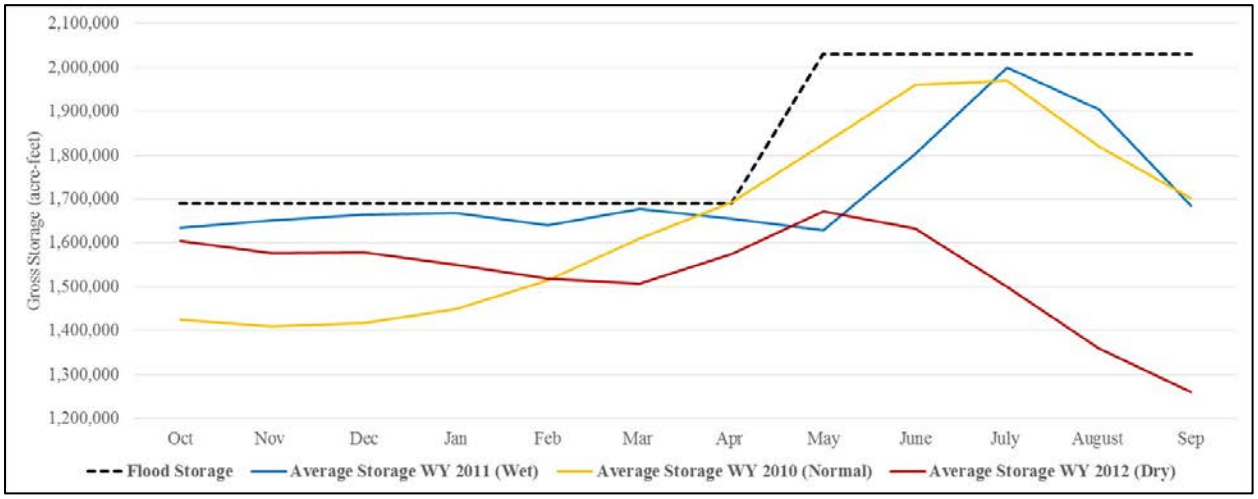

Figure 3.3.2-1. Don Pedro Reservoir storage curves for water years 2010–2012 (Source: USGS, 2018b).

Under non-spill conditions, La Grange Reservoir has a surface area of 35 acres, a gross storage capacity of 400 acre-feet, and a usable storage capacity of about 100 acre-feet. The surface elevation of the La Grange Reservoir varies between about

294 feet and 296 feet about 90 percent of the time. The drainage area upstream of the La Grange Diversion Dam is about 1,535 square miles.

Project-affected Stream Reaches

Project operation affects streamflows in the Tuolumne River downstream of Don Pedro Dam and in the lower Tuolumne River below La Grange Diversion Dam. Table 3.3.2-1 shows average annual and monthly flow statistics for these stream reaches, and table 3.3.2-2 presents the 10, 50, and 90-percent flow exceedances for each stream reach.

Tuolumne River above Don Pedro Reservoir—The Tuolumne River originates in Tuolumne Meadows in Yosemite National Park and flows westward for about 71 miles before it enters Don Pedro Reservoir at RM 80.8. Upstream of the Don Pedro Project, non-project inter-basin water transfers from the Tuolumne River to the San Francisco Bay Area reduce the volume of water that enters Don Pedro Reservoir. The largest inter-basin water diversions occur from CCSF's O'Shaughnessy Dam, which impounds the 360,400-acre-foot Hetch Hetchy Reservoir. The Hetch Hetchy System delivers an average of 250,000 acre-feet of water each year, providing 85 percent of CCSF's Bay Area municipal and industrial water supply. CCSF also owns and operates the lower Cherry Creek Diversion Dam and Early Intake Diversion Dam, which are used to divert water supplied by CCSF's Cherry Creek facilities during emergency and extreme drought conditions.

Tuolumne River below Don Pedro Reservoir and above La Grange Diversion Dam—From Don Pedro Dam, the Tuolumne River flows southwest about 1.6 miles to where it enters the La Grange Reservoir near RM 53. Outflows from Don Pedro Reservoir reflect real-time operations by the Districts to manage flows in accordance with storage requirements, Corps flood control guidelines, and diversions for downstream irrigation and municipal and industrial uses. Water releases are also provided to benefit fish and aquatic resources in the lower Tuolumne River. Flow in the Tuolumne River above La Grange Diversion Dam (i.e., total outflow from Don Pedro Reservoir) is represented by the sum of flows measured at three U.S. Department of the Interior, Geological Survey (USGS) gages: (1) gage 112896050 (Tuolumne River below La Grange Diversion Dam near La Grange, California), (2) gage 11289000 (Modesto Canal near La Grange, California), and (3) gage 11289500 (Turlock Canal near La Grange, California).

Tuolumne River below La Grange Diversion Dam—The lower Tuolumne River extends 52.2 miles from La Grange Diversion Dam to the river's confluence with the San Joaquin River just west of Modesto, California. USGS gage 11289650 (Tuolumne River below La Grange Diversion Dam near La Grange, California) is located 0.5 mile downstream of La Grange Diversion Dam and captures a drainage area of 1,538 square miles.

Table 3.3.2-1. Mean annual and monthly flow (cfs) in the Tuolumne River and its major tributaries for water years 1971–2017 (Source: USGS, 2018a, c–i).

USGS Gage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Streamflow Gages Upstream of Don Pedro Reservoir													
11276900 Tuolumne River below Early Intake near Mather, California (RM 104.4) (USGS, 2018c)	280	339	430	594	1,570	2,050	923	212	111	76	93	163	570
11278400 Cherry Creek below Dion R. Holm Powerhouse near Mather, California (RM 0.2) (USGS, 2018d)	663	705	820	1,000	1,280	1,190	757	481	392	351	366	491	708
11281000 South Fork Tuolumne River near Oakland Recreation Camp, California[a] (USGS, 2018e)	95	154	199	216	246	137	41	14	11	14	32	53	101
11282000 Middle Fork Tuolumne River at Oakland Recreation Camp, California[a] (USGS, 2018f)	50	82	110	164	289	199	52	9	5	7	18	28	84

USGS Gage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual Average
Streamflow Gages Downstream of Don Pedro Reservoir													
11289000 Modesto Canal near La Grange, California (RM 53.2) (USGS, 2018g)	63	62	274	527	652	772	859	764	494	283	161	105	418
11289500 Turlock Canal near La Grange, California (RM 53.2) (USGS, 2018h)	131	168	583	1,030	1,190	1,460	1,760	1,530	793	391	169	182	782
11289650 Tuolumne River below La Grange Diversion Dam near La Grange, California (RM 51.7) (USGS, 2018a)	1,440	1,770	1,850	1,860	1,640	959	521	336	441	555	330	790	1,041
11290000 Tuolumne River at Modesto, California (RM 16.3) (USGS, 2018i)	1,760	2,080	2,170	2,070	1,830	1,130	690	494	625	762	594	1,030	1,270

[a] Period of record (water years 1971–2002)

Table 3.3.2-2. 10, 50, and 90-percent flow exceedances in the Tuolumne River and its major tributaries for water years 1971–2017 (Source: USGS, 2018a,c–i).

	Percent Exceedance (cfs)		
USGS Gage	**10**	**50**	**90**
Streamflow Gages Upstream of Don Pedro Reservoir			
11276900 Tuolumne River below Early Intake near Mather, California (RM 104.4)	1,400	122	48
11278400 Cherry Creek below Dion R. Holm Powerhouse near Mather, California (RM 0.2)	1,390	575	53
11281000 South Fork Tuolumne River near Oakland Recreation Camp, California	277	31	5
11282000 Middle Fork Tuolumne River at Oakland Recreation Camp, California	247	21	2
Streamflow Gages Downstream of Don Pedro Reservoir			
11289000 Modesto Canal near La Grange, California (RM 53.2)	960	367	0
11289500 Turlock Canal near La Grange, California (RM 53.2)	1,850	643	1
11289650 Tuolumne River below La Grange Diversion Dam near La Grange, California (RM 51.7)	3,420	231	18
11290000 Tuolumne River at Modesto, California (RM 16.3)	3,970	416	157

Throughout this portion of the Tuolumne River, diversions for other non-project water uses (i.e., irrigation) are common. California Department of Water Resources (California DWR) lists 26 points of diversion along the lower Tuolumne River between La Grange Diversion Dam and the San Joaquin River. The diversions have an estimated total combined withdrawal capacity of 77 cfs (California DWR, 2013). Runoff from Dry Creek, agricultural return flows, groundwater seepage, and operational spills from irrigation canals all enter the lower portion of the Tuolumne River. Average monthly accretion flows in the lower Tuolumne River range from 40 to 200 cfs with an estimated annual average accretion flow rate of 152 cfs (water years 1970–2010). Beginning on October 1 of each year, flows provided by the Don Pedro Project to the lower Tuolumne River, as measured at the La Grange gage, are adjusted to meet license requirements to benefit upmigrating adult fall-run Chinook salmon; these flows include a pulse flow, the

amount of which varies depending on the water year type. In addition, flows provided by the Don Pedro Project are adjusted on October 16 of each year and maintained through May 31 of the following year to protect egg incubation, emergence, fry and juvenile rearing, and smolt outmigration of fall-run Chinook salmon; these flows include a spring pulse flow, the amount of which varies depending on the water year type. The peak flows and volume of water that have been allocated to provide pulse flows during the spring and fall each year since 1995 are shown in table 2.1.5-2.

USGS gage 11290000 (Tuolumne River at Modesto, California), which captures a drainage area of 1,884 square miles, measures flow in the Tuolumne River downstream from all project facilities and Dry Creek. The USGS streamflow gage at Modesto is the compliance point for the Corps flood control operations guideline of 9,000 cfs.

Water Rights and Water Supply Deliveries

The Raker Act, passed by Congress in 1913, authorized CCSF to build certain water and power facilities on federal lands and addressed the allocation of the waters of the Tuolumne River between the Districts and CCSF. Following the passage of the Raker Act, the Districts and CCSF entered into a series of agreements, culminating in the Fourth Agreement, which defines the allocation of the waters of the river between CCSF and the Districts and the associated water bank accounting. The water bank provision allows CCSF to pre-release water from its upstream facilities into a water bank in Don Pedro Reservoir, so at other times (e.g., during low water years), CCSF can hold back an equivalent amount of water that otherwise would have had to be released to satisfy the Districts' senior water rights.

The Districts have several individual water rights on the Tuolumne River, including certain appropriative water rights acquired in 1855, riparian water rights, additional pre-1914 appropriative water rights, and post-1914 appropriative water right licenses (license numbers 11057 and 11058) issued by the Water Board. The water rights recognized under license numbers 11057 and 11058 permit the use of water for irrigation, power generation, and recreation. The licenses also allow the storage, withdrawal from storage, diversion, and re-diversion of Tuolumne River water. Specifically, licenses 11057 and 11058 permit the Districts to annually: (1) store 1,046,800 acre-feet of water; (2) divert and re-divert 1,371,800 acre-feet of water; and (3) withdraw 951,100 acre-feet of water for consumptive water needs (i.e., irrigation and municipal and industrial water supply).

Water Demand

Total consumptive demand for Tuolumne River water in normal water years is about 1.2 million acre-feet. In addition to the 250,000 acre-feet annually diverted by CCSF, the Districts annually supply about 850,000 acre-feet of irrigation water and 67,500 acre-feet of municipal and industrial water to meet consumptive water demands. Irrigation deliveries typically begin in early March, reach their peak in July and August, and end in late October/early November. Municipal and industrial water supplies are

delivered year-round. Including instream flows (300,000 acre-feet) for aquatic resources in the lower Tuolumne River, total yearly demand for Tuolumne River water in normal water years is about 1.5 million acre-feet.

Bay-Delta Plan Amendments

The Water Board has been reviewing and amending the 2006 Bay-Delta Plan for several years. In 2012, it proposed amendments to the plan and released a draft substitute environmental document for public comment that described the proposed amendments and the Water Board's analysis of their potential effects. The Water Board subsequently modified its proposed amendments and released a revised draft substitute environmental document on September 15, 2016. It released a final proposal to amend the Bay-Delta Plan (Water Board, 2018a) and a final substitute environmental document (Water Board, 2018c) on July 6, 2018, and received oral public comments on the topic on August 21 and 22, 2018.[73] This amendment would (1) require increased flows in the San Joaquin River and its three major tributaries–the Stanislaus, Tuolumne, and Merced Rivers, and (2) establish flow-related compliance locations. On December 12, 2018, the Water Board adopted the plan amendments and final substitute environmental document establishing the lower San Joaquin River flow objectives and revised southern Delta salinity objective. The Water Board acknowledges benefits from non-flow measures and encourages voluntary agreements that will assist in implementing the lower San Joaquin River flow objectives (Water Board, 2018a). In addition, the Water Board states that non-flow measures recommended in the Bay-Delta Plan or by California DFW may support a change in the required percent of unimpaired flow within the range prescribed by the flow objectives or other adaptive adjustments otherwise allowed for implementation (Water Board, 2018a).

On March 1, 2019, California DFW and California DWR submitted a "Planning Agreement" to the Water Board that includes a project description for environmental review of the voluntary agreements, a proposal for a process for the Water Board to analyze the project description, and a process for developing appropriate terms for and implementation of the voluntary agreements. Appendix A to the Planning Agreement includes project descriptions for the proposed voluntary agreements. The draft Voluntary Agreement for the Tuolumne River (draft Voluntary Agreement) includes flow measures based on those proposed in the Don Pedro amended final license application with some modifications and examples of illustrative non-flow habitat measures, including gravel augmentation and maintenance, improvements to instream habitat morphology/complexity, an adult fish counting and barrier weir, predator control, a new downstream point of diversion (i.e., the infiltration galleries), and spill management.

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[73] These documents are available on the Water Board webpage, available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2018_sed/.

Water Quality

The *Water Quality Control Plan for the Sacramento and San Joaquin Basins* (Basin Plan) designates existing and potential beneficial uses and water quality objectives for the Tuolumne River (CVRWQCB, 2016). Table 3.3.2-3 presents the existing and proposed designated beneficial uses for three sections of the Tuolumne River: (1) upstream of the Don Pedro Reservoir, (2) Don Pedro Reservoir, and (3) the river downstream of Don Pedro Dam. Designated beneficial uses for the reaches upstream and downstream of Don Pedro Reservoir are similar with the exceptions that the lower reach includes anadromous fish migration and spawning and does not include hydropower. Hydropower is not currently a designated beneficial use of the Tuolumne River downstream of Don Pedro Dam, even though the existing La Grange Project is located in the reach. Table 3.3.2-4 presents the Basin Plan water quality objectives to support these designated beneficial uses, and table 3.3.2-5 provides mercury water quality objectives approved by EPA on July 14, 2017.

Table 3.3.2-3. Existing and proposed designated beneficial uses of the Tuolumne River Basin (Source: CVRWQCB, 2016).

Designated Beneficial Uses[a]	Source to Don Pedro Reservoir	Don Pedro Reservoir	Don Pedro Dam to San Joaquin River
Municipal and domestic supply	Existing	Proposed	Proposed
Irrigation	Existing	NA	Existing
Stock watering	Existing	NA	Existing
Hydropower	Existing	Existing	NA
Contact recreation	Existing	Existing	Existing
Canoeing and rafting recreation[b]	Existing	NA	Existing
Other noncontact recreation	Existing	Existing	Existing
Warm freshwater habitat[c,d]	Existing	Existing	Existing
Cold freshwater habitat[c]	Existing	Existing	Existing
Cold migration[e]	NA	NA	Existing
Cold spawning[e]	NA	NA	Existing
Warm spawning[f]	NA	NA	Existing
Wildlife habitat	Existing	Existing	Existing

Notes: The designated beneficial uses are to be protected for all waters except in specific cases where evidence indicates the appropriateness of additional or alternative beneficial use designations.
NA – not applicable.

[a] Although the current Basin Plan defines the beneficial uses of groundwater recharge, freshwater replenishment, and preservation of rare and endangered species, the plan states that the surface waters falling within these beneficial uses will be identified in the future.

[b] Implies certain flows are required for this beneficial use.

[c] For resident, not anadromous, species.

[d] Where both warm and cold freshwater habitat are designated, the more conservative coldwater quality objectives take precedence.

[e] Salmon and steelhead.

[f] Striped bass, sturgeon, and shad.

Table 3.3.2-4. Water quality objectives to support designated beneficial uses in the Tuolumne River Basin (Source: CVRWQCB, 2016).

Water Quality Objective	Description
Temperature	The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Quality Control Board that such alteration in water temperature does not adversely affect beneficial uses. At no time or place, shall the temperature of cold or warm freshwater habitat be increased more than 5.0°F above natural receiving-water temperature.
Bacteria	In waters designated for contact recreation, fecal coliform concentration must be: (1) less than a geometric mean of 200 per 100 milliliters water based on a minimum of five samples collected in any 30-day period, and (2) less than 400 per 100 milliliters of water in at least 90 percent of all samples taken in a 30-day period.
Biostimulatory substances	Water shall not contain biostimulatory substances that promote aquatic growth in concentrations that cause nuisance or adversely affect beneficial uses.
Chemical constituents	Waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses. At a minimum, waters designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels specified in Title 22 of the California Code of Regulations.
Color	Water shall be free of discoloration that causes a nuisance or adversely affects beneficial uses.

Water Quality Objective	Description
DO	The DO concentrations shall not be reduced below the following minimum levels at any time. • Waters designated as warm freshwater habitat: 5.0 mg/L • Waters designated as cold freshwater habitat: 7.0 mg/L • Waters designated as spawning habitat: 7.0 mg/L In the Tuolumne River from Waterford to La Grange, DO concentrations shall not be reduced below 8.0 mg/L between October 15 and June 15.[a] The monthly median of the mean daily DO concentration shall not fall below 85 percent of saturation in the main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation.
Floating material	Water shall not contain floating material in amounts that cause nuisance or adversely affect beneficial uses.
Oil and grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.
Pesticides	Waters shall not contain individual pesticides or a combination of pesticides in concentrations that adversely affect beneficial uses.[b] Waters designated for use as domestic or municipal supply shall not contain concentrations of pesticides in excess of the limiting concentrations set forth in California Code of Regulations, Title 22, Division 4, Chapter 15 or contain concentrations of thiobencarb in excess of 1.0 microgram per liter.[c]
pH	The pH of surface shall neither be depressed below 6.5 nor raised above 8.5.
Sediment	The suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause a nuisance or adversely affect beneficial uses.
Settleable material	Waters shall not contain substances in concentrations that result in deposition of material that causes nuisance or adversely affect beneficial uses.
Suspended material	Waters shall not contain suspended material in concentrations that cause a nuisance or adversely affect beneficial uses.

Water Quality Objective	Description
Taste and odor	Water shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes and odors to domestic or municipal water supplies, fish flesh, or other edible products of aquatic origin; or that cause nuisance; or otherwise adversely affect beneficial uses.[d]
Toxicity	All waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life. Compliance with this objective will be determined by analysis of indicator organisms, species diversity, population density, growth anomalies, and biotoxicity tests as specified by the Regional Water Quality Control Board.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: • where natural turbidity is less than 1 NTU, turbidity shall not cause downstream turbidity to exceed 2 NTU; • where natural turbidity is between 1 and 5 NTUs, increases shall not exceed 1 NTU; • where natural turbidity is between 5 and 50 NTUs, increases shall not exceed 20 percent; • where natural turbidity is between 50 and 100 NTUs, increases shall not exceed 10 NTU; • where natural turbidity is greater than 100 NTU, increases shall not exceed 10 percent

Notes: DO—dissolved oxygen, °F—degrees Fahrenheit, mg/L—milligrams per liter, NTU—nephelometric turbidity unit

[a] Because the Basin Plan does not specify river miles for this reach, we used available information to identify the river miles as approximately RM 31.5 to RM 52.2.

[b] The Basin Plan defines pesticide as: "(1) any substance, or mixture of substances, which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever, or (2) any spray adjuvant, or (3) any breakdown products of these materials that threaten beneficial uses."

[c] Thiobencarb, also referred to as benthiocarb, is an active ingredient of rice herbicides including Bolero® and Abolish®.

[d] Taste and odor limits for drinking water are provided as secondary maximum contaminant levels in Title 22 of the California Code of Regulations.

Table 3.3.2-5. Methylmercury water quality objectives to support designated beneficial uses in the Tuolumne River Basin.[a]

Water Quality Objective	Description
Sport Fish (human health and wildlife)[b]	Wet weight concentration in skinless fillet of highest trophic level fish shall not exceed 0.2 mg/kg within a calendar year. This objective applies to trophic level 3 fish of 150–500 mm total length and trophic level 4 fish of 200–500 mm total length.
Prey Fish (wildlife)	Wet weight concentration in whole fish 50 to 150 mm total length shall not exceed 0.05 mg/kg between February 1 and July 31.

Notes: mg/kg – milligrams per kilogram wet weight, mm – millimeters.

[a] Source: Letter from Tomás Torres, Director, Water Division, EPA, San Francisco, California, to Felicia Marcus, Chair, Water Board, Sacramento, California, regarding Water Quality Control Plan for inland surface waters, enclosed bays, and estuaries of California—Tribal and subsistence fishing beneficial uses and mercury provisions, dated July 14, 2017. Available at: https://www.epa.gov/sites/production/files/2017-07/documents/ca_hg_approval_letter_with_enclosures_signed_071417.pdf. Accessed September 25, 2018.

[b] Trophic level 3 fish are secondary consumers, and tropic level 4 fish are piscivorous fish.

The latest (combined 2014 and 2016) EPA-approved list of California's water-quality limited waterbodies under section 303(d) of the CWA includes several waterbodies within the Tuolumne River Basin (Water Board, 2019). The listed waterbodies and the parameter(s) for which they are included are as follows[74]:

- Hetch Hetchy Reservoir—mercury
- Sullivan Creek from Phoenix Reservoir to Don Pedro Reservoir—indicator bacteria
- Woods Creek[75]—indicator bacteria

[74] Listed from upstream to downstream.

[75] Tributary to Don Pedro Reservoir.

- Don Pedro Reservoir—mercury
- Lower Tuolumne River—water temperature, mercury, Group A pesticides,[76] and toxicity
- Modesto Lake—mercury
- Turlock Lake—mercury
- Dry Creek—DO, indicator bacteria, and toxicity

Potential sources were not identified for any of these 303(d) listings (Water Board, 2019), although the 2010 303(d) list identified potential sources as agriculture for Group A pesticides in the lower Tuolumne River; resource extraction for mercury in Don Pedro Reservoir and the lower Tuolumne River; and unknown for other listings (Water Board, 2011). Total maximum daily loads are expected to be completed for all these 303(d) listings by 2027 (Water Board, 2019).

Although the 303(d) list includes mercury for Don Pedro Reservoir, the lower Tuolumne River, and other waterbodies in the basin, Don Pedro Reservoir is the only waterbody in the basin with a California Office of Environmental Health Hazard Assessment of a site-specific advisory warning for eating fish (OEHHA, 2018a). This advisory provides recommended guidelines for eating black bass species including largemouth bass, suckers, sunfish species, channel catfish, and common carp (OEHHA, 2018b). In addition, a statewide advisory for eating fish from lakes and reservoirs applies to other lakes and reservoirs in the basin (OEHHA, 2013a,b). California's statewide mercury control program for reservoirs is addressing mercury control for 132 reservoirs, including Hetch Hetchy Reservoir, Don Pedro Reservoir, Modesto Lake, and Turlock Lake (Water Board, 2017a; Water Board and California EPA, 2017).

During the most recent data evaluation for the 303(d) list and 305(b) report, the Water Board's evaluation of *Escherichia coli* (*E. coli*) concentrations in the lower Tuolumne River found that 13 of 101 *E. coli* samples collected from six locations[77] exceeded the water quality objective; however, the Water Board concluded that the weight of evidence provided sufficient justification against a 303(d) listing of the lower Tuolumne River for *E. coli* (Water Board, 2017b). An evaluation of the safety of water-contact recreation (Li and Atwill, 2014) reports that five samples collected in the Tuolumne River at Fox Grove in May 2012 to September 2013 had *E. coli* concentrations ranging from 3 to 138 most probable number (MPN) and low concentrations of

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[76] Group A pesticides include one or more of the following compounds: dieldrin, endrin, alpha-chlordane, gamma-chlordane, cis-nonachlor, trans-nonachlor, oxychlordane, heptachlor, and heptachlor epoxide (CVRWQCB, 2009).

[77] These samples were collected at Shiloh, Mancini Park, Legion Park, Ninth Street, Seventh Street, and Audie Peeples Fishing Access.

waterborne human pathogens (*Cryptosporidium* spp., *E. coli* O157:H7, *Giardia* spp., and *Salmonella*).

Site-specific Water Quality Data

Based on the Districts' water temperature and DO vertical profile data, Don Pedro Reservoir typically stratifies throughout the year, although stratification is weakly defined in the winter (figures 3.3.2-2 and 3.3.2-3). As is typical, the depth and strength of the thermocline varies seasonally and depends on general runoff patterns for the year. Reservoir temperatures are coolest in January and typically range from 9 to 15 degrees Celsius (°C) in winter with stratification strengthening as spring nears. During spring and early summer, near surface temperature warms to a maximum that occurs in July or August and thermal stratification further strengthens followed by seasonal cooling of air temperature and reservoir near surface temperatures.

The timing and depth to which this seasonal pattern occurs is highly dependent on the volume of water in the reservoir, the magnitude of inflows and weather. For example, the warm upper layer in November was less than 50 feet deep in 2016 when the reservoir's water level was about 770 feet, but 100 feet deep in 2015 when the reservoir's water level was drawn down to an elevation of about 670 feet. From June through September (and sometimes in May and October), surface water temperatures exceed 20.0°C and extend to depths that are dependent on season. Figures 3.3.2-2 and 3.3.2-3 show that water temperature at the depth of the powerhouse intake is generally 9.5 to 12°C but can reach about 18°C in some periods with the reservoir drafted to a water level of about 670 feet.

Mean monthly temperatures in Don Pedro Reservoir hypolimnion near the powerhouse intake, Don Pedro Project outflows, and above La Grange Diversion Dam are relatively stable at about 10 to 12°C throughout the year (table 3.3.2-6). Mean monthly temperatures are a little cooler in Don Pedro Project's outflow than near the dam at the powerhouse intake depth likely because some of the withdrawal is drafted from below the intake elevation. Evaluation of the 2015 and 2016 temperature data that the Districts submitted with their comments on the draft EIS shows that when the Don Pedro Reservoir elevation was less than 700 feet, the daily mean outflow temperature was greater than 12°C consistently in June through October and more than 80 percent of the time in November and December (figure 3.3.2-4).

Little thermal stratification or warming occurs in the La Grange Reservoir because of the reservoir's minimal storage and run-of-river operation. Review of USGS water temperature data for the La Grange gage shows that since implementation of the 1995 Settlement Agreement, water temperatures have usually ranged between 9 and 13°C but was as high as 18.7°C in October 2015, coinciding with Don Pedro Reservoir water level being drawn down to about 670 feet (USGS, 2018a,b).

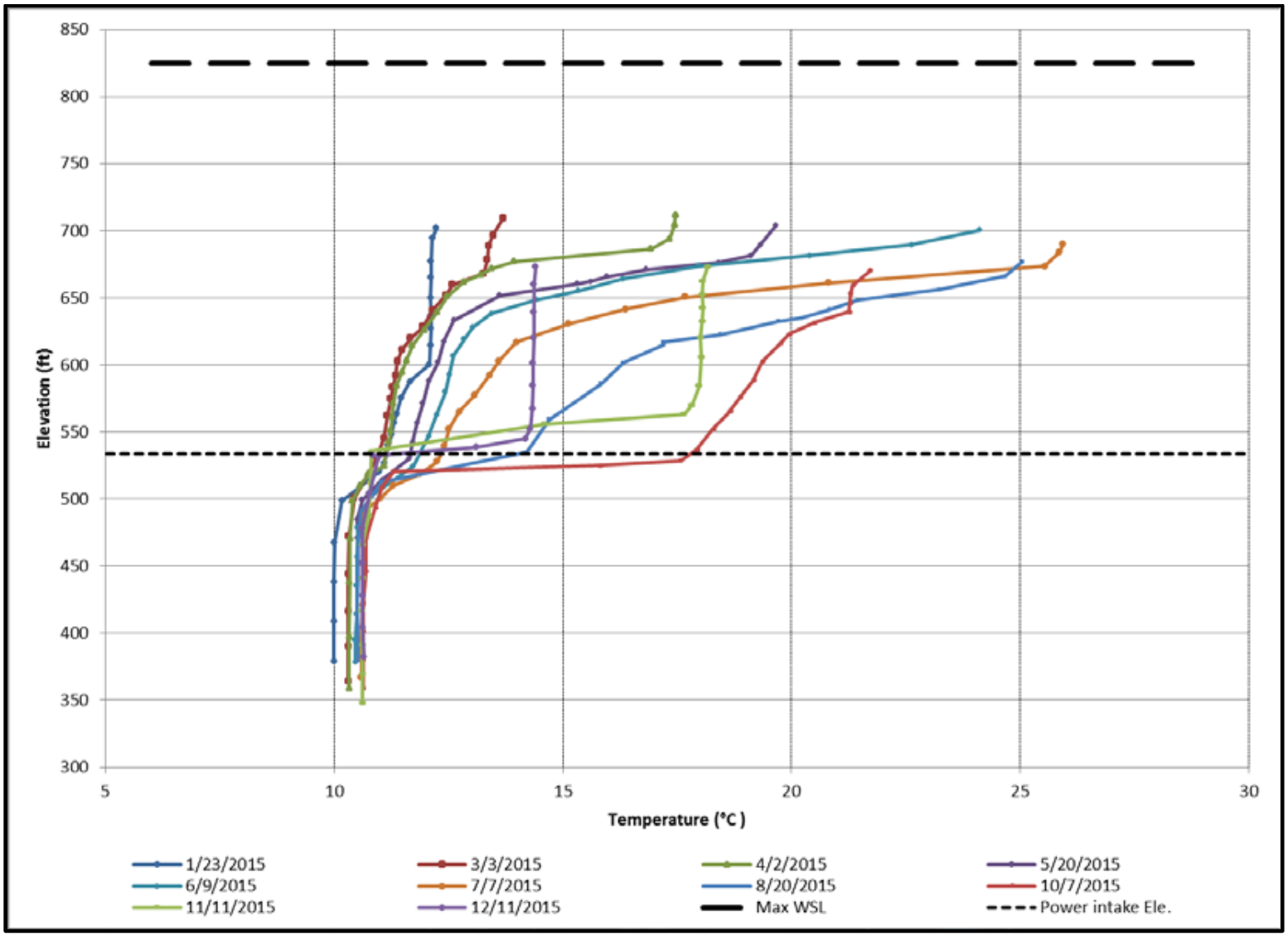

Figure 3.3.2-2. Water temperature profiles recorded in Don Pedro forebay in 2015 (Source: Districts, 2017a).

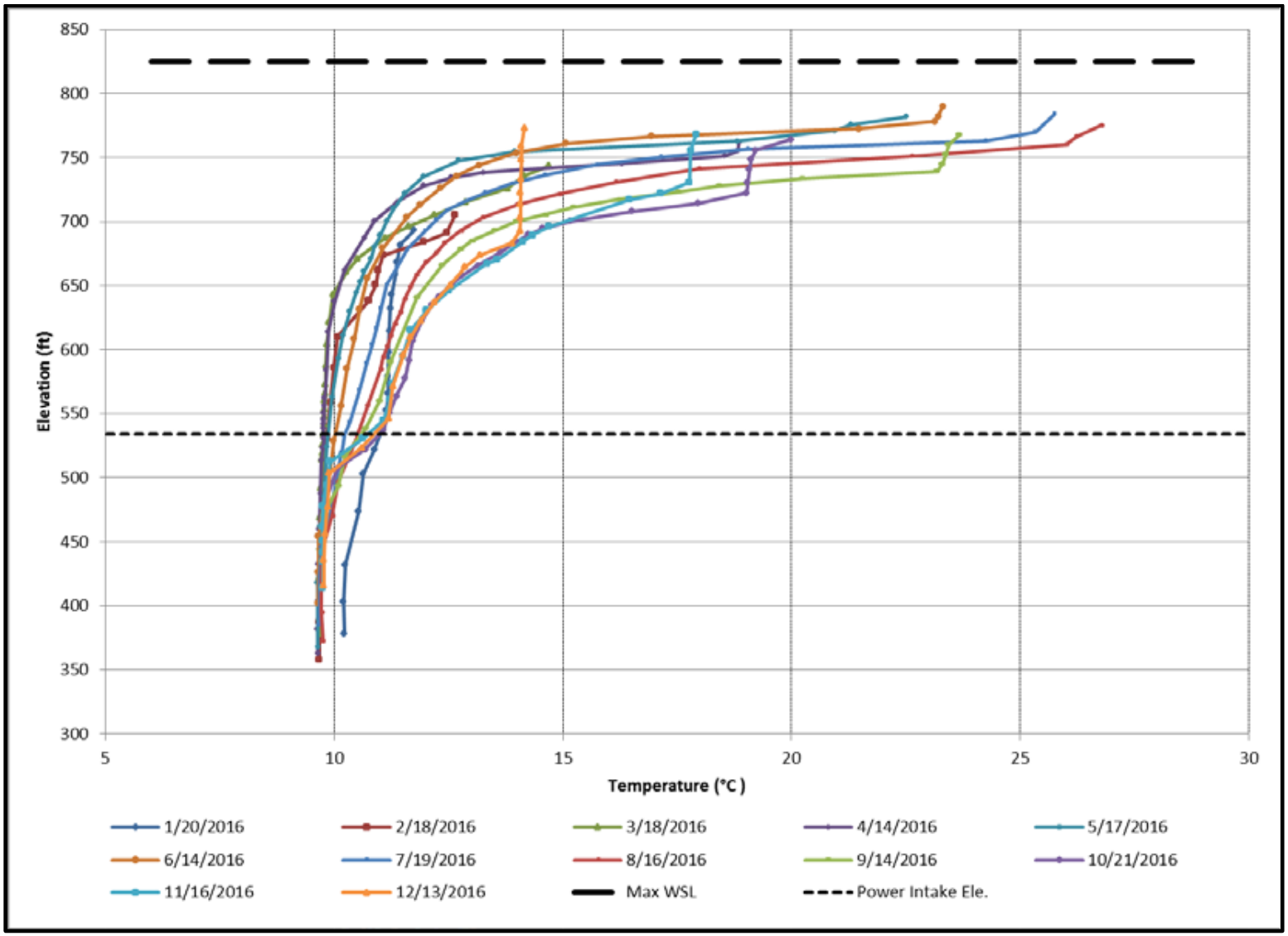

Figure 3.3.2-3. Water temperature profiles recorded in Don Pedro forebay in 2016 (Source: Districts, 2017a).

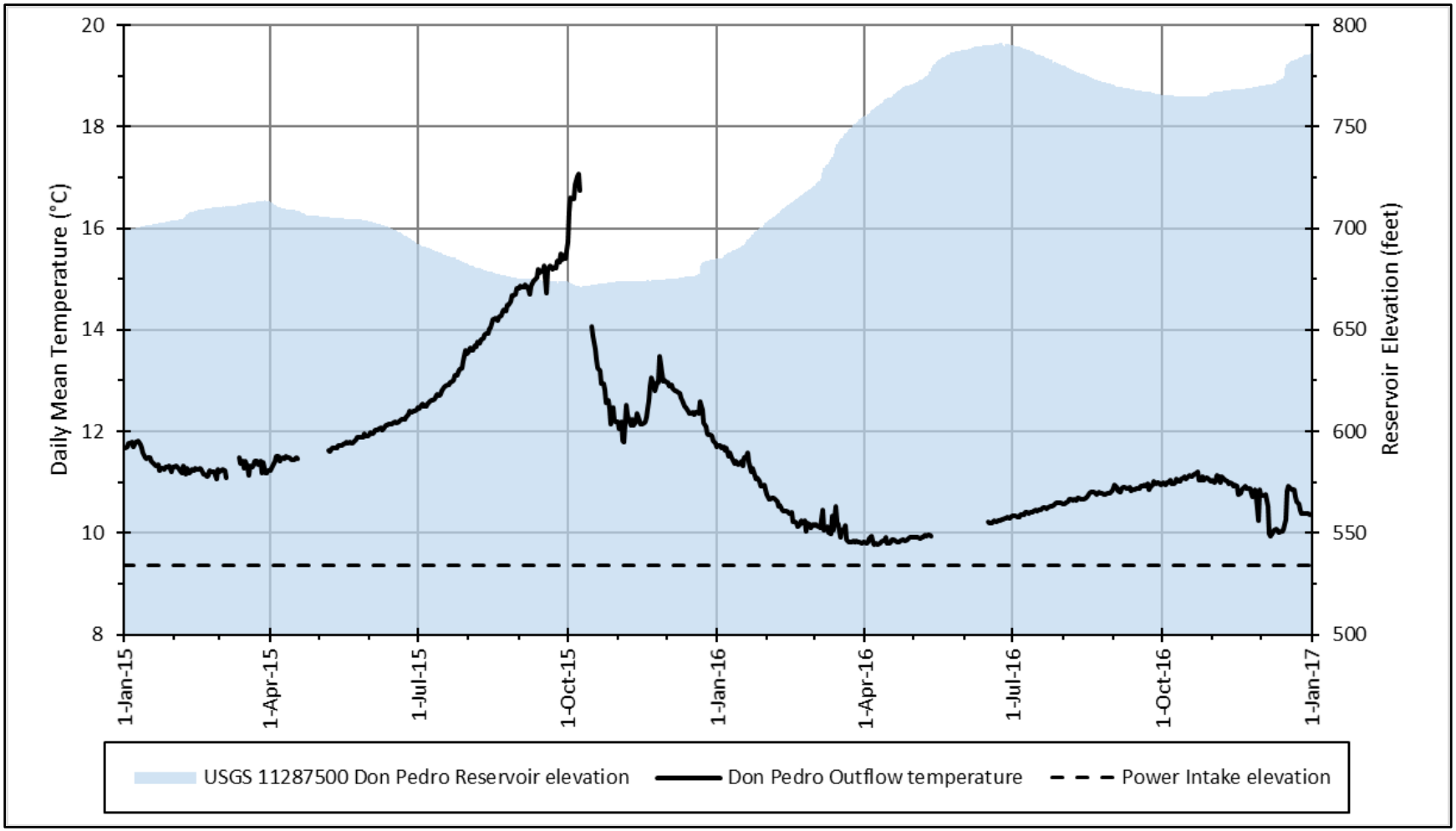

Figure 3.3.2-4. Tuolumne River daily mean temperature at Don Pedro outflow with Don Pedro Reservoir pool elevation, 2015 and 2016 (Source: Districts, 2019a; 2017a; USGS, 2018b, as modified by staff).

Table 3.3.2-6. Comparison of mean monthly water temperature in the Don Pedro forebay hypolimnion, Don Pedro Project outflow, and La Grange forebay (Source: Districts, 2017a, as modified by staff).[a]

Month	Don Pedro Reservoir Hypolimnion near Dam (RM 55.1)	Don Pedro Project Outflow (RM 54.3)	Above La Grange Diversion Dam (RM 52.2)	Don Pedro Outflow vs. Hypolimnion	Above La Grange Diversion Dam vs. Don Pedro Outflow
Jan	10.8	10.5	11.3	-0.3	0.8
Feb	10.1	9.7	10.8	-0.4	1.1
Mar	10.1	9.3	10.8	-0.8	1.5
Apr	10.2	9.4	10.9	-0.8	1.5
May	10.4	9.8	11.0	-0.6	1.2
Jun	10.7	10.2	11.2	-0.5	1.0
Jul	11.0	10.6	11.5	-0.4	0.9
Aug	11.3	10.9	11.8	-0.4	0.9
Sep	11.4	11.1	12.0	-0.3	0.9
Oct	11.5	11.3	12.1	-0.2	0.8
Nov	11.4	11.3	11.2	-0.1	-0.1
Dec	11.5	11.2	11.2	-0.3	0.0

[a] Period of record varies by station: August 2004–November 2012 with most of 2009 missing for RM 55.1; January 1987–September 1988 and May 2010–February 2013 for RM 54.3; and August 2011–December 2012 for RM 52.2.

Figures 3.3.2-5 through 3.3.2-8 show Tuolumne River daily mean temperatures between the La Grange gage (RM 51.7) and Shiloh (RM 3.4) for water years 2015 and 2016, respectively. These figures show relatively small temperature increases between RM 51.8 and RM 49.0, and much larger temperature increases downstream of RM 49.0.

The Districts' summary of the range of DO concentrations measured near Don Pedro Reservoir's upstream and downstream ends (table 3.3.2-7) shows that DO concentrations of less than the 7.0-mg/L objective occur throughout most of the year. DO vertical profiles for the reservoir follow the common pattern of many deep lakes and reservoirs with high DO near the surface and in the metalimnion (figure 3.3.2-9), likely the result of photosynthetic activity by phytoplankton during daylight hours. The lowest DO concentrations are typically in water between the reservoir bottom and the elevation of the powerhouse intake.

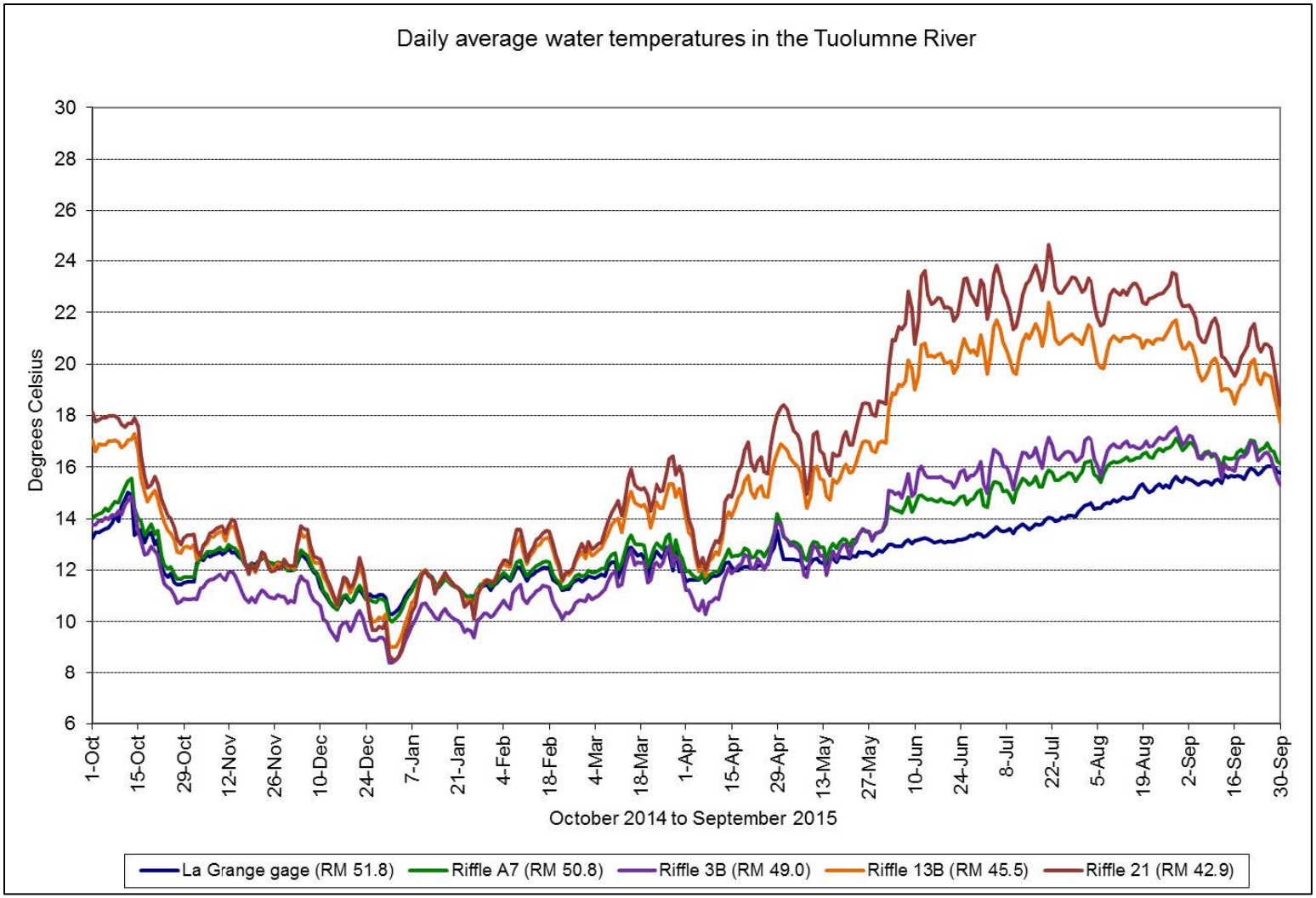

Figure 3.3.2-5. Tuolumne River daily mean temperature between RM 51.8 and RM 42.9, water year 2015 (Source: Districts, 2016).

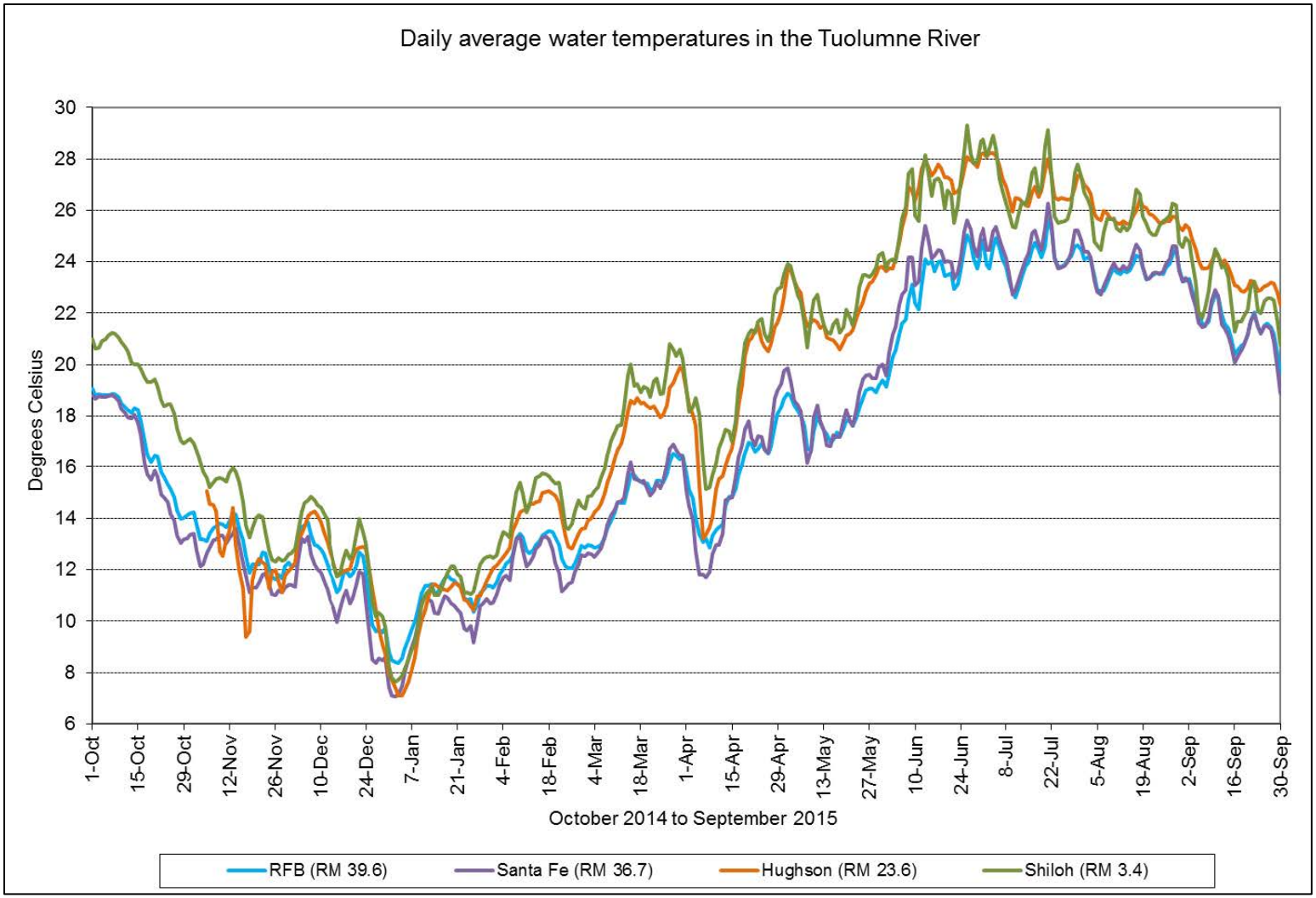

Figure 3.3.2-6. Tuolumne River daily mean temperature between RM 39.6 and RM 3.4, water year 2015 (Source: Districts, 2016).

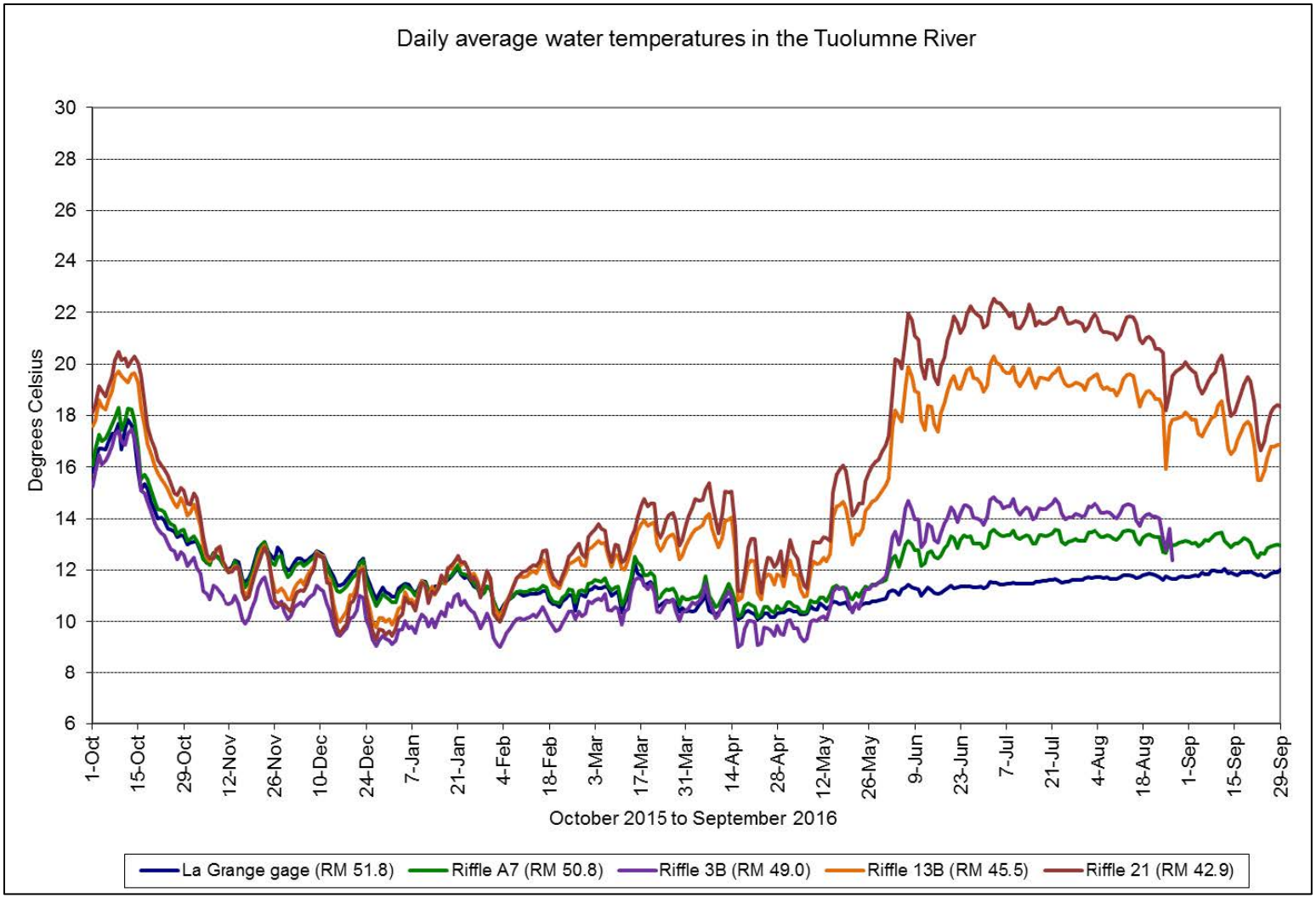

Figure 3.3.2-7. Tuolumne River daily mean temperature between RM 51.8 and RM 42.9, water year 2016 (Source: Districts, 2017c).

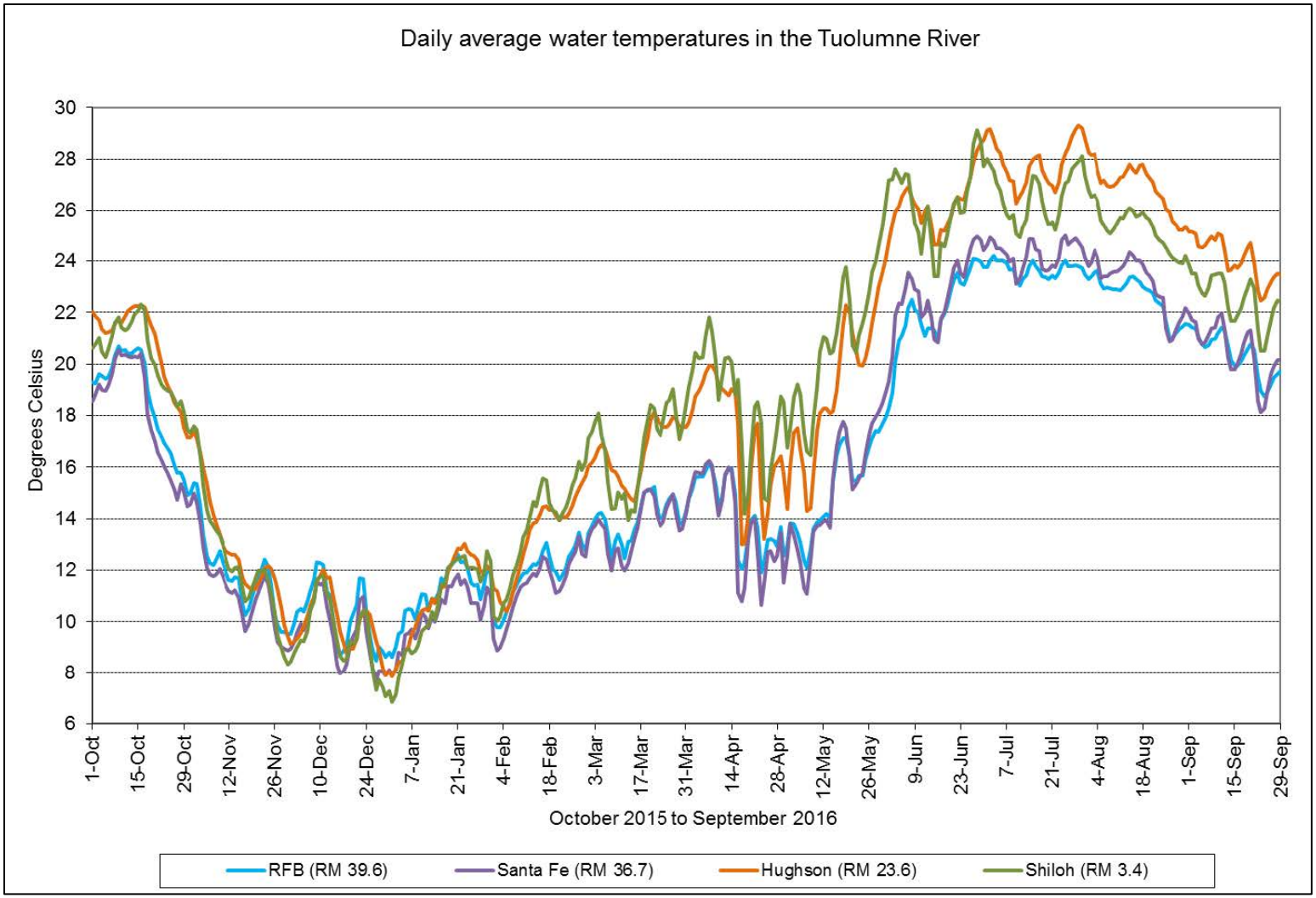

Figure 3.3.2-8. Tuolumne River daily mean temperature between RM 39.6 and RM 3.4, water year 2016 (Source: Districts, 2017c).

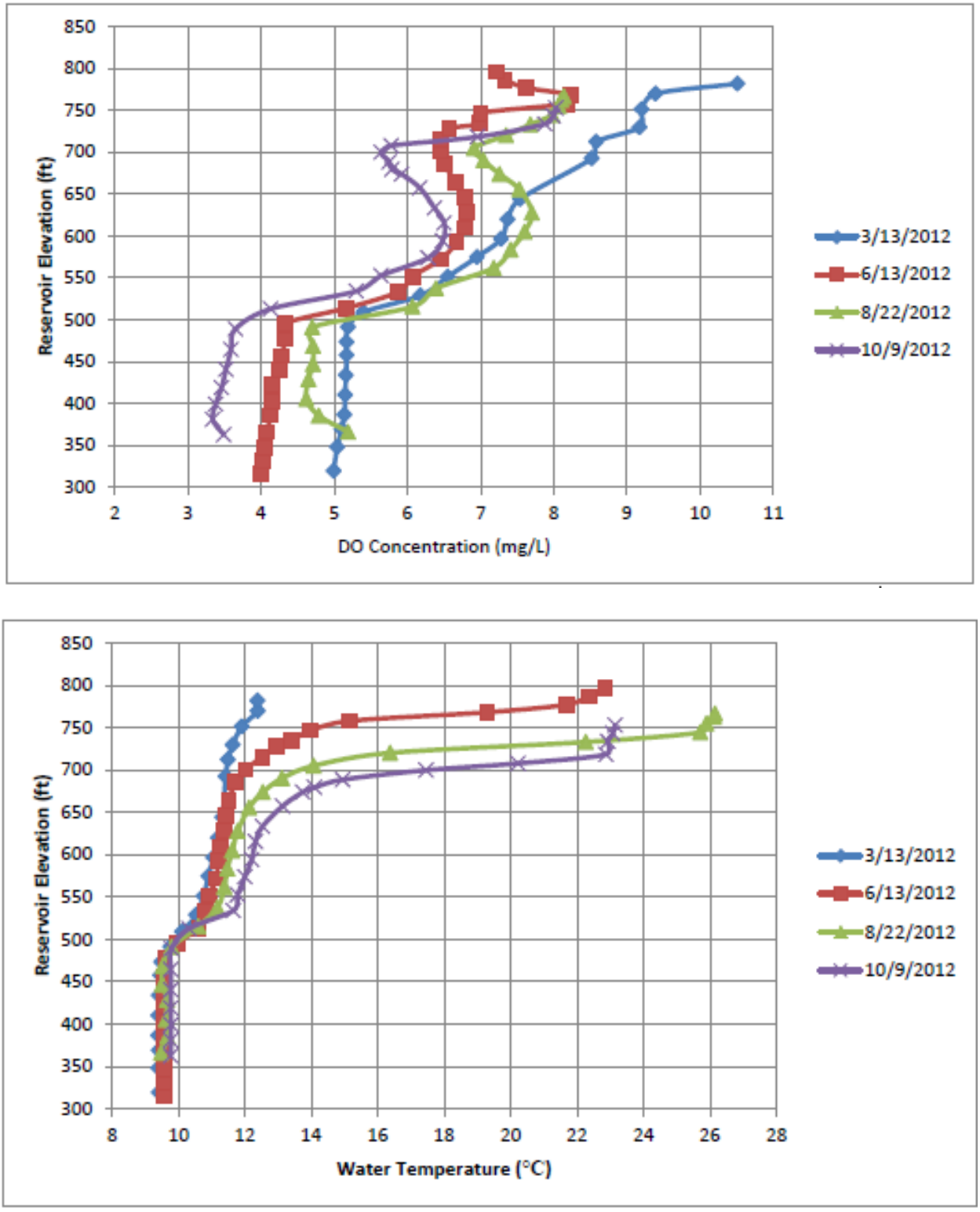

Figure 3.3.2-9. DO concentration and water temperature vertical profiles recorded in Don Pedro Reservoir near the dam in 2012 (Source: Districts, 2017a).

Table 3.3.2-7. Monthly ranges of DO concentrations in the Don Pedro Reservoir and its outflow (Source: Districts, 2017a, as modified by staff).

Month	Don Pedro Reservoir near Highway 49 Bridge[a]	Don Pedro Reservoir near Dam[b]	River Just Downstream of Don Pedro Dam and Powerhouse[c]
Jan	NR	NR	8.6–11.4
Feb	7.5–8.7	2.6–7.5	8.2–12.4
Mar	6.9–9.9	0.7–10.5	8.4–12.1
Apr	6.6–7.6	3.7–11	8.4–10.9
May	6.6–9.5	4.1–9.6	8.8–10.6
Jun	5.7–10.6	4.0–9.3	8.6–10.7
Jul	4.5–9.4	4.2–9.8	8.3–10.3
Aug	0.8–8.4	4.6–8.4	8.2–10.4
Sep	0.6–8.4	3.3–8.5	7.4–10.3
Oct	0.8–8.1	3.3–8.4	6.8–10.7
Nov	0.0–8.3	3.4–8.2	5.8–11.0
Dec	NR	NR	8.6–9.1

Note: NR—no measurements reported

[a] Period of record consists of vertical profiles conducted in June through November of 2011; March, May, June, July, September and November of 2012; and February through July and September of 2013.

[b] Period of record consists of vertical profiles conducted in June through November of 2011; March through November of 2012; and February through July and September of 2013.

[c] Period of record consists of hourly data recorded throughout 2012.

Hourly DO data collected from the Tuolumne River just downstream of the Don Pedro Dam and Powerhouse in 2012 ranged from 5.8 to 12.4 mg/L (table 3.3.2-7). Although 17 days in October and November of 2012 have at least one hourly DO measurement less than 7.0 mg/L, the Districts report that all average daily values meet the 7.0-mg/L objective.

The Districts conducted instantaneous DO measurements as part of the La Grange Project Fish Barrier Assessment (FISHBIO, 2017a). In the Tuolumne River's main channel across from the La Grange Powerhouse (refer to figure 3.3.2-10), morning instantaneous DO measurements were 9.0 to 14.2 mg/L in the September to April

monitoring season of 2015–2016, and 10.2 to 11.6 mg/L in 2016–2017 monitoring season.[78] However, morning instantaneous DO measurements for the La Grange Powerhouse tailrace channel were lower, ranging from 4.0 to 13.9 mg/L in the 2015–2016 study period and 7.1 to 10.9 mg/L in the 2016–2017 study period.[79] In the final license application for the La Grange Project, the Districts report that the DO measurements of less than 8.0 mg/L occur at the powerhouse tailrace channel weir from late September through October of 2015, when DO measurements at the main channel weir remain above 8.0 mg/L.

Table 3.3.2-8 summarizes the Districts' instantaneous DO measurements taken at several locations in the lower Tuolumne River to satisfy Don Pedro Project license requirements in 2012–2017. During this six-year period, only one measurement was less than the 8.0-mg/L Basin Plan DO objective applicable for Waterford to La Grange between October 15 and June 15. All DO measurements in 2012–2017 met the 7.0-mg/L DO objective that applies to the remainder of the year from Waterford to La Grange and all year downstream of Waterford.

Instantaneous turbidity measurements conducted at rotary screw traps (RSTs) in January to May of 2015–2017 range from 0 to 24 nephelometric turbidity units (NTUs) at RM 29.8 (downstream of Waterford) and from 2.3 to 55 NTUs at Grayson (RM 5.2) (Districts, 2016; 2017c; 2018c). Baseline turbidity levels are generally less than 5 NTUs, but turbidity occasionally exceeds 15 NTUs during this period. As expected, the out-migration of Chinook salmon fry and smolt peak at Waterford and Grayson for brief periods during rain events or scheduled releases from Don Pedro Reservoir when turbidity is slightly elevated above background levels (Districts, 2016; 2017c; 2018c). Instantaneous turbidity monitoring conducted for annual adult fall-run Chinook salmon migration studies document turbidity ranges at the existing seasonal fish counting weir at RM 24.5 of 0.4 to 27 NTUs for September to May of 2015–2017, and 0.5 to 6.1 NTUs for January to May of 2015 and 2016 (Districts, 2016; 2017c; 2018c).

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[78] The main channel and powerhouse tailrace channel are separated by a large gravel bar, which includes riparian vegetation, and extends about 150 feet across the river's floodplain.

[79] The Districts report that instantaneous DO measurements were less than 8.0 mg/L 35 times during the 42-day period of September 23 to November 3, 2015 (see the Districts' response to comments on the draft license application included as attachment B to their final license application) but do not provide the frequency or dates DO was less than 8.0 mg/L in the 2016–2017 study period.

Table 3.3.2-8. Range of DO concentrations measured in the lower Tuolumne River, 2012–2017 (Source: Districts, 2013; 2014; 2015; 2016; 2017c; 2018c, as modified by staff).

Period	RMs	2012	2013	2014	2015	2016	2017
Between La Grange Diversion Dam and Waterford: Basin Plan objective is ≥ 8.0 mg/L between October 15 and June 15 and ≥ 7.0 mg/L the rest of the year							
January–June[a]	31.6–50.5	7.7–11.9[d]	8.5–13.8	8.6–12.8	8.3–10.8	8.5–12.2	8.6–13.4
July[b]	31.5–50.7	8.4–11.0	8.4–11.8	7.0–10.4	7.0–11.0	7.6–10.4	8.3–10.4
Below Waterford: Basin Plan Objective is ≥ 7.0 mg/L throughout the Year							
January–June[a]	3.4–24.9	8.3–11.8	8.2–13.3	8.3–11.0	7.4–10.9	8.2–10.9	8.6–13.2
January–May[c]	24.5	NR	7.3–12.8	8.5–12.7	8.6–12.0	8.2–13.1	NR
September–December[c]	24.5	7.8–13.6	8.5–13.6	7.7–11.4	7.1–11.8	8.4–12.3	8.9–11.8

Notes: NR—no measurements reported

[a] Seine study reports provide instantaneous DO concentrations measured at about 14-day intervals. The 2012–2016 monitoring sites are the Old La Grange Bridge at RM 50.5, Riffle 5 at RM 48.0, Tuolumne River Resort at RM 42.4, Hickman Bridge at RM 31.6, Charles Road at RM 24.9, Legion Park at RM 17.2, Service Road at RM 7.4, and Shiloh Road at RM 3.4. In 2017, three additional sites are added for Roberts Ferry at RM 39.5, Fox Grove at RM 27.8, and Riverdale at RM 12.5. In 2015, DO was not measured in June.

[b] Snorkel surveys provide instantaneous DO concentrations measured in riffles at RMs 50.7, 49.9, 49.1, 47.9, 46.9, 45.5, 42.9, 42.3, 38.0, 37.1, 35.3, and 31.5. The 2014 DO values are limited to sites from RM 50.7 to RM 45.5, because the meter malfunctioned.

[c] Adult fall-run Chinook salmon migration reports provide instantaneous DO concentrations measured at the existing seasonal fish counting weir at RM 24.5 for the adult fall-run Chinook salmon study, which is typically from late September to early May. In 2015, DO values were not reported for May. We interpreted a reported DO reading of 1.7 mg/L in 2016 as a typographical error because the next lowest reported DO reading was 8.2 mg/L.

[d] The 7.7 mg/L value recorded at RM 31.6 on June 5, 2012, is the only value less than the Basin Plan DO objective of 8.0 mg/L for the period from October 15 to June 15.

Figure 3.3.2-10. Location of La Grange main channel weir and powerhouse tailrace channel weir (Source: FISHBIO, 2017a).

The Districts' water quality study conducted in 2012 provides insight into water quality conditions of summer low inflow to Don Pedro Reservoir, water near the surface and bottom of the reservoir, and water downstream of the reservoir (HDR, 2013a). This study consisted of sampling physical and chemical characteristics in August, and a recreational water quality element surrounding the Independence Day holiday high-use recreation period. The study involved collecting surface water samples from three Tuolumne River sites and within 1 to 2 meters of the surface and bottom from two Don Pedro Reservoir sites[80] for five *in situ*, 17 basic water quality, 18 metal, and 15 pesticide constituents.[81] August 2012 data indicate water quality is generally good upstream, within, and downstream of the Don Pedro Reservoir. Alkalinity is low (<16 mg/L as $CaCO_3$ in all samples), and pH is nearly neutral (6.4 to 8.0 standard units and did not meet the Basin Plan objective values of 6.4 to 8.5 only near the bottom of the reservoir). No algae blooms were observed, and nutrient concentrations were generally low with measured concentrations of nitrate, nitrite, ammonia, total Kjeldahl nitrogen, ortho-phosphorus, and total phosphorus at or near the analytical method reporting limits. Turbidity is relatively low (i.e., <10 NTUs) at all sites other than the near surface in the reservoir between the upper and middle bays, which had a turbidity of 283 NTUs, possibly because of accumulation of plankton. All 12 recreational sites[82] have fecal coliform counts that meet the Basin Plan water quality objectives, and *E. coli* counts meet the criteria recommended by EPA (2012) for primary-contact recreational uses. Most other analytes were reported as non-detectable to just above analytical reporting limit concentrations. None of the agricultural pesticides on the 303(d) list—chlorpyrifos, diazinon and Group A pesticides—were detected at commercially available reporting limits. Both samples collected near the bottom of Don Pedro Reservoir exhibit a

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[80] Sampling sites were (1) the Tuolumne River upstream of Don Pedro Reservoir, downstream of Don Pedro Dam, and downstream of La Grange Diversion Dam and (2) in Don Pedro Reservoir near the dam and at a location about one-third of the way from the dam to Ward's Ferry Bridge.

[81] *In situ* constituents are temperature, DO, specific conductance, pH, and turbidity. Basic water quality constituents are total alkalinity, total hardness, ammonia, nitrate, nitrite, total Kjeldahl nitrogen, total phosphorus, ortho-phosphorus, total organic carbon, dissolved organic carbon, calcium, chloride, magnesium, potassium, sodium, total suspended solids, and total dissolved solids. Metal constituents are total and dissolved arsenic, cadmium, copper, iron, lead, methyl-mercury, silver and zinc; and dissolved mercury and selenium. Pesticide constituents are aldrin, alpha-BHC, beta-BHC, chlordane, chlorpyrifos, delta-BHC, diazinon, dieldrin, endosulfan I, endosulfan II, endrin, gamma-BHC, heptachlor, heptachlor epoxide, and toxaphene.

[82] These sampling sites are located on Don Pedro Reservoir near recreation areas, specifically four sites at Moccasin Point, five sites at Fleming Meadows, and three sites at Blue Oaks.

dissolved copper concentration that exceeds the corresponding California Toxics Rule (hardness-dependent) concentration of 1.8 microgram per liter.[83] The remaining six samples exhibited dissolved copper concentrations ranging from 0.4 microgram per liter to 0.96 microgram per liter (HDR, 2013a). Except for total iron in the Tuolumne River upstream of Don Pedro Reservoir, all the samples met the California Toxics Rule criteria.

The Districts report that mercury concentrations in fish tissue sampled in 2008 and 2009 exceeded the EPA 0.3-milligram-per-kilogram criterion (EPA, 2001) for all sites sampled within Don Pedro Reservoir and in the lower Tuolumne River. The highest fish tissue mercury concentrations (0.29 to 0.99 milligram per kilogram) occurred in largemouth bass sampled from the shallow Moccasin Creek and Woods Creek arms of Don Pedro Reservoir.

Fishery Resources

Aquatic Habitat

The upper Tuolumne River originates from tributary streams located on Mount Lyell and Mount Dana in the Sierra Nevada. These tributaries join at Tuolumne Meadows (elevation 8,600 feet), and from this point the upper Tuolumne River descends rapidly through a deep canyon in wilderness areas of Yosemite National Park to Hetch Hetchy Reservoir (at an elevation of about 3,800 feet). Except for a short reach at Early Intake Reservoir about 13 miles downstream from O'Shaughnessy Dam (which impounds Hetch Hetchy Reservoir), the river flows unimpeded through a deep canyon for approximately 40 miles, from O'Shaughnessy Dam to the upstream end of Don Pedro Reservoir, which has a normal maximum water surface elevation of 830 feet.

The mainstem Tuolumne River is joined by several tributaries including Cherry Creek, the South Fork Tuolumne River, the Clavey River, and the North Fork of the Tuolumne River, before entering Don Pedro Reservoir. Within the Don Pedro Project vicinity, a number of tributaries flow into Don Pedro Reservoir. Because of their relatively low elevation, most of the streams contributing flow to the reservoir are ephemeral and rain-driven, and thus contribute comparatively little water when compared to the mainstem Tuolumne River.

Downstream of Don Pedro Reservoir, the rolling hills of the eastern Central Valley gradually flatten to become a terraced floodplain. Two small, intermittent drainageways—Big Creek and Twin Gulch—enter the La Grange Reservoir between Don Pedro Dam and La Grange Diversion Dam. As part of their fish population assessment, the Districts characterized the aquatic habitat between Don Pedro Dam and La Grange

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[83] The near-bottom dissolved copper concentrations are 8.16 micrograms per liter for the site near the dam and 6.25 micrograms per liter for the site between the upper and middle bays.

Diversion Dam in 2012 (HDR, 2013b). The reach between Don Pedro Dam and Twin Gulch was characterized as riverine habitat with currents, large substrate dominated by boulders, and a lack of rooted macrophyte beds. Very little habitat complexity is present because bedrock cliffs are the dominant shoreline habitat type with sparse overhanging vegetation. Flow velocities in this reach can range from 5 feet per second during high outflows (about 4,000 cfs) to 3 feet per second during lower outflows (1,000 cfs) just downstream of Don Pedro Powerhouse, and from 2.5 feet per second to 1 foot per second in the deeper pool section just upstream of Twin Gulch. The change in stage between high and low outflows in this reach is about 1.5 feet. The reach downstream of Twin Gulch is characterized as lacustrine with a lack of currents and rooted macrophyte beds. In addition to numerous boulders, smaller substrate, including cobble and gravel are more common than upstream of Twin Gulch. Habitat complexity, however, was similar to the reach upstream of Twin Gulch. Flow velocities in this reach can range from 0.8 foot per second during high outflows to 0.3 foot per second during low outflows. The change in stage between high and low outflows in this reach is approximately 0.2 foot.

Downstream of the La Grange Diversion Dam, the Tuolumne River flows to its confluence with the San Joaquin River. Dry Creek, which joins the lower Tuolumne River at RM 16, is the only significant tributary (drainage area of about 204 square miles) downstream of the La Grange Diversion Dam. The Tuolumne River downstream of the La Grange Diversion Dam to RM 24 is gravel-bedded with moderate slope (0.10 to 0.15 percent), whereas the lower zone (RM 0 to RM 24) is sand-bedded with a slope generally less than 0.03 percent (McBain and Trush, 2000).

From June 12 to June 14, 2012, the Districts surveyed instream habitat at six locations along the lower Tuolumne River from La Grange Diversion Dam (RM 52.2) to Roberts Ferry Bridge (RM 39.5). Table 3.3.2-9 summarizes the combined instream habitat types and physical attributes, and table 3.3.2-10 summarizes the dominant substrates within each of the instream habitat types surveyed by the Districts.

The Districts also surveyed woody material in Don Pedro Reservoir near Ward's Ferry Bridge on March 15, 2012,[84] and at 10 locations along the lower Tuolumne River from about RM 52 to RM 24 from June 12 to June 15, 2012. The Districts surveyed 305 pieces of LWM (woody material meeting minimum size criteria is defined in the study plan) from Don Pedro Reservoir and 200 pieces from the lower Tuolumne River (table 3.3.2-11). Most surveyed LWM was less than 8 inches in diameter and less than 13 feet long. The Districts did not see any LWM larger than 31 inches in diameter and 52 feet long in 2012. Using data about wood raft and burn pile volumes provided by Don Pedro Recreation Agency (DPRA), the Districts estimated that Don Pedro Reservoir captured an average volume of LWM of 70,761 cubic feet annually between 2005 and 2013.

[84] Burn piles inventoried during this survey were left over from the 2011 wood collection and burning season.

Table 3.3.2-9. Habitat types and physical attributes surveyed in the lower Tuolumne River between RM 51.8 and RM 39.5 (Source: Stillwater Sciences, 2017a).

Habitat Type	Number of Habitat Units	Total Habitat Length (feet)	Percent of Total Length	Average Habitat Unit Length (feet)	Average Habitat Unit Width (feet)	Average Habitat Unit Depth (feet)	Average Maximum Habitat Unit Depth (feet)	Average Habitat Unit Area (square feet)
Riffle	10	2,384	14	238	112	0.7	1.3	26,725
Flatwater	12	9,244	55	770	130	2.3	4.4	99,822
Main channel pool	5	2,845	17	569	128	7.2	14.5	72,604
Scour pool	3	1,335	8	445	102	7.7	17.5	45,538
Side channel flatwater	3	1,098	6	366	49	1.5	2.9	18,056
Overall	**33**	**16,906**	**100**	**512**	**114**	**3**	**6.0**	**61,179**

Table 3.3.2-10. Dominant substrate by habitat type in the lower Tuolumne River between RM 51.8 and RM 39.5 (Source: Stillwater Sciences, 2017a).

Habitat Type	Substrate Type	Percent within Habitat Type	Percent within Total Reach Length
Riffle	Gravel	40	6
	Small cobble	60	8
Flatwater	Gravel	17	11
	Small cobble	45	27
	Large cobble	34	21
	Bedrock	4	2
Main channel pool	Large cobble	65	11
	Boulders	22	4
	Bedrock	13	2
Scour pool	Large cobble	41	3
	Boulders	59	5

Table 3.3.2-11. Summary of large woody material surveyed in Don Pedro Reservoir and the lower Tuolumne River (Source: Stillwater Sciences, 2017a).

Diameter (inches)	Length (feet)	Instream Count	Percentage of Instream Total	Reservoir Count	Percentage of Reservoir Total
4–8	3.0–6.5	30	15.0	84	27.5
	6.6–13.0	62	31.0	42	13.8
	13.1–26.0	26	13.0	28	9.2
	26.1–52.0	1	0.5	1	0.3
8.1–16	3.0–6.5	8	4.0	23	7.5
	6.6–13.0	28	14.0	27	8.9
	13.1–26.0	21	10.5	25	8.2
	26.1–52.0	5	2.5	2	0.7
16.1–31	3.0–6.5	0	0.0	12	3.9
	6.6–13.0	4	2.0	19	6.2
	13.1–26.0	11	5.5	24	7.9
	26.1–52.0	4	2.0	18	5.9
Total	**--**	**200**	**100**	**305**	**100**

Reservoir Fish Populations

California DFW manages Don Pedro Reservoir as a put-and-take fishery for coldwater species and as a year-round fishery for black bass. Table 3.3.2-12 shows the numbers and species stocked by California DFW in Don Pedro Reservoir from 2000 through 2012. DPRA has annually stocked black bass in the reservoir since the early 1980s.

In 2012, the Districts collected 14 fish species in Don Pedro Reservoir by electrofishing and gillnet sampling (table 3.3.2-13). Additional species not collected during the 2012 study, but known to occur in Don Pedro Reservoir, include brown trout, brook trout, Eagle Lake trout,[85] Chinook salmon, coho salmon, black bullhead, Sacramento pikeminnow, and whitefish (HDR, 2013c). District biologists collected

[85] Eagle Lake trout are a subspecies of rainbow trout endemic to Eagle Lake, in Lassen County, California.

scales of black bass species[86] for age class analysis and observed multiple age classes including young of the year. District biologists additionally observed 14 bass nests at depths ranging from 2.2 to 8 feet with nest diameter between 0.6 foot and 6.5 feet and mostly within 30 feet of shore. These observations indicate that black bass successfully reproduce within Don Pedro Reservoir.

Table 3.3.2-12. Fish stocking record for species planted in Don Pedro Reservoir by California DFW (2000–2012) (Source: HDR, 2013c).

Year	Kokanee	Chinook Salmon	Brook Trout	Brown Trout	Rainbow Trout	Eagle Lake Trout	Black Bass
2000	45,982	0	2,000	20,070	59,100	0	1,980
2001	50,103	0	3,520	19,800	65,600	0	2,758
2002	10,080	0	0	14,600	52,450	0	1,719
2003	10,043	0	0	0	71,675	0	1,825
2004	9,984	0	0	26,400	179,263	0	3,621
2005	10,143	100,440	118,400	73,687	262,585	3,600	2,000
2006	4,061	70,015	0	22,100	388,720	405	1,062
2007	6,517	91,000	0	15,860	41,720	72,680	1,667
2008	10,080	93,885	18,222	10,050	37,617	31,600	1,680
2009	10,050	100,006	5,610	31,320	329,495	93,790	1,367
2010	10,032	100,000	0	0	4,800	52,300	1,755
2011	10,260	129,980	0	16,000	44,300	55,300	0
2012	10,000	99,997	0	15,400	52,300	37,900	2,000

Table 3.3.2-13. Fish species collected by the Districts in Don Pedro Reservoir in October 2012 (Source: Districts, 2017a).

		Composition		Length (mm)			Weight (g)			Mean Condition Factor (Kn)[a]
Species	Native Species (N)	N	%	Min	Max	Mean	Min	Max	Mean	
Threadfin shad	--	135	20.8	58	111	76.3	1.0	18.7	6.0	0.99
Common carp	--	8	1.2	450	686	578.0	1,420	4,678	2,910	--
Golden shiner	--	5	0.8	53	90	70.6	2.6	11.5	6.0	--

[86] The term *black bass* is used to refer to any bass species in the genus *Micropterus*, and includes, but not limited to, largemouth, smallmouth, and spotted bass.

Species	Native Species (N)	Composition		Length (mm)			Weight (g)			Mean Condition Factor (Kn)[a]
		N	%	Min	Max	Mean	Min	Max	Mean	
Sacramento sucker	N	9	1.4	322	495	406.9	322.0	1310	785.0	--
White catfish	--	1	0.2	295	295	295	368.5	368.5	368.5	--
Channel catfish	--	30	4.6	60	575	326.1	3.3	2,350	760.8	0.99
Kokanee	--	18	2.8	308	412	332.3	172.0	965.0	380.6	0.92
Rainbow trout	N	1	0.2	422	422	422.0	683.0	683.0	683.0	--
Black bass[b]	--	76	11.7	52	98	68.8	1.2	11.2	4.1	--
Largemouth bass	--	116	17.8	45	465	252.3	1.1	1,723	361.2	1.06
Smallmouth bass	--	20	3.1	54	410	201.7	2.1	1,107	285.3	1.04
Spotted bass	--	57	8.8	100	403	276.8	11.9	992.2	377.1	0.95
Green sunfish	--	95	14.6	32	102	67.1	0.5	19.0	5.2	1.04
Bluegill sunfish	--	78	12.0	37	138	80.7	1.0	60.0	12.8	1.00
Crappie	--	1	0.2	57	57	57.0	2.2	2.2	2.2	--

[a] Species with 10 or fewer individuals or poorly fit regressions did not have a reportable condition factor.

[b] Small-sized black bass were not identified to species.

Stream Fish Populations

No known fish stocking has occurred in the reach of the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam, and no hatchery supplementation occurs in the reach downstream of the La Grange Diversion Dam. The Districts collected *O. mykiss* and prickly sculpin in 2012 throughout the reach between Don Pedro Dam and La Grange Diversion Dam, and both species exhibited multiple age classes, indicating successful reproduction in this reach.

The Tuolumne River downstream of the La Grange Diversion Dam to the confluence with the San Joaquin River contains a fish community mixed with native and introduced species and resident and migratory species. Water temperature and velocity, which vary by location and season and in response to flow, influence the distributions of native and non-native fishes. Most native resident fish species are riffle-spawners and are generally more abundant in the gravel-bedded reach (RM 24-52). The Sacramento sucker is the most abundant and widespread native fish species in the river downstream of the La Grange Diversion Dam. Non-native fishes are present throughout the lower river but are typically most abundant in the sand-bedded reach (RM 0-24) and in the lower 6 to 7 miles of the gravel-bedded reach (RM 24 to RM 31), where water

temperatures are warmer and SRPs[87] provide habitat (Ford and Brown, 2001). Sunfishes are the most abundant and widespread non-native fish in the lower river. The non-native predator fish community in the lower river includes largemouth, smallmouth, and striped bass. Migratory species in the Tuolumne River downstream of the La Grange Division Dam include Pacific lamprey, Sacramento splittail, fall-run Chinook salmon, *O. mykiss*, and striped bass.

Fall-run Chinook salmon spawn in the Tuolumne River between RM 24 and RM 52 from late October through December, egg incubation and fry emergence occur from November through January, and rearing primarily occurs between January and April (Stillwater Sciences, 2013a). Early estimates of Chinook run sizes have ranged from 130,000 spawners in 1944 to 100 in 1963. Since the completion of Don Pedro Dam in 1971, spawner estimates from 1971 to 2015 have ranged from 40,300 in 1985 to 77 in 1991 (table 3.3.2-14). From 1971 to 2009, the date of the peak weekly live spawner count has ranged from October 31 (1996) to November 27 (1972) with a median date of November 12. Since fall 2009, escapement monitoring has been conducted at the seasonal fish counting weir established at RM 24.5, just downstream of the downstream boundary of the gravel-bedded reach.

Table 3.3.2-14. Tuolumne River fall-run Chinook salmon run-size estimates, 1971-2015 (Source: Districts, 2013; 2014; 2015; and 2016; Stillwater Sciences, 2013a).

Year	Estimated Run Size	Year	Estimated Run Size	Year	Estimated Run Size
1971	21,885	1986	7,288	2001	9,222
1972	5,100	1987	14,751	2002	7,125
1973	1,989	1988	6,349	2003	2,961
1974	1,150	1989	1,274	2004	1,700
1975	1,600	1990	96	2005	719
1976	1,700	1991	77	2006	625
1977	450	1992	132	2007	211
1978	1,300	1993	431	2008	372
1979	1,184	1994	513	2009	300
1980	559	1995	928	2010	766

[87] SRPs are large, in-channel pits (up to 400 feet wide and 35 feet deep) created by historical aggregate mining.

Year	Estimated Run Size	Year	Estimated Run Size	Year	Estimated Run Size
1981	14,253	1996	4,362	2011	2,847
1982	7,126	1997	7,548	2012	2,120
1983	14,836	1998	8,967	2013	3,738
1984	13,689	1999	7,730	2014	638
1985	40,322	2000	17,873	2015	421

Steelhead are the anadromous form of rainbow trout, and both forms (anadromous and resident) are variants of the same species, *Oncorhynchus mykiss*. NMFS considers naturally spawned anadromous *O. mykiss* originating below natural and manmade impassable barriers from the Sacramento and San Joaquin Rivers and their tributaries to belong to the California Central Valley Steelhead DPS. California Central Valley steelhead return from the ocean to enter fresh water beginning in August and spawning occurs from December through April. After spawning, adults may survive and migrate back to the ocean. Steelhead offspring rear for one to three years in fresh water before they migrate to the ocean as smolts, where most of their growth occurs.

The question of whether the *O. mykiss* population in the Tuolumne River includes a migratory component that represents a population of steelhead has been a contentious subject in the record for the Don Pedro Project. In an order issued on July 16, 2009, the Commission concluded that the information filed by FWS, NMFS, and other stakeholders was sufficient to support the conclusion that steelhead are present in the Tuolumne River. However, between 2009 and 2016, only six *O. mykiss* greater than 16 inches in length were detected at the seasonal fish counting weir operated by the Districts at RM 24.5 (HDR, 2017a), and since then, none were detected in 2017 (Districts, 2018c) and one was detected in 2018 (Districts, 2019b). The low number of large *O. mykiss* detected at the weir indicates that a self-sustaining run or population of California Central Valley steelhead does not now occur in the Tuolumne River. Table 3.3.2-15 presents the *O. mykiss* population estimates based on snorkeling surveys from 2008 through 2011.

Table 3.3.2-15. Summary of *O. mykiss* population estimates in the Tuolumne River from 2008–2011, between RM 51.8 and RM 29 (Source: Stillwater Sciences, 2013b).

	***O. mykiss* <150 mm**			***O. mykiss* ≥150 mm**		
Survey Date	**Observed**	**Estimate**	**Standard Deviation**	**Observed**	**Estimate**	**Standard Deviation**
July 2008	128	2,472	616.9	41	643	217.7
March 2009	5	63	--	7	170	86.3

Survey Date	*O. mykiss* <150 mm			*O. mykiss* ≥150 mm		
	Observed	Estimate	Standard Deviation	Observed	Estimate	Standard Deviation
July 2009	641	3,475	1,290.5	105	963	254.4
March 2010	1	1	0.3	13	109	30
August 2010	313	2,405	908.1	324	2,139	720.6
September 2011	4,913	47,432	5,662.2	813	9,541	1,200.9

Special-status Fishes

Three special-status fish species—hardhead, Red Hills roach, and Sacramento-San Joaquin roach—occur in tributaries to Don Pedro Reservoir or in the mainstem Tuolumne River upstream and downstream of the reservoir. However, these species have not been found within the project boundary. The hardhead is a California species of special concern and historically was widely distributed and locally abundant in the Central Valley. Widespread alteration of lower elevation riverine habitats and predation by bass species have resulted in population declines and isolation of populations (Moyle, 2002). The Red Hills roach is a California endangered species and is part of the California roach fish community. Individuals in the California roach fish community are abundant in several permanent pools in tributaries to Don Pedro Reservoir. The Red Hills roach is specifically found in areas characterized by serpentine soils and stunted vegetation (Moyle, 2002). The Sacramento-San Joaquin roach is a California species of special concern and part of the California roach fish community. The Sacramento-San Joaquin roach is generally found in small, warm, intermittent streams and is most abundant in mid-elevation streams in the Sierra foothills and in the lower reaches of some coastal streams (Moyle, 2002). The adult Sacramento-San Joaquin roach has been observed and documented in the general vicinity of the Don Pedro Project, (i.e., in Hatch and Second Creeks and Rough and Ready Creek, but not in the Tuolumne River mainstem).

Benthic Macroinvertebrates

Benthic macroinvertebrates (BMI) are a diverse and typically abundant group of organisms with specific habitat preferences. Many species are sensitive to environmental conditions and stresses and intolerant of specific pollution sources. Therefore, benthic communities are excellent indicators of both water quality and biological integrity. Based on community structure metrics, indices can be developed where higher scores on an index indicate better water quality and higher biological integrity.

The Districts have conducted BMI monitoring in the lower Tuolumne River since 1987. Table 3.3.2-16 presents a comparison of Hess samples collected at riffles 4A

(RM 48.4) and 23C (RM 42.3). The EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) Index is the percentage of all organisms in the taxonomic orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) and will generally decrease with biological impairment. The percent of Chironomidae, or percent of midge larvae, will generally increase with biological impairment. The EPT/Chironomid ratio, or ratio of EPT larvae to midge larvae, will generally decrease with biological impairment, as will the Shannon Diversity index metric. Although overall invertebrate abundances in Riffle 4A samples declined slightly from 1996 to the present, community composition shifted away from pollution-tolerant organisms and toward those with higher food value for juvenile salmonids and other fish.

Table 3.3.2-16. BMI community metrics for long-term Hess sampling sites at riffles R4A (RM 48.8) and R23C (RM 42.3) in the lower Tuolumne River (Source: Districts, 2017a, as modified by staff).

Year	Sampling Location	EPT Index (%)	EPT / Chironomid Ratio	Shannon Diversity	Percent Chironomidae	Density (no. per square meter)
1992	R4A	14	0.28	2.13	60	23,272
1993	R4A	15	0.38	1.77	44	24,813
1994	R4A	22	1.73	2.62	17	3,897
1996	R4A	84	11.09	1.59	8	22,987
1997	R4A	28	0.45	1.31	63	20,780
2000	R4A	52	2.57	2.13	25	28,832
2001	R4A	44	1.44	2.7	30	17,037
	R23C	48	2.17	2.43	22	15,528
2002	R4A	49	1.52	2.0	34	24,798
	R23C	11	0.38	2.26	32	11,649
2003	R4A	41	0.85	2.32	48	23,547
	R23C	51	8.16	2.37	8	11,767
2004	R4A	68	3.18	1.92	21	28,994
	R23C	79	26.86	1.79	3	19,120
2005	R4A	76	7.52	1.56	10	27,440
	R23C	85	15.34	1.42	3	6,710
2007	R4A	58	1.91	2.73	30	10,040

Year	Sampling Location	EPT Index (%)	EPT / Chironomid Ratio	Shannon Diversity	Percent Chironomidae	Density (no. per square meter)
	R23C	80	15.95	1.84	5	4,143
2008	R4A	61	0.88	2.58	18	4,733
	R23C	68	23.28	2.12	3	2,762
2009	R4A	50	1.82	2.79	28	28,516
	R23C	49	12.99	2.33	4	23,917

Aquatic Invasive Species

The aquatic invasive species of concern in the Central Valley include the quagga mussel, zebra mussel, New Zealand mudsnail, and water hyacinth. Except for water hyacinth, none of these species have been documented in Don Pedro Reservoir or the Tuolumne River Watershed (Districts, 2017a, exhibit E, appendix E-4). The zebra mussel was found for the first time in California in January 2008 at the San Justo Reservoir in San Benito County. The New Zealand mudsnail is more prevalent in California than either mussel species and has been documented in the Merced and Stanislaus Rivers (USGS, 2018j). If the New Zealand mudsnail were to become established in the Tuolumne River Watershed, it would pose similar threats as other aquatic invasive species in other areas, including clogging facility pipes and out-competing other aquatic macroinvertebrates for food, thereby disrupting ecosystem balances across the food web.

The water hyacinth is a non-native invasive plant from the Amazon River Basin and is considered one of the world's most invasive aquatic weeds. It can double in size every ten days in hot weather and can quickly become a dense floating mat of vegetation up to six feet thick (California DPR, 2019). In California, the water hyacinth is usually found at elevations of 650 feet or lower in the San Francisco Bay area, along the South Coast, and in the Central Valley, including the lower Tuolumne River. Water hyacinth has been documented as occurring in dense mats covering the lower Tuolumne River from bank to bank, particularly in the reach between Riverdale Park (RM 12.3) and Shiloh Bridge (RM 4.0). The California State Parks Division of Boating and Waterways (formerly, the Department of Boating and Waterways) is the lead state agency that works with local, state, and federal entities to, among other things, manage the aquatic invasive plants in the Delta and its tributaries (California DPR, 2019). California DPR (2015a, 2016, 2017, 2018) reports the number and location of herbicide treatments in the lower Tuolumne River varied widely with the total number of treatments being three in 2017, 65 in 2016, 36 in 2015, and 23 in 2014.

3.3.2.2 Environmental Effects

The Districts, in consultation with Don Pedro Project stakeholders,[88] developed a suite of models to evaluate the effects of alternative operations on water supply; Don Pedro Reservoir pool storage and elevation; and lower Tuolumne River flow, water temperature, and populations of Chinook salmon and *O. mykiss.* The resulting models are:

- Operations Model, a model built on a spreadsheet platform to simulate current and potential future operations of the project encompasses the area from the CSF's Hetch Hetchy System to the Tuolumne River confluence with the San Joaquin River.[89]
- Don Pedro Reservoir Temperature Model, a 3-dimensional model developed on the Danish Hydraulic Institute's MIKE3-FM platform, which incorporates the old Don Pedro Dam structure, to simulate the dynamics of the water temperature regime in Don Pedro Reservoir and characterize the existing seasonal cool-water storage volume.[90]
- Lower Tuolumne River Temperature Model, a 1-dimensional model developed on the Corps' HEC-RAS platform for the Tuolumne River from Don Pedro Dam (RM 54.8) to the confluence with the San Joaquin River.[91]
- Lower Tuolumne River Floodplain Hydraulic and Habitat Model developed using the TUFLOW model platform that simulates the interaction between flow within the Tuolumne River main channel and the floodplain downstream of the La Grange Diversion Dam (RM 52.2) to the confluence with the San

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[88] The Districts' consultation with relicensing participants included workshops held between March 20, 2012, and May 18, 2017; training sessions for operation of the models; and provision for the participants to directly run the models.

[89] The operations model developed under the W&AR-2 study is documented in the Project Operations Water Balance Model Amended Study Report (Steiner, 2017); it provides the needed flow and reservoir water elevations to the other models. It also provided estimates of energy production by the projects for each flow scenario, which we present in section 4, *Developmental Analysis*.

[90] The reservoir temperature model is documented in the W&AR-3 Study Report (HDR, 2017b); it provides Don Pedro Reservoir outflow temperatures to the lower Tuolumne River temperature model.

[91] The lower river temperature model is documented in the W&AR-16 study report (HDR, 2017c); it provides simulated lower Tuolumne River temperatures to the Chinook salmon and *O. mykiss* population models.

Joaquin River (RM 0) to estimate floodplain juvenile salmonid rearing habitat.[92]

- Lower Tuolumne River Chinook Population Model,[93] referred to as TRCh, a multi-stage individual-based simulation model that evaluates the relative effect of in-river factors on Chinook salmon production using the publicly available "R" statistical package and documented by Stillwater Sciences (2017b).[94]
- Lower Tuolumne River *O. mykiss* Population Model,[95] referred to as TROm, a multi-stage individual-based simulation model that evaluates the relative effect of in-river factors on *O. mykiss* production using the publicly available "R" statistical package and documented by Stillwater Sciences (2017c).[96]

As described in the Districts' May 14, 2018, filing of modeling results,[97] the models were revised to (1) correct the operations model's representation of the Districts' proposed "dry year relief" of reducing spring pulse flows in sequential dry water years[98] and (2) update the reservoir temperature model's representation of old Don Pedro Dam

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[92] The floodplain model is documented in the W&AR-21 Study Report (HDR and Stillwater Sciences, 2017); the results of this model are incorporated into the Chinook salmon and *O. mykiss* population models.

[93] Although TRCh is referred to as a population model in the Districts' filings, the model is not a true population model because it is designed to evaluate the effect of in-river factors (within the Tuolumne River) to compare the effects of alternative operations and enhancement measures. It is not intended to predict population sizes, so we refer to it hereafter as a production model.

[94] The Chinook salmon population model is documented in the W&AR-06 study report (Stillwater Sciences, 2017b).

[95] Although TROm is referred to as a population model in the Districts' filings, the model is not a true population model because it is designed to evaluate the effect of in-river factors (within the Tuolumne River) to compare the effects of alternative operations and enhancement measures. It is not intended to predict population sizes, so we refer to it hereafter as a production model.

[96] The *O. mykiss* salmon population model is documented in the W&AR-10 study report (Stillwater Sciences, 2017c).

[97] Districts, 2018a.

[98] Prior to this revision, input to the operations model incorrectly applied 35 thousand acre-feet, instead of the proposed 45 thousand acre-feet, for spring pulse flows in sequential dry water years. The Districts (2018a) report that this only affected simulated flows in 2002.

with information discovered after the Districts filed the amended final license application.[99]

The Districts used the resulting models to simulate the proposed and recommended operation scenarios and filed their response to staff's additional information requests (AIRs) on May 14, June 19, July 11, July 30, 2018; December 11, 2019; and January 24 and March 17, 2020 (Districts, 2018a,b,d,e; 2019c, and 2020a,b). The general approach for this modeling is to represent the no-action scenario (base case) and proposed and recommended operations within the limits of the models. All these scenarios use the Fourth Agreement's shared responsibility of the CCSF Hetch Hetchy System operations contributing 51.7 percent of the required releases greater than the current FERC license flows.[100] Although the models account for accretion/depletion and compute water temperatures, simulations of recommended operations were not altered to meet water temperature objectives or account for accretion/depletion between the La Grange gage and locations downstream of the two proposed infiltration galleries. The base case and some of the other scenarios do not include operation of the infiltration galleries.

On May 14, 2018, the Districts filed model simulations to provide model results for nine scenarios of project operations in response to staff's AIR issued February 16, 2018.[101] Commission staff's review of this filing revealed a lack of information about (1) Tuolumne River flows just downstream of the Districts' proposed infiltration galleries, (2) modeling of the Districts' proposed interim flows, which would be in effect until the infiltration galleries are operational, and (3) misrepresentations of recommendations made by The Bay Institute and ECHO. Therefore, the Commission requested additional information to fill these data gaps, and the Districts filed the

[99] Newly discovered design drawings indicate the original side-channel spillway of the old dam, which is located at about RM 56.4 about 1.5 miles up-reservoir of the current dam, had a concrete crest at elevation 596.5 feet and was about 570 feet long. The Districts' also revised the model's bathymetry to be consistent with removal of the original spill gates that were on top of the spillway prior to filling of new Don Pedro Reservoir.

[100] The shared responsibility is subject to the terms of the Fourth Agreement, as amended, between the Districts and CCSF.

[101] Districts (2018a) includes information for the base case, DPP-1r, FWSREA, NMFSREA, DFWREA, SWBREA, CGREA10% and two scenarios that are not used in this EIS.

requested additional information on June 19[102] and July 30, 2018.[103] The draft EIS used 10 of the Districts' model scenarios.

After the publication of the draft EIS, multiple commenters raised concerns about how well the simulated scenarios addressed potential effects of recommended flow and non-flow measures. On September 17, 2019, staff issued an AIR, requesting that the Districts use their models to provide scenarios that would:

- Better represent The Bay Institute's recommendations.
- Model the draft Voluntary Agreement[104] to serve as a Tuolumne River-specific alternative to the Water Board's update to the Bay-Delta Plan.
- Enable evaluation of the effects of non-flow measures, including coarse sediment management, the LTRHIP, the predator control plan (including fish counting/barrier weir), spawner superimposition reduction, and gravel cleaning.

On December 11, 2019, the Districts filed model simulations in response to this AIR (Districts, 2019c).[105]

While analyzing these model simulation results, Commission staff identified a discrepancy in the data depicting proposed releases to the lower Tuolumne River related to the proposed infiltration galleries, and notified the Districts of this possible discrepancy on February 4, 2020. The Districts confirmed that it did appear the results of their proposed flows with infiltration galleries operational scenario contained an error in the simulated releases to the lower Tuolumne River. The Districts subsequent assessment of the extent of this error on other model results determined that the discrepancy affected two alternative operating scenarios that include infiltration galleries. On March 17, 2020, the Districts filed an errata package (Districts, 2020a) that corrects the inadvertent modeling errors to these two scenarios. The Districts' consultant became aware of and corrected a coding error in the Chinook and *O. mykiss* production models that affected

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[102] Districts (2018d) includes Tuolumne River flows at RM 25.5 for the scenarios filed on May 14, 2018.

[103] Districts (2018e) includes information for the DPP-1r-NoIG and ECHOREA-NoIG scenarios, and the TBIREA-NoIG scenario used in the draft EIS.

[104] Draft version submitted to the Water Board on March 1, 2019.

[105] Districts (2019c) includes information for the draft Voluntary Agreement, DPP-1r-NoIG_wBF, and the TBIREA-NoIG-AIR scenarios used in this final EIS. The Districts' December 11, 2019, filings also provide population model results for their proposed interim flows with adaptive management of spring pulse flows and the draft Voluntary Agreement without non-flow measures and with each non-flow measure separately and combined.

the allocation of juvenile fish between the floodplain and the main channel. On June 17, 2020, the Districts filed revised results running most model scenarios through the corrected models.

Table 3.3.2-17 summarizes the 11 flow model scenarios analyzed in this EIS, and table 3.3.2-18 summarizes the non-flow measures included in each simulation. Table 3.3.2-19 provides a clear path to the source data that we used in this final EIS for each model scenario.

Streamflows and Reservoir Levels

The Districts have historically operated the Don Pedro Project for flood control, water supply, recreation, hydropower, and environmental benefits. The project attenuates high flows in the Tuolumne River from winter storms and spring runoff by storing water in Don Pedro Reservoir. The project provides a flood storage capacity of 340,000 acre-feet based on a contract with the Corps. The Districts operate the project from April through June for flood control purposes. Irrigation deliveries normally reach their peak in July and August, while municipal and industrial deliveries occur year-round. Don Pedro Reservoir is operated to provide water storage sufficient to satisfy annual flow requirements, while considering the need for carry-over storage that may be needed to meet water needs over successive dry years.

Table 3.3.2-17. Description of flow measures in model scenarios (Source: Districts, 2018a,b; 2019c, as modified by staff).

Scenario Name	Represents	Minimum Don Pedro Reservoir Pool	Minimum Instream Flows[a]	Pulse Flows	Ramping Rates/ Recession Flows	Operation of IGs
Base case	Environmental Baseline[b]	375 TAF, ≈610 feet	At La Grange gage	Spring pulse flows	No	No
DPP-1r-NoIG	Districts' proposed interim flows (without IGs operational)	375 TAF, ≈610 feet[c]	At La Grange gage[d]	Fall and spring pulse flows[e]	Up- and downramping rates for October pre-spawning flushing flows and downramping rate for spring gravel mobilization	No
DPP-1r	Districts' proposed flows with IGs operational	375 TAF, ≈610 feet[c]	At La Grange gage and below the IGs supplemented with boatable flows[d]	Fall and spring pulse flows[e]	Up- and downramping rates for October pre-spawning flushing flows and downramping rate for spring gravel mobilization	Yes[f]

Scenario Name	Represents	Minimum Don Pedro Reservoir Pool	Minimum Instream Flows[a]	Pulse Flows	Ramping Rates/ Recession Flows	Operation of IGs
VA[f]	Draft Voluntary Agreement under discussion among the Districts, CCSF, the Water Board, and California DFW, as part of the state process to update Bay-Delta Plan	375 TAF, ≈610 feet[c]	At La Grange gage and limit withdrawals at the IGs supplemented with boatable flows	Fall and spring pulse flows, geomorphic flood pulses	Up- and downramping rates for floodplain pulses and October pre-spawning flushing flows and downramping rate for spring pulses	Yes
FWSREA[g]	FWS 10(j) recommendation 2 filed on January 29, 2018 (accession no. 20180129-5298)	---	At La Grange Gage and below the IGs	Fall and spring pulse flows	Recession flow rates	Yes, 100 cfs July–September
NMFSREA[h]	NMFS 10(j) recommendation 1 filed on January 29, 2018 (accession no. 20180129-5258)	--	At La Grange gage and below the IGs	Fall and spring pulse flows	Pulse flow recession rates, minimum instream flows up and downramping rates	Yes, none in extra critical dry years
DFWREA[i]	California DFW 10(j) recommendation M1 filed on January 29, 2018 (accession no. 20180129-5315)	500 TAF, ≈647 feet	At La Grange gage and below the IGs	Fall and spring pulse flows, geomorphic flood pulses	Spring recession rates, ramping rates	Yes

Scenario Name	Represents	Minimum Don Pedro Reservoir Pool	Minimum Instream Flows[a]	Pulse Flows	Ramping Rates/ Recession Flows	Operation of IGs
SWBREA[j]	The Water Board filed on January 29, 2018 (accession no. 20180129-5393)[k]	800 TAF, ≈700 feet, on September 30 unless needed to meet 363 TAF minimum annual diversion	February–June 40% of unimpaired with up to 10% of the unimpaired flow shifted to the fall in wet years, and current FERC requirement rest of year[l]	No	No	No
CGREA10%[m]	Conservation Groups filed January 29, 2018 (accession no. 20180129-5200)	---	At La Grange gage and below the IGs	Fall and spring pulse flows	Recession flow rates	Yes, 100 cfs July–September
TBIREA-NoIG'	The Bay Institute filed January 29, 2018 (accession no. 20180129-5262) supplemented on April 12, 2019 (accession no. 20190412-5031)	---	At La Grange gage	Fall pulse flows	Recession rates	No
ECHOREA-NoIG	ECHO filed January 29, 2018 (accession no. 20180129-5047)	---	February–June 60% unimpaired inflow to Don Pedro Reservoir; other periods same as base case	---	---	No

Notes: The May 14, 2018, filing (Districts, 2018a) provides the base case, FWSREA, NMFSREA, DFWREA, and SWBREA scenarios. The July 30, 2018, filing (Districts, 2018b) provides the DPP-1r-NoIG and ECHOREA-NoIG scenarios. The December 11, 2019, filing (Districts, 2019c) provides the VA and TBIREA-NoIG scenarios. The DPP-1r and CGREA10% scenarios were based on the May 14, 2018, filing (Districts, 2018a) in the draft EIS, but are now (in this final EIS) based on the March 17, 2020, filing (Districts, 2020a) which provides output that has corrected modeling errors that were inadvertently incorporated into the earlier filing.

SJI – San Joaquin River Index, TAF – thousand acre-feet, IG – infiltration gallery

[a] Instream flow recommendations for below the IGs were incorporated into the operations model by subtracting the allowed IG water withdrawal from the La Grange gage flow (i.e., they do not account for flow changes, accretion, or depletion, that occur between La Grange and the infiltration galleries).

[b] Environmental baseline conditions in accordance with the current license, Corps flood management guidelines, the Districts' irrigation and municipal and industrial water management practices, and changes in CCSF's operations resulting from construction of capital improvement projects permitted under the California Environmental Quality Act, approved by CCSF, and funded but not fully implemented at the time of model development (i.e., in 2013). The Districts provide additional details for this scenario in the Water Balance Model Amended Study Report filed in the Don Pedro Project amended application (Steiner, 2017).

[c] Although the Districts propose lowering the minimum elevation of Don Pedro Reservoir from 600 feet to 550 feet, which would reduce the storage from about 311 TAF to 158 TAF, they apply the same minimum pool level as baseline conditions. In comments on the draft EIS, the Districts explain that they applied the same Don Pedro Reservoir minimum pool level as baseline for two reasons: (1) relying on water that may not become available would be improper water supply planning, and (2) the purpose of the additional water is an insurance policy against potentially higher instream flows being imposed in the new license, future droughts more severe than represented in the 1971–2012 period, and long-term increases in water supply demands over a 40–50 year license term.

[d] Proposed minimum flows are provided in exhibit E, table 5.6-2.

[e] The Districts' proposals include dry-year relief, which would provide lower pulse flows in sequential dry and critical years (i.e., 45 TAF instead of 75 TAF in sequential dry years, and 11 TAF instead of 35 TAF in sequential critical years).

[f] This scenario simulates IG operations between June 1 and October 15 except during the fall pulse flows, depending on water year type and a reduction of IG withdrawals to provide boatable flows.

[g] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

[h] Water year types for Bulletin 120 values less than 830 TAF are categorized as extra critical dry and simulated with the same minimum instream flows as dry years without pulsing or IG operation. In other July 1–October 15 periods, the IGs' operation is simulated as 200 cfs for wet, above normal, and below normal years or 225 cfs for dry and critically dry years.

[i] Simulated ramping rate limits are 500 cfs per day for downramps and unrestricted for upramps.

[j] Although the Water Board's substitute environmental document's compliance point for target flows is at Modesto, simulations applied them to at La Grange (i.e., Dry Creek inflows and accretion/depletion below La Grange are not considered) to be conservative. Don Pedro Reservoir's minimum storage on September 30 is maintained at 800 thousand acre-feet (pool elevation of about 700 feet) unless it is needed to supply 363 thousand acre-feet minimum diversion. This scenario does not include operation of the infiltration galleries.

[k] The Water Board's January 29, 2018, filing does not provide a specific minimum flow recommendation, but states that the Water Board will likely condition minimum instream flows in light of the whole record. In modeling the Water Board's condition, the Districts assumed that the Water Board would require the 40 percent of unimpaired Tuolumne River at Modesto (USGS no. 1129000) flow regime specified in the substitute environmental document.

[l] Also incorporated pro-rated increase to meet 1,000 cfs in the San Joaquin River at Vernalis.

[m] Simulations do not include the Conservation Groups' recommended groundwater water bank recharging and accounting.

[n] As directed staff's September 17, 2019 AIR, the Districts consulted The Bay Institute to better represent The Bay Institute's recommendations. The Districts report that re-modeling this scenario required changing the operations model to not limit the water bank from having a negative storage and adding provisions to minimize the number of years when storage in Don Pedro Reservoir is below 1 million acre-feet on November 1. Although the Districts refer to this scenario as TBIREA-NoIG-AIR, we use TBIREA-NoIG in this final EIS.

Table 3.3.2-18. Flow and non-flow measures simulated with the Chinook salmon and *O. mykiss* production models and used in this EIS (Source: Districts, 2018a; 2020c, as modified by staff).

Measures	**June 17, 2020**
None	Base Case, DPP-1r-NoIG, DPP-1r, FWSREA, NMFSREA, DFWREA, SWBREA CGREA10%, VA, TBIREA[a]
Gravel augmentation	VA
LTRHIP	VA
Predator control	VA
Spawner superimposition reduction	VA
Gravel cleaning	VA
All five non-flow measures above	VA
Districts' proposed non-flow measures	DPP-1r
Agencies' non-flow measures[b]	FWSREA, DFWREA, CGREA10%

[a] The TBIREA scenario was re-modeled between the draft and final EIS to better represent The Bay Institute's recommendations.

[b] Combination of agencies' recommended gravel augmentation, LWM augmentation, and floodplain lowering. As discussed in the Districts' May 14, 2018, response to staff's AIR (Districts, 2018a), these same non-flow measures were simulated using the same assumptions for all these scenarios.

Table 3.3.2-19. Sources (accession nos.) used for quantitative analyses of the Districts' model results used in this final EIS (Source: staff).[a]

Scenario Name	Non-Flow Measures	Below La Grange Flow, Stage, and Temperature	RM 25.5 Flow	Don Pedro Reservoir Elevation and Storage; Lower River Temperature[b]	Chinook and O. mykiss Populations	Water Supply	Labor
Base case	None	20180514-4004	20180619-5118	20180514-4004	*20200617-5172*	*20191211-5155*	*20200124-5176*
DPP-1r-NoIG	None	20180730-5268	20180730-5268	20180730-5268	---	---	*20200124-5176*
DPP-1r	None[c]	*20200317-5109*	*20200317-5109*	*20200317-5109*	*20200617-5172*	*20200124-5176*	*20200124-5176*
	Districts' NFMs	---	---	---	*20200617-5172*	---	---
VA	None[d]	*20200124-5176*	*20200124-5176*	*20200124-5176*	*20200617-5172*	*20200124-5176*	---
	Yes	---	---	---	*20200617-5172*		
FWSREA	None	20180514-4004	20180619-5118	20180514-4004	*20200617-5172*	20180920-5046	20180920-5046
	Agencies' NFMs	---	---	---	*20200617-5172*	---	---
NMFSREA	None[e]	20180514-4004	20180619-5118	20180514-4004	*20200617-5172*	*20200124-5176*	*20200124-5176*
DFWREA	None	20180514-4004	20180619-5118	20180514-4004	*20200617-5172*	*20200124-5176*	*20200124-5176*
	Agencies' NFMs	---	---	---	*20200617-5172*	---	---
SWBREA	None	20180514-4004	20180619-5118	20180514-4004	*20200617-5172*	*20200124-5176*	*20200124-5176*
CGREA10%	None	*20200317-5109*	*20200317-5109*	*20200317-5109*	*20200617-5172*	*20200124-5176*	*20200124-5176*
TBIREA[f]	None	*20200124-5176*	*20200124-5176*	*20200124-5176*	*20200617-5172*	*20200124-5176*	*20191211-5155*
ECHOREA	None	20180730-5268	20180730-5268	20180730-5268	---	*20200124-5176*	20180829-4001

[a] Source: Districts (2017a; 2018b,d,f,g; 2019c; 2020a,b,c). Between the draft and final EIS, accession nos. identified with italics represent sources that changed between the draft and final EIS to incorporate the Districts' filings for refinement of the TBIREA scenario, correction of the DPP-1r and CGREA10% scenarios, re-analysis for socioeconomics, and correction of an error in the Chinook salmon and *O. mykiss* production models.

[b] Water temperature data for RM 50, 46, 43, 39, 26, 16, and 3.

[c] 20200617-5172 also provides a separate scenario of DPP-1r with Adaptive Management for 2,000 Chinook salmon spawners.

[d] 20200617-5172 also provides separate scenarios of VA with individual non-flow measures (i.e., Gravel Augmentation, LTRHIP, Predation Reduction, Superimposition Reduction, and Gravel Cleaning).

[e] 20200617-5172 also provides a separate scenario of NMFS with Gravel and LWD.

[f] The TBIREA scenario was re-modeled between the draft and final EIS to better represent The Bay Institute's recommendations.

The minimum annual reservoir water level generally occurs from October to November, and the maximum water level generally occurs from May to June. Reservoir storage changes over a water year can be as small as 100,000 acre-feet to as great as 1,000,000 acre-feet or more. Don Pedro Reservoir typically operates between elevation 690 feet and 830 feet.

The Districts propose to lower the required minimum operating pool level of Don Pedro Reservoir from the current elevation of 600 feet to 550 feet. During the relicensing process, the Districts conducted preliminary studies that indicate a single turbine-generator unit would be able to operate at reduced loads down to water levels of about 570 feet, and the hollow jet valve in the powerhouse can operate to water levels of 550 feet or lower. The 150,000 acre-feet of additional storage that would be made available by this change would be used to reduce the stress on the Districts' surface water supplies and other water supplies (i.e., groundwater) during times of extended drought.

Under non-spill conditions, La Grange Reservoir is operated to maintain a storage capacity of 400 acre-feet and a usable storage capacity of about 100 acre-feet. The surface elevation of La Grange Reservoir varies between about 294 and 296 feet about 90 percent of the time.

The Districts currently calculate the water supply index and water year type for the project based on the amended Article 37 of the existing Don Pedro Project license. Under amended Article 37, the water year classification is determined using the Water Board's San Joaquin Basin 60-20-20 Water Supply Index[106] and the California DWR's April 1 San Joaquin Valley unimpaired runoff forecast. The 60-20-20 index numbers used each year are updated to incorporate subsequent water years pursuant to standard California DWR procedures to maintain approximately the same frequency distribution of water year types. The Districts currently determine water year type by early April and issue the schedule of releases for the subsequent April 15 to April 14 of the next calendar year. The volume of annual flow is periodically readjusted upon agreement among the Districts, California DFW, and FWS after April 1 or each year as more current unimpaired flow information becomes available.

To determine minimum required flows in the Tuolumne River downstream of the La Grange Diversion Dam, the Districts propose to continue to use the existing hydrologic index and water year types as defined by the Water Board's Decision 1641. The Districts would make the preliminary water year determination on February 1, March 1, and April 1 of each year using a 90 percent flow exceedance, consistent with the draft

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[106] Water year classification for the San Joaquin Valley 60-20-20 Index is based on the sum of unregulated (i.e., unimpaired) flow at Stanislaus River below Goodwin Reservoir (i.e., inflow to New Melones Reservoir), Tuolumne River below La Grange (i.e., inflow to Don Pedro Reservoir), Merced River below Merced Falls (i.e., inflow to Lake McClure), and San Joaquin River inflow to Millerton Lake.

Voluntary Agreement. California DWR would make the final water year determination on May 1 of each year using a 75 percent flow exceedance. If California DWR does not make the water year determination by May 1 of each year, the Districts would make the final water year determination on May 7 of each year using a 75 percent exceedance. The five water year classifications—wet, above normal, below normal, dry, and critically dry—are calculated as 60 percent of the current year's April through July inflow to Don Pedro Reservoir, plus 20 percent of the current year's October through March inflow to Don Pedro Reservoir, plus 20 percent of the previous year's index (i.e., 20 percent of the total unregulated inflow to Don Pedro Reservoir). Table 3.3.2-20 presents the San Joaquin River Index thresholds and associated water year types.

Table 3.3.2-20. San Joaquin 60-20-20 Index water year types and associated thresholds (Source: Districts, 2017a).

Water Year Type[a]	**San Joaquin Valley 60-20-20 Index Classification (thousand acre-feet)**
Wet	Greater than 3,800
Above normal	3,101 to 3,800
Below normal	2,501 to 3,100
Dry	2,101 to 2,500
Critically dry	Less than 2,100

[a] Over the course of the 42-year modeling term, wet, above normal, below normal, dry, and critical water year types occurred 36 percent, 14 percent, 7 percent, 17 percent, and 26 percent of the time, respectively.

Table 3.3.2-21 shows the minimum streamflow schedules, based on the applicable water year type, the Districts currently maintain in the Tuolumne River downstream of the La Grange Diversion Dam.

Table 3.3.2-21. Existing project flow requirements (cfs and acre-feet) for the lower Tuolumne River downstream of the La Grange Diversion Dam (Source: Districts, 2017a).

Month	**Wet**	**Above Normal**	**Below Normal**	**Dry Water**	**Critically Dry**
October 1–15 (cfs)	300	300	200	150	100
October 16–May 31 (cfs)	300	300	175	150	150

Month	Wet	Above Normal	Below Normal	Dry Water	Critically Dry
June 1–September 30 (cfs)	250	250	75	75	50
Attraction pulse flow[a] (acre-feet)	5,950	5,950	1,736	None	None
Out-migration pulse flow[b] (acre-feet)	89,882	89,882	60,027	37,060	11,091
Total Volume (minimum flows +flow pulses) (acre-feet)	300,923	300,923	165,002	127,507	94,000

[a] Flow used to attract upstream-migrating adult fall-run Chinook salmon.

[b] Flows for fall-run Chinook salmon smolt outmigration.

To benefit Tuolumne River coldwater fisheries and protect their water supplies, the Districts propose to install and operate two in-stream infiltration galleries—IG-1 and IG-2. The Districts intend to complete construction of IG-1 and undertake construction of IG-2, both of which would be located at approximately RM 25.9. IG-1 has a design capacity of 100 cfs, and IG-2 would have a capacity of 100 to 125 cfs. Water withdrawn from the river through the infiltration galleries would be delivered to TID's Ceres Canal for consumptive use. The infiltration galleries would be in operation from June 1 through October 15 each year.

The Districts' proposal includes new project flow requirements for the Tuolumne River downstream of the La Grange Diversion Dam. The proposed minimum flows would be determined by the applicable San Joaquin 60-20-20 Index water year type. Table 3.3.2-22 presents the proposed minimum flow requirements by water year type, as measured at the La Grange gage (RM 51.7) and below the existing IG-1 and proposed IG-2 infiltration galleries (RM 25.9). The table also shows interim flows that would be provided until the infiltration galleries are operational.

Table 3.3.2-22. Proposed minimum flow requirements (in cfs) with and without infiltration galleries for the Tuolumne River downstream of the La Grange Diversion Dam by San Joaquin 60-20-20 Index water year type as measured at the La Grange gage (RM 51.7) and RM 25.5 (Source: Districts, 2017a).

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Flows [To be Provided Until Both Infiltration Galleries are Operational] (cfs)**
Water Year/Period	**RM 51.7[a] (La Grange Gage)**	**RM 25.5**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[b]	150
July 1 through October 15	350	150[c]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75[c]	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [To be Provided Until Both Infiltration Galleries are Operational] (cfs)
	RM 51.7[a] (La Grange Gage)	RM 25.5	RM 51.7 (La Grange Gage)
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[a] USGS gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] Cease irrigation gallery withdrawals for one pre-scheduled weekend to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

[c] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

Any infiltration gallery outage preventing the planned amount of water to be withdrawn and lasting for more than three consecutive days would result in the Districts' proposed minimum instream flows required at the La Grange gage to be reduced by two-thirds of the amount that would have been withdrawn. The Districts propose to install a gage in the flow line from the infiltration galleries (infiltration galleries pipeline gage) and to monitor compliance with the flows downstream of the infiltration galleries by subtracting the flow volume measured at the infiltration galleries pipeline gage from the flow measured at the La Grange gage.

In addition to the flows presented in table 3.3.2-22, the Districts would provide a flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7 to clean accumulated algae and fines from gravels prior to peak Chinook salmon spawning with the proposed infiltration galleries shut off. These flows would be provided in wet, above normal, and below normal water years only.

The Districts would also provide spring pulse flows in the following amounts to facilitate outmigration of juvenile fall-run Chinook salmon (these flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application):

- Wet and above normal water years—150,000 acre-feet
- Below normal water years—100,000 acre-feet
- First dry water year—75,000 acre-feet
- Dry water year following a dry or critical water year—45,000 acre-feet[107]
- First critical water year—35,000 acre-feet
- Critical water year following a dry or critical water year—11,000 acre-feet

To enhance downstream spawning conditions, the Districts propose to implement a coarse sediment management program. To promote sediment mobilization downstream of the La Grange Diversion Dam, the Districts would release flows ranging from 6,000 to 7,000 cfs, measured at the La Grange gage, for at least two days during years when sufficient spill is projected to occur. The Districts estimate that sufficient flow would be released to provide the gravel mobilization flows at an estimated average frequency of once every three to four years. In years when the spring (March through June) spill at the La Grange Project is anticipated to exceed 100,000 acre-feet, the Districts would plan to release a flow of 6,500 cfs for two days during the spill period, and down-ramping would not exceed 300 cfs per hour.

The proposed interim minimum flow schedule would provide flows suitable for boating (175 cfs or higher) in the Tuolumne River downstream of the La Grange Diversion Dam in all months except June, in all water year types. After the infiltration galleries are operational, flows in the reach upstream of the infiltration galleries would be 175 cfs or higher year-round in all water year types, and flows downstream of the infiltration galleries would be 175 cfs or higher from October 16 through May 31 in all water year types. To further enhance conditions for recreational boating, the Districts propose to provide increased flows during scheduled weekend releases. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional boating flows to the river downstream of the proposed fish counting/barrier weir (RM 25.5). In all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.5 for the three-day July 4 holiday, three-day Labor Day holiday, and two pre-scheduled additional weekends in either July or August, representing an incremental increase of 50 cfs downstream of RM 25.5 (over the background of 150 cfs) in wet, above normal, and below normal water years, and an incremental increase of 125 cfs (over the background of 75 cfs) in dry water years, as measured at the La Grange gage. In spill years, the

[107]In their April 12, 2019 comments on the draft EIS, the Districts' modified their proposal to reduce the flow volume allocated for spring pulse flows from 75,000 acre-feet to 45,000 acre-feet in dry years following a dry or critical water year (Districts, 2019a).

Districts would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions.

In addition to the flows proposed by the Districts and other stakeholders described above, we also analyzed a modified flow regime that was presented in the draft Voluntary Agreement submitted to the Water Board by California DFW and California DWR on March 1, 2019. Compared to the Districts' proposed flows, the minimum flows included in the draft Voluntary Agreement would increase the minimum flow required downstream of the infiltration galleries from 75 to 125 cfs from June 1 through October 15 in dry and critical water years, and reduce the minimum flow required at the La Grange gage from 350 to 300 cfs from July 1 through October 15 in wet, above normal, and below normal water years.

Our Analysis

The Districts developed a water balance/operations model (Tuolumne River Operations Model) to simulate: (1) Don Pedro Project operations and Hetch Hetchy System water supply operations for a period of analysis that covers a range of historical hydrologic conditions; and (2) the alternative operating scenarios and their effects on hydropower generation, downstream flows, and water supplies to the Districts and CCSF's Bay Area customers. For modeling purposes, the Districts defined the no action (i.e., base case) scenario as current operations, including required minimum flows and reservoir operations that have been historically implemented over the period of record. The Districts' proposed project scenario would increase the amount of water that would be released annually into the lower Tuolumne River compared to its current license requirements. The Districts' modeling assumes that CCSF's Hetch Hetchy System operation would contribute 51.7 percent of the additional water that would be needed to meet the releases in the proposed flow regime.

Figures 3.3.2-11 through 3.3.2-14 present simulated hourly flows for the Tuolumne River downstream of the La Grange Diversion Dam (RM 51.5) for the Districts' no-action and proposed project scenario for representative wet, normal, dry, and critical water years. Figures 3.3.2-15 through 3.3.2-18 present simulated daily Don Pedro Reservoir water surface elevations for the Districts' no-action and proposed project scenario for representative wet, normal, dry, and critical water years. Figures 3.3.2-19 through 3.3.2-20 present simulated daily Don Pedro Reservoir water surface elevations for the Districts' no-action and proposed project scenario for representative sequential dry/critical water years. Effects of these changes in project flows and reservoir water levels on specific resources are addressed in following sections.

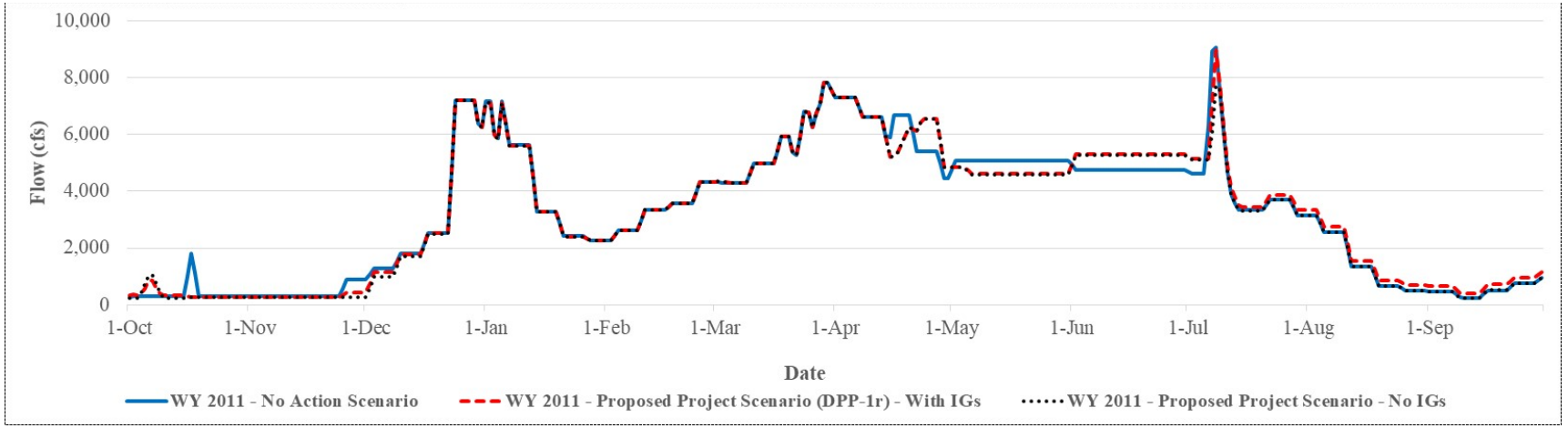

Figure 3.3.2-11. Simulated Tuolumne River flow downstream of the La Grange Diversion Dam for the Districts' no-action and proposed project scenarios for representative wet (2011) water year (Source: Districts, 2018a,b; 2020a).

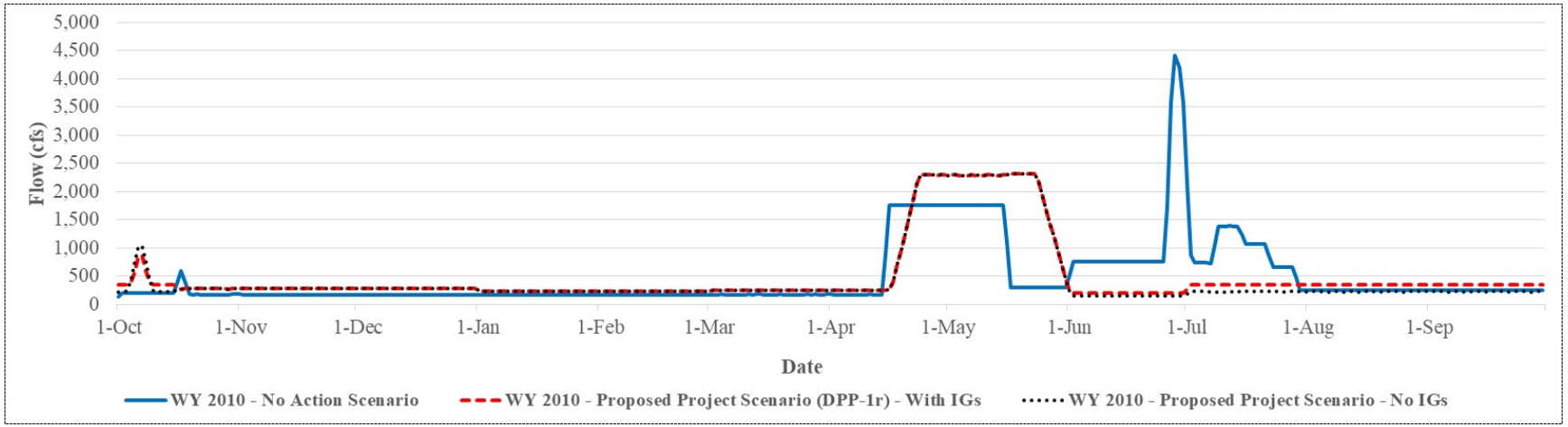

Figure 3.3.2-12. Simulated Tuolumne River flow downstream of the La Grange Diversion Dam for the Districts' no-action and proposed project scenarios for representative normal (2010) water year (Source: Districts, 2018a,b; 2020a).

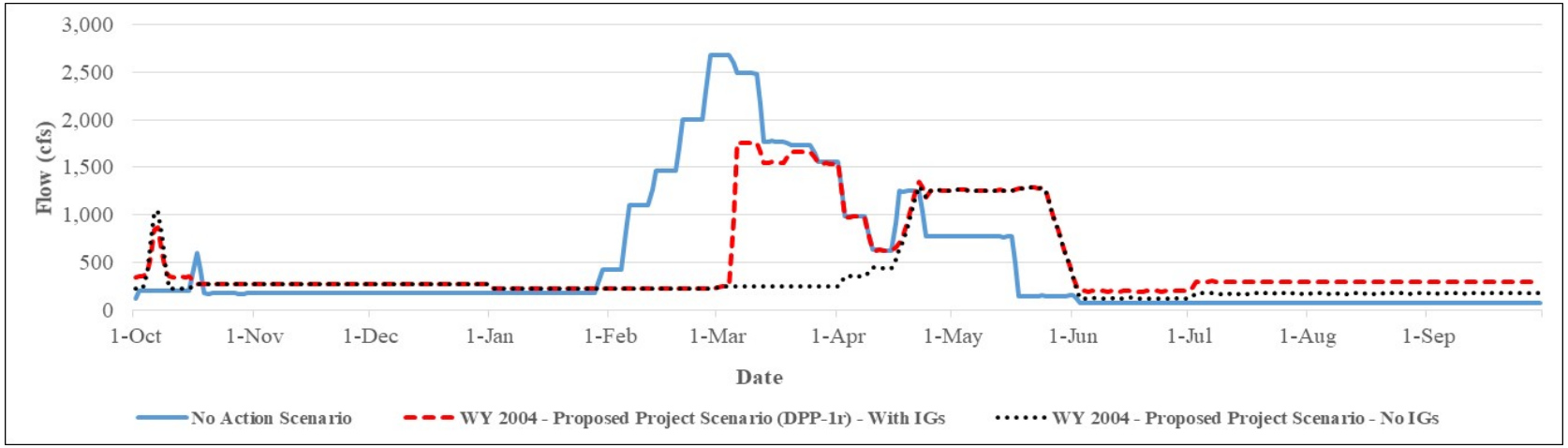

Figure 3.3.2-13. Simulated Tuolumne River flow downstream of La Grange Diversion Dam for the Districts' no-action and proposed project scenarios for representative dry (2004) water year (Source: Districts, 2018a,b; 2020a).

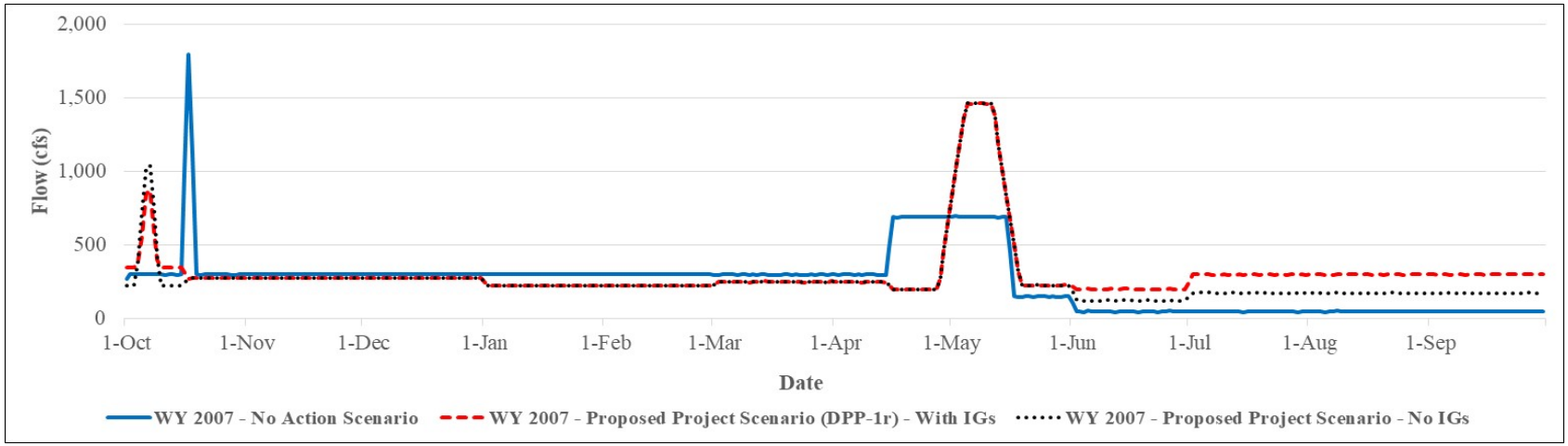

Figure 3.3.2-14. Simulated Tuolumne River flow downstream of La Grange Diversion Dam for the Districts' no-action and proposed project scenarios for representative critical (2007) water year (Source: Districts, 2018a,b; 2020a).

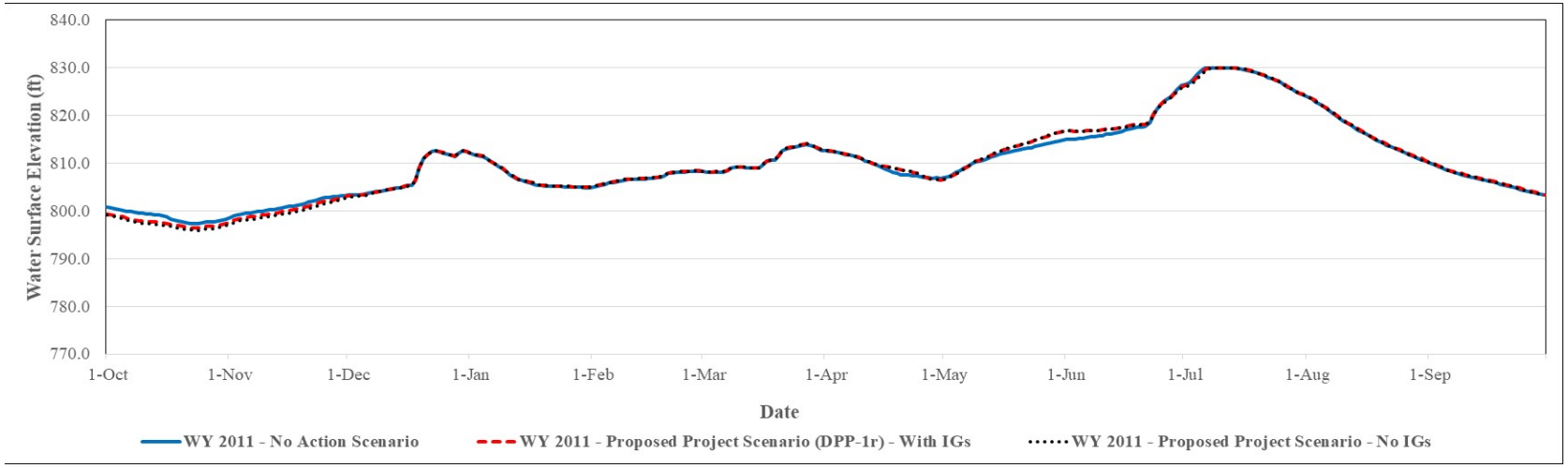

Figure 3.3.2-15. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenarios for representative wet (2011) water year (Source: Districts, 2018a,b; 2020a).

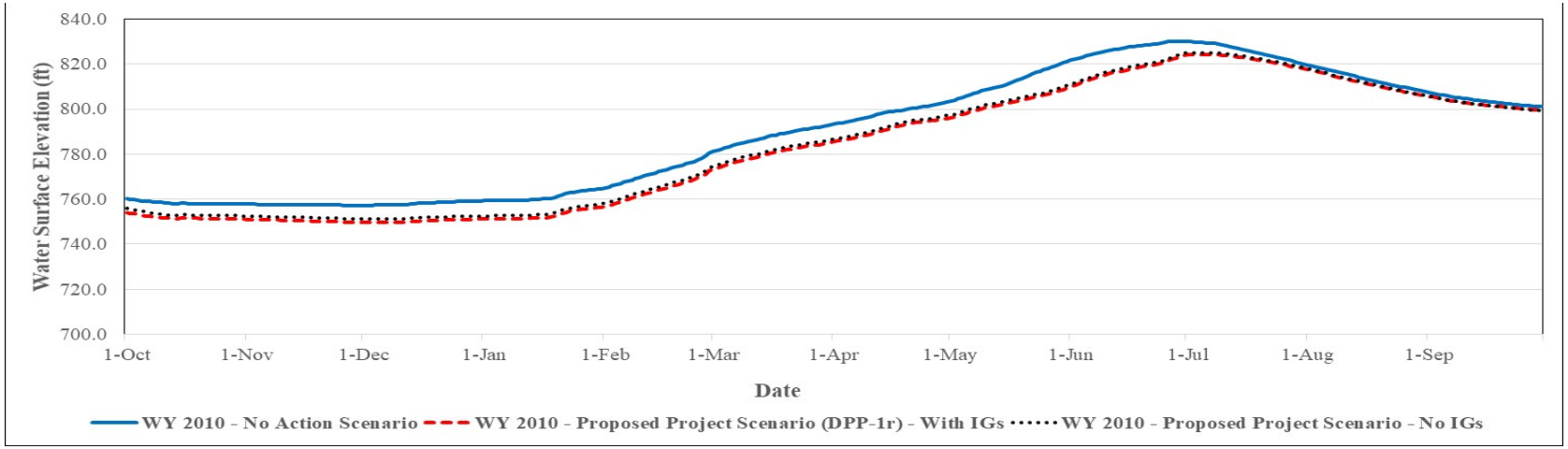

Figure 3.3.2-16. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenarios for representative normal (2010) water year (Source: Districts, 2018a,b; 2020a).

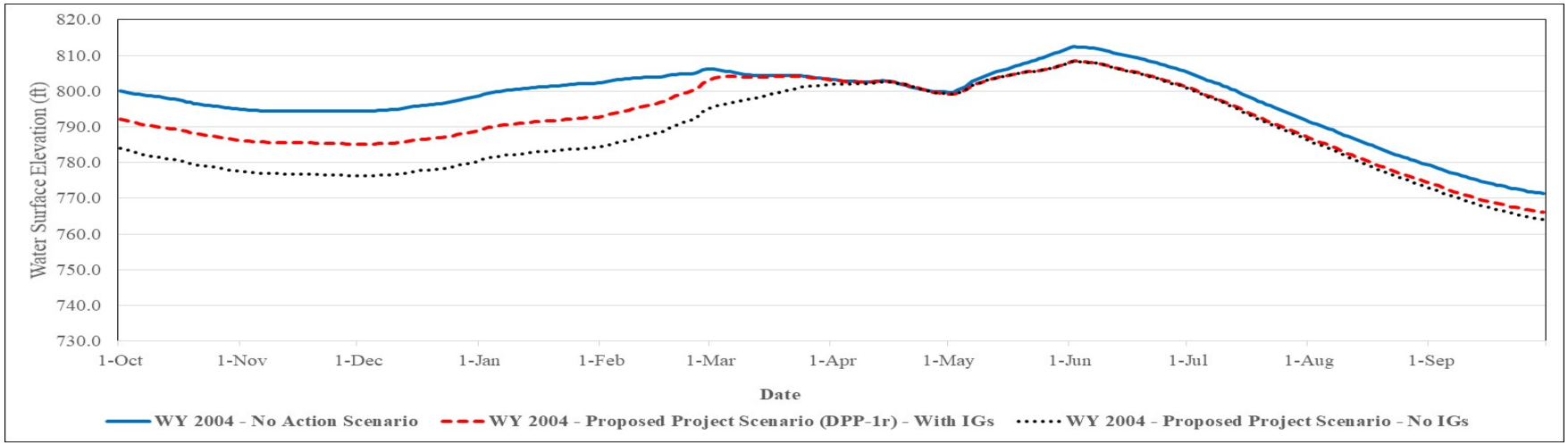

Figure 3.3.2-17. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenarios for representative dry (2004) water year (Source: Districts, 2018a,b; 2020a).

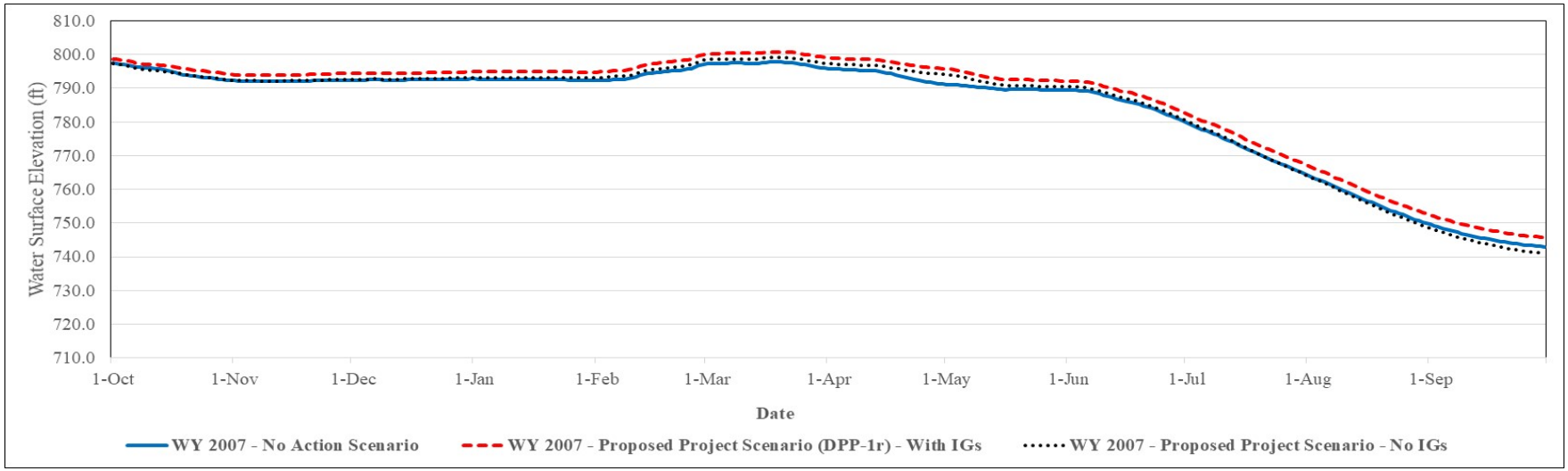

Figure 3.3.2-18. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenarios for representative critical (2007) water year (Source: Districts, 2018a,b; 2020a).

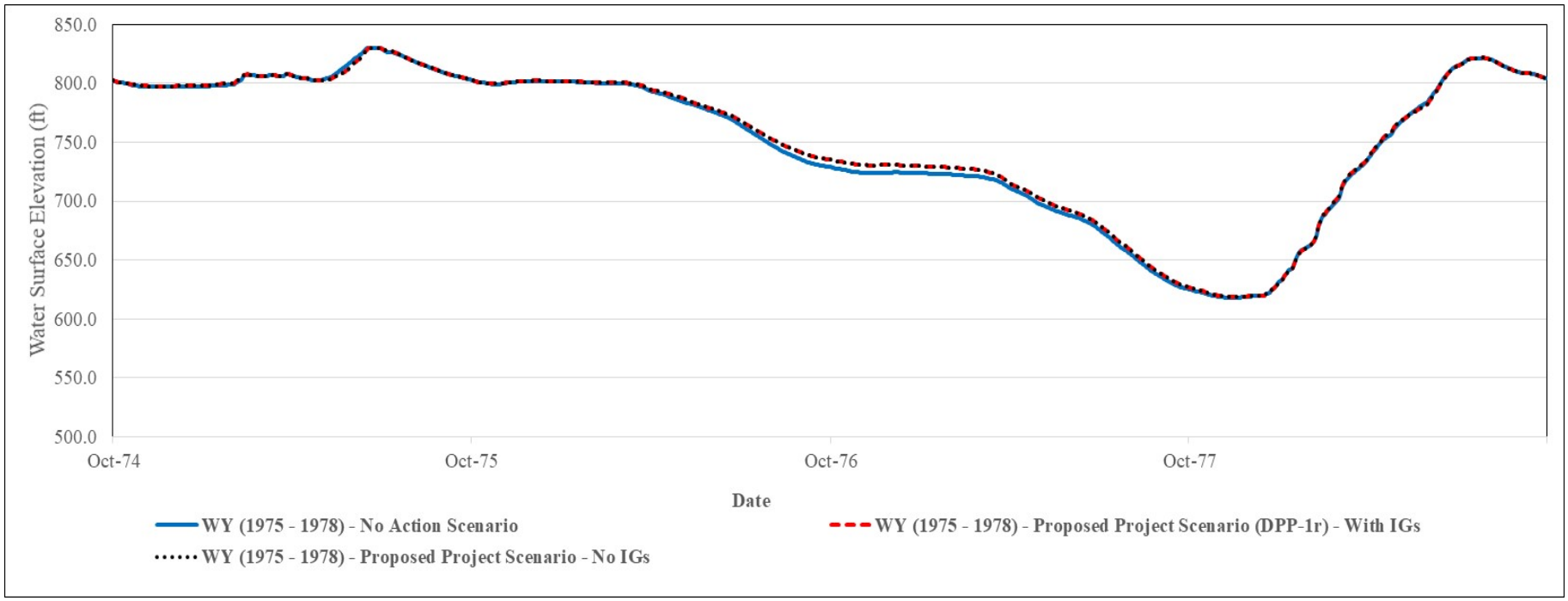

Figure 3.3.2-19. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenarios for representative sequential dry/critical (1976–1977) water years (Source: Districts, 2018a,b; 2020a).

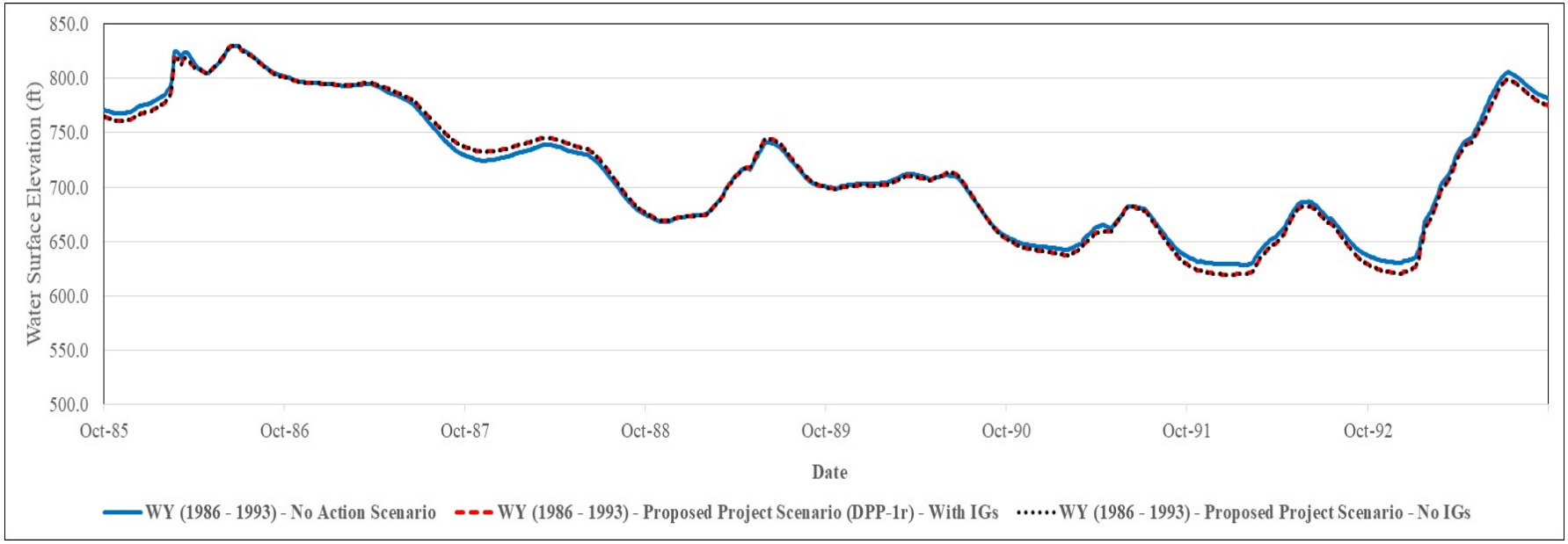

Figure 3.3.2-20. Simulated daily Don Pedro Reservoir water surface elevation for the Districts' no-action and proposed project scenarios for representative sequential dry/critical (1987–1992) water years (Source: Districts, 2018a,b; 2020a).

Drought Management

The Districts' relicensing proposal includes several flow-related measures that specify how flow releases into the lower Tuolumne River and storage requirements would be adjusted during years when water availability is limited. These adjustments include lower minimum flows for dry and critically dry water years; a reduction in spring pulse flows during sequential-year droughts, including an additional reduction in pulse flows in dry or critical water years that follow a dry or critical water year; and a lower minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet. The reduced minimum operating elevation would make an additional 150,000 acre-feet of storage available to meet instream flow and water supply needs.

CCSF approved the Water System Improvement Program in 2008, a comprehensive program designed to improve CCSF's regional water system (RWS) with respect to water supply and water delivery needs. The Water System Improvement Program includes a level of service goal of no more than 20 percent system-wide average rationing in any year of CCSF's 8.5-year design drought. The Water System Improvement Program also seeks to diversify CCSF's water supply portfolio by requiring the development of 20 million gallons per day (mgd) of conservation, recycled water, and groundwater within the San Francisco Public Utilities Commission (SFPUC) service area.

NMFS 10(j) recommendation 1.6 recommends a drought plan that in the event that three or more consecutive dry and/or critically dry water years occur, the Districts would modify operation of the Don Pedro and La Grange Projects. Under this measure, by March 10 of the second or subsequent dry and/or critically dry water year, NMFS recommends that the Districts notify the appropriate resource agencies (e.g., the Water Board, NMFS, California DFW, and FWS) of their concerns in meeting one or more license conditions. By May 1 of the same year, the Districts would consult with the appropriate agencies to discuss the projects' operational plans to manage the drought conditions. If the Districts and appropriate agencies agree on a revised operational plan (i.e., drought plan), the Districts may begin implementing the new drought plan as soon as it files documentation of the agreement with the Commission. If unanimous agreement between the Districts and appropriate agencies is not reached, the Districts would submit a revised drought plan, including as many of the commenting agencies' issues as possible and any assenting and dissenting comments, to the Commission and would implement the proposed drought plan upon Commission approval.

In their reply comments, the Districts state that NMFS's recommendation lacks clarity regarding what circumstances would trigger the proposed measures, what action would be required, and the time frames for submittals, responses, and approvals.

Our Analysis

The operational guidelines of the existing license determine the water levels and streamflows in the Tuolumne River downstream of the La Grange Diversion Dam.

During drought conditions, water storage in Don Pedro Reservoir provides a buffer to downstream areas and could lessen the effects of a drought on aquatic habitat (i.e., more water is available to provide a minimum instream flow).

While the Districts' proposed flow-related measures incorporate a dry-year relief provision (e.g., lower minimum flows for dry and critically dry water years, reduction of spring pulse flows, and lowering the minimum operating elevation of Don Pedro Reservoir from 600 feet to 550 feet), compounded drought conditions could make it difficult for the Districts to supply all water uses, such as minimum flows for aquatic resources and irrigation and municipal and industrial deliveries. The Districts used six models[108] to evaluate the effects of their proposed flows on water supply and environmental resources to seek an appropriate balance between competing needs in all types of water years, including prolonged droughts. It is unclear how NMFS's recommendation to trigger the development of a drought plan when three or more consecutive dry and/or critically dry water years occur would result in a better balance among competing needs compared to the flows developed by the Districts, based on model results.

However, because of the highly variable nature of hydrologic conditions and the increasing water demand in the region, it is possible that an extreme or prolonged drought may occur that would require a variance from license conditions. Developing a drought plan that defines the process the Districts would follow to request a variance from license conditions would help to ensure that the available water is allocated in the most beneficial manner. Such a plan should define drought conditions based on available data specific to the project (e.g., current and projected storage in Don Pedro Reservoir, watershed snowpack and precipitation, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); identify license requirements that would be temporarily modified during drought conditions; and describe how the project would be operated when drought conditions occur (e.g., reduction in minimum flows). Developing a drought management plan in consultation with the Water Board, California DFW, NMFS, BLM, and FWS would help guide the implementation of this measure and ensure that the resource agencies have an opportunity to provide input on the plan. Incorporating environmental data specific to the projects (e.g., water temperature in Don Pedro Reservoir and the lower Tuolumne River) into making decisions of how to operate the Don Pedro Project would facilitate maximizing benefits of alternative project operations.

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[108] Tuolumne River Operations Model, which includes the Districts' water supply and hydropower operations and the water supply operations of CCSF; Don Pedro Reservoir Temperature Model; Lower Tuolumne River Temperature Model; Lower Tuolumne River Fall-run Chinook Population Model; Lower Tuolumne River *O. mykiss* Population Model; and Lower Tuolumne River Floodplain Hydraulic and Habitat Model.

Coordination of Project Operations

The Districts currently operate the Don Pedro and La Grange Projects in coordination with CCSF and the Corps to manage and provide a reliable water supply for consumptive use and flood flow management. The Districts propose to continue to operate the Don Pedro and La Grange Projects in coordination with CCSF and the Corps, while also implementing several environmental measures related to instream flows, flow management, habitat improvement, aquatic organism health, and recreation.

California DFW (10(j) recommendation M3-2) recommends that the Districts develop a coordinated operations plan to provide for coordination of environmental requirements and actions (i.e., flood control, water storage, and water diversion) with the Districts and other hydroelectric facilities of the San Joaquin River Basin. The coordinated operations plan would include: (1) a list of other participating projects and operators; (2) a description of the roles and responsibilities of participating projects and operators; (3) a list of coordination goals and objectives; (4) a description of the extent of ability to cooperate and coordinate flood control, water storage, water diversion with other hydroelectric facilities of the San Joaquin River Basin; (5) a description of the roles and responsibilities related to the Stanislaus, Tuolumne and Merced Work Group (STM Work Group) organized by the Water Board; and (6) a list of voluntary actions aimed at increasing effectiveness of actions, monitoring, and data synthesis. Once a draft coordinated operations plan is completed, the appropriate resource agencies would have 30 days to review and comment. Following the comment period, the Districts would incorporate any comments received and following final agency approval, file the plan with the Commission for approval.

The resource agencies also recommend the Districts coordinate with other stakeholders within the San Joaquin Watershed to meet desired goals and objectives for environmental protection and mitigation at the projects. FWS 10(j) recommendation 12 for the Don Pedro Project and 11 for the La Grange Project, California DFW 10(j) recommendation M3-1, and Conservation Groups recommendation 3 recommend the formation or reestablishment of a Tuolumne River Ecological Group (TREG) that would meet annually for consultation and coordination. FWS and California DFW provided a recommended agenda and topics to be discussed would include license conditions, monitoring, and annual river operations.

In their reply comments, the Districts note that many of the coordination activities (e.g., providing a water bank in Don Pedro Reservoir to CCSF for water supply requirements) with the Districts and non-licensees are not under the jurisdiction of the Commission. The Districts state that they would participate in a coordinated operations organization composed of federal and state agency leadership as long as its jurisdiction and authorities were clear.

Our Analysis

CCSF's Cherry Creek facilities and the Hetch Hetchy System are located on the Tuolumne River about 38 miles upstream of Don Pedro Reservoir, and no other hydroelectric facilities occur downstream of the La Grange Diversion Dam on the lower Tuolumne River. Although the Districts operate the Don Pedro and La Grange Projects in close coordination with CCSF's facilities, developing a coordinated operations plan is not necessary to ensure implementation of the project license conditions. The Districts have contracts with the Corps that regulate the use of flood control storage space in Don Pedro Reservoir to reduce flooding in the lower Tuolumne River near Modesto, California. The Districts would continue to be required to meet the terms of their contract with the Corps and the terms of any new license. Additional agreements with CCSF would also have to incorporate the terms of any new license.

The formation of the TREG would facilitate communication among the Districts, the resource agencies, and other stakeholders in the Tuolumne River Watershed and provide interested stakeholders with an opportunity to discuss license implementation. While the formation of such a group may provide an efficient method of consultation, the Commission does not have the authority to require any agencies or other stakeholders to join or participate in the group.

California DFW 10(j) recommendation M3-2 would put the responsibility on the Districts to develop a plan to facilitate coordination of operations among multiple projects and entities in a very large river basin and cover a wide range of project purposes, many of which are outside of the Commission's jurisdiction. As noted by California DFW, the Water Board is considering the establishment of the STM Work Group as part of the update to the 2006 Bay-Delta Plan. The Districts' voluntary participation in this type of regional planning effort would be better suited to address basin-wide coordination associated with the range of project purposes identified by California DFW in its recommendation.

Streamflow and Reservoir Level Compliance Monitoring

The Districts have historically operated the Don Pedro and La Grange Projects on an annual cycle consistent with managing for and providing a reliable water supply for consumptive use purposes, providing flood flow management, and ensuring delivery of downstream flows (i.e., minimum flows) to protect aquatic resources. The Districts currently monitor requirements of the existing license using the following streamflow gages: (1) USGS gage 112875000 Don Pedro Reservoir near La Grange, California (Don Pedro Reservoir elevation and Corps flood storage requirements); (2) USGS gage 11289650 Tuolumne River below La Grange Diversion Dam near La Grange, California (project minimum flows, which we refer to as the La Grange gage in this document); and (3) USGS gage 11290000 Tuolumne River at Modesto, California (Corps flood regulation).

The Districts propose to use two gages to monitor compliance with the proposed license conditions: (1) the existing La Grange gage and (2) a new USGS gage that would measure flow in pipeline that conveys water from the infiltration galleries to the Districts' water supply system. The La Grange gage would be used to monitor compliance for flows to be released from La Grange Diversion Dam. For flows required downstream of the infiltration galleries (to be measured at RM 25.5, downstream of the fish counting/barrier weir), the Districts would subtract the flow measured at the proposed infiltration gallery pipeline gage from the flow measured at the La Grange gage to yield the instream flow downstream of the infiltration galleries. Compliance would be deemed met if flows equaled or exceeded the Districts' proposed minimum flows over monthly time frames, with no deficits of more than 10 percent below the minimum for more than 60 minutes, and no instantaneous deficits of more than 20 percent below the proposed minimum flows.

The Districts also propose to formalize the current project practice of at all times releasing a minimum flow of 5 to 10 cfs through the MID Tainter gates and Hillside gates to the plunge pool downstream of the La Grange Project.

The Water Board includes preliminary 401 condition 3 that specifies the Districts develop a streamflow and reservoir level compliance plan to document compliance with streamflow and reservoir level requirements in the new project license. At a minimum, this plan should include: (1) locations where the Districts monitor streamflow and reservoir levels; (2) equipment to be used by the Districts to monitor streamflow and reservoir levels in compliance with requirements of this certification; (3) a description of how the equipment used by the Districts to monitor streamflow and reservoir levels in compliance with the requirements of this certification is deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained; (4) a description of how the data will be retrieved from the equipment used by the Districts to monitor compliance with the requirements in the certification related to streamflow and reservoir levels, including frequency of data downloads, quality assurance/quality control procedures, and data storage; and (5) a description of how streamflow and reservoir level data are provided to the Water Board.

California DFW 10(j) recommendation M1-1 and FWS 10(j) recommendation 1 recommend the Districts develop a streamflow and reservoir level compliance monitoring plan to monitor compliance with flow and water level requirements specified in a new license. The plan would be developed in consultation with the Water Board, California DFW, FWS, and NMFS. The plan would include descriptions of: (1) locations where the Districts monitor compliance to the requirements in the license related to streamflows and reservoir levels; (2) equipment used by the Districts to monitor compliance to the requirements in the license related to streamflows and reservoir levels; (3) how the equipment used by the Districts to monitor compliance to the requirements in the license is deployed; (4) how data are retrieved from the equipment used by the Districts, including frequency of data downloads, quality assurance/quality control procedures, and data storage; (5) how the Districts make streamflow and reservoir level data available to

the Commission, agencies, and the public; and (6) how the Districts will report streamflow and reservoir data to the Commission, and update the proposed plan as needed in the future.

Both California DFW and FWS also recommend that the Districts add an additional minimum instream streamflow compliance gage in the lower Tuolumne River. The new compliance gage would be located in the river up to 1,500 feet downstream of the Districts' existing and proposed infiltration galleries. NMFS (10(j) recommendation 1.4) recommends the Districts establish a new streamflow gage, rated to USGS gaging standards and criteria, near RM 25, downstream of the proposed infiltration galleries. The new gage would be capable of recording up to 8,000 cfs.

In their reply comments, the Districts state that they are opposed to the requirement to establish an additional USGS-type streamflow gage downstream of the existing and proposed infiltration galleries. The Districts state that (1) the Districts' proposed infiltration gallery gage would be more accurate than an open channel streamflow gage, and (2) establishing a stream flow gage below the infiltration galleries would make the Districts responsible for non-project diversions and accretions associated with multiple irrigation diversions that exist between La Grange gage and the proposed gage location, and over which they have no control.

Our Analysis

We provide our analysis of the proposed and recommended minimum flows and ramping rates for the Tuolumne River downstream of the project under *Effects of Minimum Flows and Pulse Flows* and *Ramping Rates and Fish Stranding*, later in this section. Our discussion herein focuses on the flow gaging and monitoring that would be required to determine whether the project is operating in compliance with any flow requirements of any license issued.

The Districts propose to modify and provide new minimum flows downstream of the project facilities. An effective streamflow and reservoir compliance plan would include, at a minimum, the five elements identified by the Water Board, and should be submitted to the Water Board, California DFW, and FWS for review before it is filed with the recommendations, as well as procedures for submitting to the Commission for approval. Such a plan would specify how compliance with the operational requirements of any license issued would be measured, documented, and reported, which would minimize misunderstandings about operational compliance.

However, California DFW, FWS, and NMFS's recommendations to measure flow compliance using a new gage installed downstream of the infiltration galleries would make compliance difficult because of non-project water diversions. As noted in section 3.3.2.1, *Aquatic Resources*, *Affected Environment*, *Water Quantity*, California DWR lists 26 non-project points of diversion along the lower Tuolumne River between the La Grange Diversion Dam and the San Joaquin River, with an estimated total combined withdrawal capacity of 77 cfs (California DWR, 2013). Of the 26 points of diversion

listed by California DWR, 12 exist between the La Grange gage (RM 51.7) and the agency-recommended gage location (i.e., near RM 25) and account for over half (43 cfs) of the estimated total combined withdrawal capacity on the lower Tuolumne River (Water Board, 2018b). Variations in withdrawal rates at these diversions, which are not controlled by the Districts, would make it difficult for the Districts to ensure compliance with flow requirements tied to a gage downstream of the infiltration galleries.

Spill Prevention, Control, and Countermeasures

Construction of any new project facilities, modification of existing project facilities, and routine and non-routine maintenance could affect water quality if pollutants (e.g., fuels, lubricants, herbicides, pesticides, and other hazardous materials) are discharged into project waterways.

At the Don Pedro Project, the Districts propose to implement a Spill Prevention Control and Countermeasure Management Plan to guide the handling of hazardous substances and protect water quality and aquatic biota during project construction and operation. The Districts' Spill Prevention Control and Countermeasure Management Plan (Districts, 2017d) identifies relevant federal, state, and local regulations and consists of two components: (1) DPRA Spill Prevention, Control, and Countermeasure Plan, and (2) DPRA HAZMAT Plan.[109]

BLM (Don Pedro revised 4(e) condition 43 and La Grange preliminary 4(e) condition 34) specifies that, within one year of issuance of any new license or prior to undertaking activities on BLM lands, the Districts would file with the Commission a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup. BLM also specifies that during planning and prior to any new construction or maintenance not addressed in an existing plan, the Districts would be required to consult with BLM to determine whether a new oil and hazardous substances storage and spill prevention and cleanup is needed. The plan would need to be approved by BLM before it is filed with the Commission.

BLM specifies that at a minimum, a plan must require the Districts to: (1) maintain in the project area, a cache of spill cleanup equipment suitable to contain any spill from the project; (2) to periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the project area; and (3) to immediately inform BLM of the magnitude, nature, time, date, location, and action taken for any spill. BLM would require that the plan include a monitoring plan that details corrective measures that would

[109] Although the Districts state that their plan incorporated a third component (the Don Pedro Hydroelectric Project Spill, Prevention, Control, and Countermeasure Plan); this component was not included in the version that was filed on October 11, 2017.

be taken if spills occur. The plan would include a requirement for a weekly written report during construction, documenting the results of the monitoring.

The Water Board (preliminary 401 condition 10) states they will likely require the Districts, in consultation with the relevant resource agencies, to develop a plan for the storage, use, transportation, and disposal of hazardous materials in the projects' area. The Water Board specifies that the plan discuss appropriate measures and equipment required to prevent or limit the extent of any hazardous material spill. This plan would also include protocols to prevent adverse impacts to beneficial uses in the event that hazardous materials are spilled. The Water Board specifies that on-site containment for hazardous-chemical storage be placed away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320. Protocols and methods in this plan would abide by federal, state and local laws and policies.

Our Analysis

Developing project-specific plans for hazardous substance control would help to ensure that proper procedures are in place to prevent accidental spills and address any discharges of hazardous substances to project lands and waters. These project-specific plans would address the prevention of hazardous substance spills, ensure protocols and equipment are in place to contain and cleanup any spills, and ensure appropriate notification procedures are followed.

The Districts' proposed measures would focus on managing risks associated with the DPRA warehouse and fuel island located at 10181 Bonds Flat Road by defining locations for storage of hazardous materials used for the project, specifying primary and secondary containment of hazardous materials, identifying mitigation measures to prevent any hazardous material spill from spreading, ensuring that the Districts' staff receive training for managing hazardous materials, and cleaning up any hazardous material spills. However, the Districts' proposed plan does not address management of oil or other hazardous materials associated with the Don Pedro or La Grange hydroelectric facilities. Development of separate plans to manage oil or other hazardous materials associated with the Don Pedro and La Grange hydroelectric facilities would provide assurance that the frequency and magnitude of spills would be minimized, and appropriate cleanup procedures would be conducted in the event of a spill.

Development of project-specific spill prevention control and countermeasure management plans through consultation with the Water Board, California DFW, BLM, FWS, and NMFS would facilitate addressing their concerns. Appropriate plans would focus on management of oil, fuels, lubricant products, and other hazardous liquid substances and include: (1) description of how they would be transported, stored, handled, and disposed of in a safe and environmentally acceptable manner; (2) a description of the equipment and procedures used to ensure containment and cleanup of any spilled hazardous substances; (3) a provision to notify the Water Board, California

DFW, BLM, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with FERC within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future. If the Districts are required to document all spill and cleanup activities as described above, BLM's specified weekly reporting during construction would not be warranted.

Overall, the proposed plan and the separate plans discussed above would minimize any negative effects on water quality and aquatic resources within the Don Pedro and La Grange Projects that may result from accidental hazardous substance spills.

Water Quality Management and Compliance

As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment*, existing water quality data document that:

- DO is less than the 7.0-mg/L Basin Plan objective[110] in the hypolimnion of Don Pedro Reservoir; and for brief periods just below Don Pedro Dam and Powerhouse. However, the average daily concentrations below Don Pedro Dam and Powerhouse remain above 7.0 mg/L.
- DO of less than the 8.0-mg/L Basin Plan objective for the Waterford-La Grange reach occurs in September and October of some years in the La Grange Powerhouse tailrace channel, while DO in the mainstem channel remains at 9.0 mg/L or higher.
- Dissolved copper in Don Pedro Reservoir's hypolimnion exceeds the corresponding California Toxics Rule's allowable level, although all other sites and metals meet the California Toxics Rule limit.
- Bioaccumulation of mercury in Don Pedro Reservoir and lower Tuolumne River fishes exceeds limits considered safe for human consumption (OEHHA, 2018b; Districts, 2017a).

Changing the operations for either project has the potential to alter water quality from existing conditions. Even if water quality conditions are not changed, continuation of negative water quality effects has the potential to adversely affect beneficial uses. To

[110] The Basin Plan objectives for DO are to maintain at least 7.0 mg/L for cold freshwater habitat and spawning, and at least 8.0 mg/L from Waterford to La Grange between October 15 and June 15.

address low DO observed in the La Grange Powerhouse tailrace,[111] the Districts propose to monitor DO from September 1 to November 30 in the first two years of a new La Grange Project operating license, and to submit an action plan if low DO levels are found. This proposal includes collecting DO information at 15-minute intervals at three locations: (1) the La Grange Project forebay, (2) immediately below the La Grange Powerhouse, and (3) at the lower end of the La Grange Powerhouse tailrace channel. At the end of each year's monitoring period, that year's DO data would be compiled, analyzed, and submitted as an annual report to FERC. The Districts state that in the event the monitoring indicates a specific cause for low DO, the Districts would develop and submit an action plan to FERC in the third year of the license.

The Water Board (preliminary 401 condition 6) states they will likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to monitor water quality. The Water Board specifies that the plan address: (1) monitoring locations, (2) monitoring periods, (3) monitoring parameters, and (4) reporting. The Water Board specifies that monitoring locations include an adequate number and spatial distribution of monitoring sites in the projects' reservoirs and throughout project-affected river reaches to provide data that measures potential water-quality impacts from operation of the projects. Water quality monitoring would occur at intervals during the license term to document trends in time and changes in water quality related to operational changes that may impact water quality or designated beneficial uses of water. The Water Board specifies that the plan consider in-situ, DO, recreation-related water quality, and bioaccumulation monitoring components. The Water Board specifies that if at any point monitoring suggests water quality conditions are in exceedance of Basin Plan water quality objectives, the Districts would immediately notify the Water Board and Central Valley Regional Water Quality Control Board.

In its comments on the draft EIS, EPA recommends a DO monitoring period of more than five years to capture California's high degree of interannual variability in river runoff and to sufficiently describe the DO range and critical conditions that can vary based on weather and dam operations.

Our Analysis

Although the Districts propose to reduce the minimum pool level in Don Pedro Reservoir from 600 feet to 550 feet, use of the water below the current 600 feet elevation would most likely occur in successive dry years, so frequency of use would be low. In general, results of the Districts' operations model filed as responses to staff's AIRs suggest that Don Pedro Reservoir water levels would remain similar to existing conditions under proposed operation and the draft Voluntary Agreement (table 3.3.2-23). Simulated daily reservoir water levels are within 10 feet of the base case levels 94

[111] Instantaneous measurements of DO are as low as 4.0 mg/L in the La Grange Powerhouse Tailrace channel.

percent of the time for the Districts' proposed interim flows and 99 percent of the time for the Districts' proposed operation with infiltration galleries throughout the 42-year period of water years 1971–2012.

Because proposed project operation and the draft Voluntary Agreement would not substantially change the flow of water through the project reservoirs, water quality in the reservoirs or in project releases would similarly not change. Low DO near the bottom of Don Pedro Reservoir would likely continue and may contribute to the release of mercury from sediments and subsequently lead to bioaccumulation in aquatic organisms, some of which may be consumed by humans. However, this effect is a typical result of reservoir stratification, and overall effects of the proposed project operation are expected to result in water quality that is at least as good as under existing conditions.

Table 3.3.2-23 shows that simulated monthly median Don Pedro Reservoir elevations are more than 10 feet lower than existing conditions for nearly all months at the scenarios recommended by other stakeholders, and monthly 90 percent exceedance pool levels would often be more than 10 feet higher or 10 feet lower than existing conditions at the alternative scenarios. These large differences in pool levels suggest that water quality could be affected by all the alternative recommended operations compared to either of the Districts' proposals or the draft Voluntary Agreement. Although the effects of reservoir elevations lower than 600 feet on water quality were not modeled, the lower pool elevations could further affect the depths of mixing zones in the reservoir, potentially affecting reservoir stratification and the resulting DO levels both in the reservoir and in reservoir releases.

Under the Districts' proposed operations, the Basin Plan DO objectives would be mostly met immediately below the Don Pedro Powerhouse and in the lower Tuolumne River, except for the La Grange Powerhouse tailrace channel. As discussed in section 3.3.2.1, *Aquatic Resources*, *Affected Environment*, *Water Quality*, low DO concentrations are expected to continue to occur in the La Grange Powerhouse tailrace in September, October, and November unless the cause is mitigated; DO concentrations throughout most of the lower Tuolumne River are expected to continue to typically meet the Basin Plan DO objectives.

In response to comments on the draft license application, the Districts state these low DO concentrations appear to be a localized phenomenon associated with high levels of aquatic vegetation in the La Grange Powerhouse forebay and near the penstock intake.[112] To further evaluate potential causes of the low DO, the Districts propose DO monitoring from September 1 to November 30 in the first two years of the license. This

[112] While aquatic vegetation may enhance DO levels during daylight hours via photosynthesis, during nighttime hours this vegetation uses oxygen via respiration, and may result in depression of DO levels. Oxygen is also consumed as vegetation decays.

Table 3.3.2-23. Monthly simulated 10, 50, and 90 percent exceedance values for Don Pedro Reservoir elevations (feet), water years 1971–2012 (Source: Districts, 2018b,f; 2020a,b, as modified by staff).

Month	Base Case	Districts Interim	Districts Interim with Boating Flows[a]	Districts with-IGs[a]	Draft Voluntary Agreement[b]	FWS[c]	NMFS	Calif. DFW	Water Board	Cons. Groups[a]	The Bay Institute[b]	ECHO
			10% Exceedance									
January	805.8	805.9	805.9	805.9	805.9	802.3	803.8	805.4	805.2	802.3	805.1	804.7
February	810.9	811.1	811.1	811.2	811.2	805.2	806.3	808.9	806.4	805.3	806.2	805.9
March	811.1	811.0	811.0	811.0	810.2	804.8	807.0	809.2	807.3	805.0	807.0	806.1
April	809.5	809.4	809.4	809.4	807.5	804.8	803.5	808.1	807.2	804.9	805.4	804.4
May	819.4	818.0	818.0	818.0	817.7	811.4	811.3	817.4	817.2	810.9	813.2	809.0
June	830.0	829.5	829.5	829.6	829.4	820.1	824.1	828.5	830.0	820.3	824.6	813.8
July	828.4	828.0	828.0	828.1	828.1	826.1	828.1	829.1	829.2	826.9	826.1	818.2
August	817.4	817.2	817.3	817.4	817.2	815.0	816.1	817.3	816.7	815.1	815.3	812.8
September	807.1	807.1	807.1	807.4	807.2	806.2	805.7	807.0	805.7	806.2	806.0	804.6
October	800.9	800.8	800.9	801.1	801.1	800.1	799.8	800.8	798.2	800.1	800.1	799.1
November	799.1	799.0	799.2	799.6	799.0	795.9	794.8	795.7	793.6	796.0	796.4	797.3
December	802.8	803.2	803.3	803.4	803.2	799.4	797.6	799.5	795.3	799.8	799.2	798.2
			50% Exceedance (Median)									
January	793.2	792.8	792.9	794.5	794.3	756.2	759.6	780.1	772.1	757.1	776.9	774.4
February	798.9	795.6	795.9	798.1	797.0	768.6	771.0	788.9	779.3	770.1	785.4	781.3
March	803.0	802.3	802.5	802.9	800.8	775.0	779.5	793.9	784.2	776.7	788.7	787.5
April	802.3	802.2	802.2	802.2	799.2	770.5	780.3	793.1	784.0	775.3	788.1	785.3
May	805.4	803.5	803.5	803.7	801.3	775.8	780.9	798.2	785.2	780.6	791.9	782.3
June	813.6	808.5	808.8	810.1	807.3	775.9	784.8	798.3	789.3	780.5	794.1	776.9
July	814.6	810.1	811.2	812.9	809.0	767.2	778.7	797.6	782.9	772.3	784.6	768.1

Month	Base Case	Districts Interim	Districts Interim with Boating Flows[a]	Districts with-IGs[a]	Draft Voluntary Agreement[b]	FWS[c]	NMFS	Calif. DFW	Water Board	Cons. Groups[a]	The Bay Institute[b]	ECHO
August	804.9	797.4	798.7	801.5	796.2	756.8	763.1	787.8	776.0	757.7	775.3	759.8
September	795.5	787.0	788.4	792.4	786.5	745.7	750.0	777.3	770.6	744.5	768.1	754.0
October	793.6	786.9	788.2	791.5	787.4	738.5	745.2	775.5	769.0	738.8	767.4	751.4
November	792.2	784.5	785.0	788.6	785.7	737.8	744.8	771.3	765.6	734.4	765.4	753.2
December	793.1	788.6	788.7	791.6	789.2	742.4	748.3	776.4	768.0	739.0	775.6	762.6
			90% Exceedance									
January	673.8	673.5	673.8	670.6	667.6	653.1	670.8	682.6	**701.8**	653.2	**693.4**	663.8
February	690.4	688.3	688.4	691.9	691.4	675.2	688.7	**707.2**	**708.2**	669.8	**709.2**	678.7
March	711.9	709.9	710.1	708.9	708.0	695.6	700.7	714.8	719.3	694.7	**733.4**	686.6
April	712.7	713.8	713.9	709.1	711.4	697.7	708.9	717.4	722.6	700.4	**726.9**	684.2
May	722.1	724.6	724.8	721.1	719.9	700.0	712.2	**732.5**	**733.4**	703.5	721.5	689.1
June	723.4	728.4	728.6	722.0	720.5	703.0	717.2	728.8	**735.3**	703.4	725.0	686.4
July	706.6	710.8	711.0	705.6	703.7	692.3	705.5	**719.6**	**727.1**	689.7	**723.0**	683.2
August	688.7	691.8	692.1	686.9	684.6	675.2	687.9	**704.3**	**712.7**	672.2	**712.6**	669.7
September	676.2	678.1	678.4	674.1	671.3	660.1	671.8	**691.0**	**703.3**	657.1	**706.0**	660.9
October	669.4	670.3	670.6	667.1	664.0	651.6	663.2	**682.4**	**698.3**	646.0	**699.4**	657.0
November	668.1	668.8	669.1	665.6	662.5	647.0	659.5	**678.6**	**695.7**	640.8	**695.5**	654.8
December	672.1	672.2	672.5	669.1	666.0	650.3	665.3	679.6	**696.5**	637.2	**694.3**	653.6

Note: See table 3.3.2-17 for a description of each model scenario. Elevations shown in bold are at least 10 feet higher than the base case, and shaded values are at least 10 feet lower than the base case.

[a] Although values for the Districts with IGs and Conservation Groups scenarios are based on the Districts' March 17, 2020, filing (Districts, 2020a) to correct an inadvertent modeling error that was incorporated into the draft EIS, none of the values in this table changed from those in the draft EIS.

[b] Between the draft and final EIS, newly available information was used to re-model The Bay Institute scenario to better represent its recommendation and model the draft Voluntary Agreement and Districts interim operations with additional 175-cfs boating flows below the infiltration galleries (IGs) on one weekend in June of wet, above normal, and below normal water years.

[c] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

would enable: (1) a better understanding of the diel[113] pattern of DO concentrations and when DO is lower than the Basin Plan objective, (2) determine whether low DO concentrations coincide at multiple sites, and (3) determine whether low DO in the powerhouse tailrace is consistently reaerated to at least the Basin Plan objective by the lower end of the powerhouse tailrace channel. Adding a monitoring location in the upstream end of the La Grange Reservoir would provide baseline DO levels for the inflow to the forebay and could be used to determine whether low DO in the forebay is caused by low-DO inflows from upstream or local conditions. Because of the linkage of DO with water temperature and aquatic vegetation, it would also be beneficial to collect coinciding water temperature data at each location DO concentrations are monitored and record weekly observations of aquatic vegetation and algae growth and senescence in the La Grange Powerhouse forebay and near the penstock intake throughout the monitoring period. Preparation of an annual report following the end of each monitoring season would provide locations and times when the Basin Plan DO objectives are not met, and an evaluation of whether the La Grange Project operation is a factor causing any such low DO. If the project is found to be a factor in causing DO not to be consistent with Basin Plan DO objectives, this could be addressed by the Districts developing an approach to mitigate the project's effect and implementing it in the year following the determination of a project effect.

Monitoring DO, temperature, and aquatic vegetation in the first three years of a license would document whether the project is contributing to low DO in the La Grange Powerhouse tailrace channel, and whether any mitigation actions implemented in years immediately following the initial detection of the cause of low DO are effective at addressing project effects. Because weather, runoff in the basin, project operations, and other factors are expected to cause DO to vary from year to year, it would be important to monitor in enough years to capture a range of project operations and environmental conditions. Conducting this monitoring for the greater of three years or until documentation of effective mitigation for any contribution of the project to these low DO levels would provide reasonable assurance that any adverse effects of the project on DO levels are appropriately addressed.

Flows and reservoir levels proposed by the Districts and recommended by the agencies and other stakeholders would not measurably influence recreation-related water quality (i.e., the concentration of coliform bacteria, oils, or grease). As discussed in section 3.3.5.2, *Recreation, Environmental Effects*, the Districts would periodically assess each project's recreational use and any need for recreational facility upgrades to maintain a safe environment for recreational use during any license term. Any recreational needs

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[113] The diel pattern (i.e., the daily cycle) for DO is primarily determined by the timing and magnitude of the production of oxygen by primary production, the consumption of oxygen by decomposition, and water temperature which limits the amount of oxygen that can be dissolved in water.

identified for the Don Pedro Project would be addressed through an RRMP. These measures are expected to also maintain safe recreation-related water quality in the lower Tuolumne River.

As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment*, EPA has issued a human health advisory for the consumption of largemouth bass, suckers, sunfish species, channel catfish, and common carp from Don Pedro Reservoir (OEHHA, 2018b), and fish in the lower Tuolumne River have mercury concentrations exceeding the 0.3-milligram-per-kilogram criterion for safe human consumption of fish (EPA, 2001). Although concentrations of mercury and other metals sometimes increase in newly constructed reservoirs and cause increases in bioaccumulation of mercury in fish, this is less likely to occur in project reservoirs that have been in place for decades (Willacker et al., 2016; Bilodeau et al., 2017). It is unclear how additional bioaccumulation data collected under Water Board preliminary 401 condition 6 would be used to guide project operation. Based on the above, there appears to be little basis for requiring the Districts to monitor recreation-related water quality or bioaccumulation in aquatic organisms.

Water Temperature Monitoring

Operation of the projects would continue to affect the thermal regime of the Don Pedro Reservoir, its releases, and the thermal regime of the lower Tuolumne River. The development, growth, survival, and maturation of most aquatic organisms would be highly dependent on the resulting thermal regime. In general, aquatic organisms exhibit physiological and behavioral responses to water temperature depending on its magnitude and duration. Figure 3.3.2-21 shows some general relationships between the magnitude and duration of temperature and salmonids (Sullivan et al., 2000). As illustrated in this figure, very warm/hot, short duration events can cause rapid death, but salmonids can survive in slightly cooler water for longer periods. In addition, salmonids can seek out cool-water refuges to avoid warm areas that would otherwise be lethal. The thermal regime also has a major influence on the success of salmonid egg incubation and growth of juveniles and adults. Warm temperatures also can contribute to competition, disease, and predation.

The water quality objective for temperature in the Basin Plan specifies, "At no time or place shall the temperature of COLD or WARM intrastate waters be increased more than 5 degrees Fahrenheit (°F) [(2.8°C)] above natural receiving water temperature." As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment, Water Quality*, water temperatures at USGS station 11289650 below La Grange typically range from about 8.0 to 16.0°C annually and occasionally reach a maximum of nearly 19°C. The lower Tuolumne River is listed under CWA section 303(d) as impaired for temperature, based on life-stage-specific 7-day average daily maximum (7DADM) values (EPA, 2011). Under current conditions, warm water temperatures provide sub-optimal habitat for Chinook salmon and *O. mykiss* in the lower Tuolumne River downstream of the La Grange Diversion Dam, particularly for spawning and egg incubation.

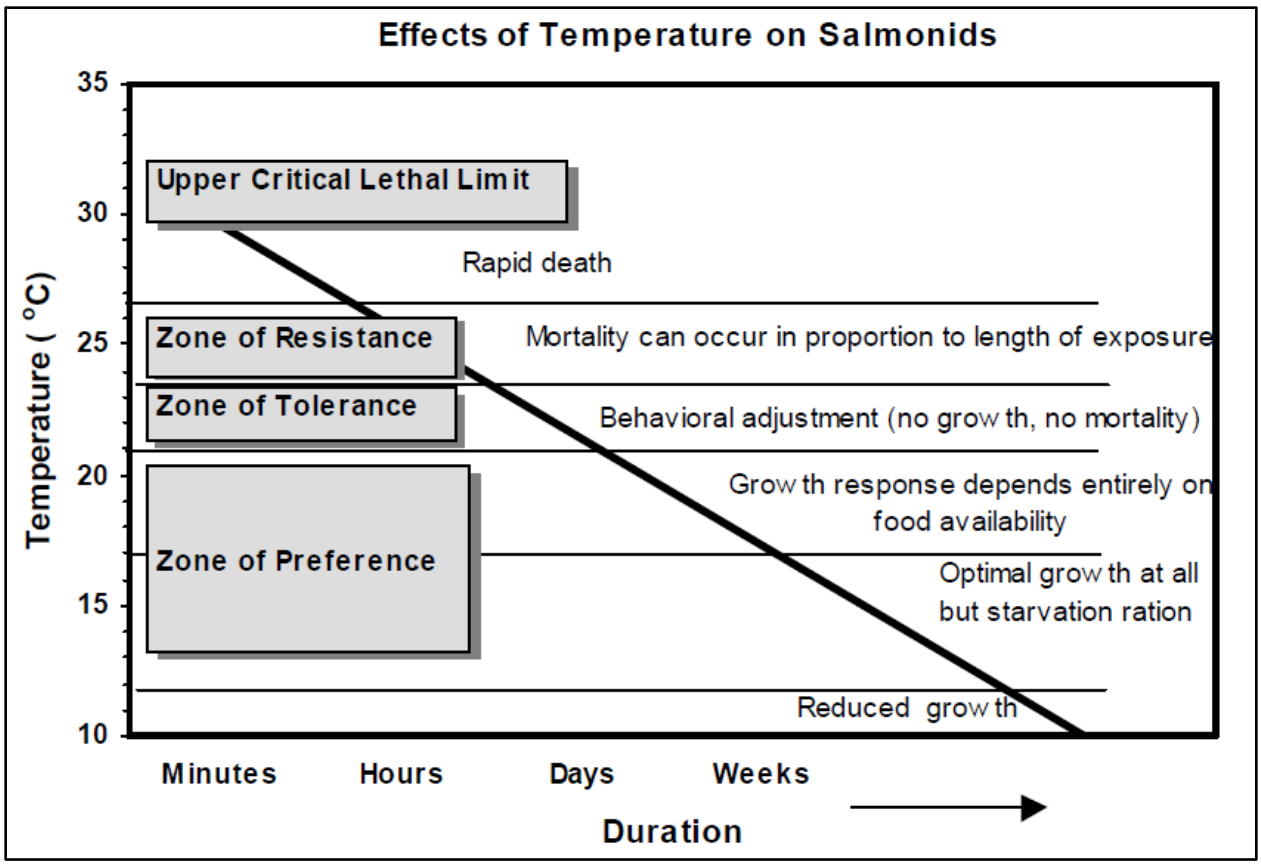

Figure 3.3.2-21. General biological effects of water temperature on salmonids (Source: Sullivan et al., 2000).

Based on the Districts' modeling studies, the rate of flow released from the Don Pedro Project affects water temperatures in the main channel of the lower Tuolumne River downstream of Don Pedro Dam (RM 54.8).[114] During the irrigation season, the project and other disturbances to the channel (e.g., diversions and agricultural returns) contribute to cumulative increases in water temperature. The Districts do not propose to monitor water temperature at the projects.

Water Board preliminary 401 condition 7 for the Don Pedro and La Grange Projects specifies that the Districts develop, in consultation with relevant resource agencies, a plan to monitor potential effects on water temperature from the projects by monitoring water temperature in Don Pedro Reservoir, La Grange Reservoir, and the lower Tuolumne River. The Water Board specifies water temperature monitoring at "an adequate number of sites to track the changes in water temperature stored in reservoirs

[114] Simulated summer 7DADMs for the base case scenario are (1) cooler with little variability immediately below Don Pedro Dam (RM 54) compared to the without-dams scenario, (2) have increased to 20°C but are still 5°C cooler than the without-dams conditions at RM 46, and (3) generally reach thermal equilibrium at RM 34.

and released below impoundments," and states that water temperature data would be used to help determine the effects of the projects' operations on thermal conditions. The Water Board specifies that the Districts monitor reservoir water temperature and thermocline depth by profile sampling near the dam to determine reservoir stratification depths and flowing-water temperatures by installing and anchoring appropriate devices to continuously record water temperature seasonally or throughout the year.

FWS 10(j) recommendation 6 for both projects and California DFW 10(j) recommendation M2-1 for both projects recommend that the Districts develop a water temperature monitoring plan that includes the project reservoirs and project-affected reaches of the lower Tuolumne River. The plan would be developed in consultation with the Water Board, FWS, NMFS, and California DFW, and and would include descriptions of: (1) methods to monitor and analyze water temperature, (2) locations and frequency of water temperature monitoring, and (3) how the Districts would report water temperature data to FERC and update the plan, as needed.

California DFW 10(j) recommendation M2-1 recommends that the plan include location-specific temperature-performance measures that are consistent with CWA section 303(d) water temperature objectives for the lower Tuolumne River, a reporting schedule for annual reports detailing temperature gage and flow data, and summary reports every five years that provide: (1) a summary of the annual reports, and information and analysis of the operation of the projects in relation to meeting location-specific temperature performance measures; (2) recommendations for improvement, if needed, in meeting performance measures; and (3) recommendations of changes to performance measures and rationale for those recommendations, if information has been developed in this system or with outside studies that indicate changes should be made.

California DFW 10(j) recommendation M2-3 recommends a schedule for each report that includes providing the reports to the TREG including the Water Board , California DFW, FWS, and NMFS. For annual reports, California DFW's recommended schedule includes a 30-day comment period, the Districts' incorporation of comments into the report, and filing the final report with FERC. For summary reports, California DFW's recommended schedule includes a 60-day comment period; the Districts' incorporation of comments into a draft final report; a 30-day period for the agencies to approve the draft final report or provide additional comments; and filing of a final report, which includes an appendix documenting the consultation process with the TREG and the agencies, with FERC.

California DFW 10(j) recommendation M2-3 states that the Districts would be financially responsible for implementation of the Water Temperature Monitoring Plan and Compliance Plan, but includes a provision allowing any organization of the TREG to be assigned the lead in implementing portions of the plan.

California DFW 10(j) recommendation M2-1 and FWS 10(j) recommendation 6 recommend that the plan include monitoring in the flowing reaches, at a minimum:

1. Between RM 52.2 and 47.5 (La Grange Diversion Dam to Basso Bridge);
2. Between RM 47.5 and 39.5 (Basso Bridge to Roberts Ferry);
3. Between RM 39.5 and just upstream of the infiltration galleries[115];
4. Downstream of the infiltration galleries to the confluence with the San Joaquin River.

NMFS 10(j) recommendation 1.4 for the La Grange Project recommends establishing temperature gages near RM 25 and near the Robert's Ferry Bridge crossing at RM 39.5.[116] NMFS recommends that these new temperature gages record temperature at 1-hour or shorter intervals and the data be made publicly available in real-time.

NMFS 10(j) recommendation 1.5 for the La Grange Project recommends that the Districts prepare a report and provide it to FERC and the resource agencies before January 1 annually. NMFS recommends that the report use empirical temperature data from the lower Tuolumne River to describe the timing, magnitude, and duration of the temperature target exceedance events; and include analysis of operational changes needed to prevent similar exceedance events in the future.

California DFW, NMFS, FWS, and others recommend project operations to maintain specific water temperatures in project-affected waters.[117] Table 3.3.2-24 provides California DFW 10(j) recommendation M2-2 and NMFS 10(j) recommendation 1.5 water temperature targets and compliance points. Temperatures recommended by NMFS are set as 7DADMs; California DFW values are set as maximums for a short period that has not been specifically defined.[118] California DFW specifically

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[115] The location of the existing and proposed infiltration galleries is about RM 25.9.

[116] NMFS recommends co-locating the temperature gage near RM 25 with a new flow gage at the same site.

[117] California DFW recommends that the Districts meet its recommended water temperature objectives, NMFS recommends that the Districts "make a good faith effort to meet [its] recommended temperature objectives," and FWS does not recommend specific water temperature objectives.

[118] California DFW states: "The objective temperature requirement is a maximum temperature, to be determined over a short duration such as hourly or daily, as set by the water temperature monitoring plan and compliance plan developed as part of Measure M2-1."

recommends that the Districts meet the designated maximum temperatures under the following conditions[119]:

- The outflow water temperatures of Don Pedro Reservoir and La Grange Diversion Dam are equal to or lower than the required temperatures;
- River accretions (inflows) below La Grange Diversion Dam are of large enough quantity and high enough temperatures to preclude meeting the required temperatures at the appropriate location; or
- Some other reasonably uncontrollable condition exists that precludes the Districts from meeting the requirements.

Table 3.3.2-24. California DFW and NMFS water temperature recommendations (Source: California DFW 10(j) recommendation M2-2; NMFS 10(j) recommendation 1.5, as modified by staff).

	California DFW		NMFS	
Water Year Type(s) [a]	**Temperature [b]**	**Compliance Point [c]**	**Temperature**	**Compliance Point [c]**
Salmon Spawning, Egg Incubation, and Fry Emergence, October 16–December 31				
Wet, above normal, and below normal	13°C maximum	RM 42.8	13°C 7DADM	RM 39.5
Dry and critical	Same	RM 47.4	Same	RM 47.4
Steelhead Smoltification, January 1–May 31				
Wet	13°C maximum	RM 31.8	14°C 7DADM	RM 31.8
Above normal	Same	RM 35 Riffle	Same	RM 31.8
Below normal	Same	RM 40 Riffle	Same	RM 31.8
Dry	Same	RM 40 Riffle	Same	RM 39.5
Critical	Same	RM 42.8	Same	RM 39.5
Steelhead Juvenile Rearing, June 1–October 15				
Wet, above normal, and below normal	18°C maximum	RM 42.8	18°C 7DADM	RM 39.5

[119] California DFW's recommendation as repeated herein is unclear. We interpret condition "a" to be the general requirement that the outflow from Don Pedro Reservoir and La Grange Diversion Dam should be equal to or lower than the required maximum temperatures, while conditions "b" and "c" would be scenarios that would allow an exceedance of the location-specific designated temperature maximum without assigning responsibility to the Don Pedro or La Grange Project.

Water Year Type(s) [a]	California DFW		NMFS	
	Temperature [b]	Compliance Point [c]	Temperature	Compliance Point [c]
Dry and critical	Same	RM 42.8	Same	RM 42.8

[a] Water year types are based on estimated annual unimpaired flow of the Tuolumne River at the La Grange gage.

[b] California DFW recommends that the Districts meet water temperature maximums, determined over a short duration (e.g., hourly or daily), after the first five years of implementing the Water Temperature Monitoring and Compliance Plan.

[c] Compliance point descriptions provided by California DFW and NMFS are: RM 31.8 Modesto Gage, RM 39.5 Robert's Ferry Bridge, RM 42.8 Turlock State Park, and RM 47.4 Basso Bridge. Although they list RM 31.8 as the Modesto Gage, that gage is located at about RM 16.5, and RM 31.8 is located near Waterford. We interpret the intent as RM 31.8, not the Modesto Gage (USGS No. 11290000).

In its January 29, 2018, filing with the Commission, The Bay Institute recommends a flow regime for the Don Pedro and La Grange Projects that is partially based on water temperature objectives of 12.5°C for optimal spawning and incubation, 13.0°C for fair incubation, 14.5°C for holding at an unspecified level of protection, 15.5°C for optimal adult migration, 16.0°C for optimal juvenile rearing, and 16.0°C for an undefined "suitable release" in July, August, and September (table 3.3.2-25).[120] The Bay Institute states that it will revise its flow recommendation as more temperature modeling and other information becomes available. In its comments on the draft EIS, The Bay Institute states that the Districts' modeling and the model results in the draft EIS include errors in characterizing its recommended diversions. The Bay Institute provides a time series of its recommended reservoir storage and expresses the desire to work iteratively with temperature modelers to optimize flow and temperature management.

Table 3.3.2-25. The Bay Institute-recommended upper 7DADM in-channel temperature limits (in °C) with different quality of outcomes for Chinook salmon (Source: The Bay Institute, 2019, as modified by staff).

Life Stage	Optimal[a]	Fair[b]	Poor[a]	Detrimental[a]	Lethal[b]
Adult migration	15.5	18.0 [c]	20.5	24.0	≥24.0

[120] In comments on the draft EIS, The Bay Institute indicates its temperature objectives are for 7DADMs that are based on biological studies of Chinook salmon and extend to *O. mykiss*. It appears The Bay Institute's goal for the 16.0°C "suitable release temperatures" in July, August, and September is for optimal juvenile rearing.

Life Stage	Optimal[a]	Fair[b]	Poor[a]	Detrimental[a]	Lethal[b]
Spawning/incubation	12.5	13.0	13.8	15.6	≥15.6
Juvenile rearing migration [d]	16.0	18.0 [c]	20.0	24.0	≥24.0

Notes: Condition ratings are defined as optimal for those identified in the literature and are associated with zero temperature stress; fair ratings result in limited temperature-related stress; poor ratings are associated with high-levels of temperature-related stress and reductions in fitness;, and detrimental ratings are associated with failure to complete the life-cycle, even if mortality is an indirect result, or not the immediate result, of temperature stress. Temperature values provided by The Bay Institute in °F have been converted to °C.

[a] Source indicated by The Bay Institute is SEP (2016, as cited by The Bay Institute, 2019).

[b] Source indicated by The Bay Institute is EPA (2003).

[c] Temperatures associated with increased disease risk and habitat avoidance in adult and juvenile Chinook salmon, respectively.

[d] Temperature thresholds refer to those that occur in-channel under food-limiting conditions. Food availability affects temperature tolerance among Chinook salmon juveniles; in floodplain habitats where food is not limiting, temperature tolerances may be higher.

In their reply comments, the Districts state that they should not need to comply with temperature regimes at points located 10 miles or more downstream of the project and likely affected by non-project local conditions, groundwater inflows/outflows, and riparian withdrawals. The Districts also state that the existing cumulative efforts of California DFW, USGS, and the Districts result in a network of more than 10 temperature monitoring stations in the lower Tuolumne River that provides adequate coverage of the lower river's temperature regime.[121] The Districts agree to relocate existing station(s), as California DFW prefers, because the existing locations may not be optimal.

In their comments on the draft EIS, the Districts comment that there is no justification for the Commission to require temperature monitoring because there are no

[121] The Districts do not provide insight into which stations are monitored by whom. Our review of USGS gages (USGS, 2018k) indicates USGS currently monitors water temperature at two gages in the lower Tuolumne River (11289650 below La Grange Diversion Dam and 11290000 at Modesto). Review of California Data Exchange Center's database (California DWR, 2018) provides no active California DFW temperature stations in the lower Tuolumne River and suggests it discontinued temperature monitoring at six lower Tuolumne River stations in May 2018.

specific temperature compliance criteria and no site-specific scientific evidence indicating that temperatures are unsuitable for native salmonids in the lower Tuolumne River. Nonetheless, the Districts state that they would continue to voluntarily maintain a system of temperature monitors in the lower Tuolumne River and San Joaquin River[122] and would cooperate with the agencies on desired relocations.

In its comments on the draft EIS, EPA supports the Commission's alternative water temperature monitoring plan and acknowledges that there is an open scientific question about the thermal adaptability of Central Valley salmonids as indicated in the draft EIS. However, EPA states that there is a lack of consensus regarding *O. mykiss* adaptation to the recent shift in the lower Tuolumne River's thermal regime and recommends that the Commission consider a robust suite of data and endpoints that broadly address thermal physiological and ecological effects, both acute and chronic, when determining temperature values. EPA recommends revising the EIS to include a description of additional studies and references available regarding protective thermal values of salmonids and a discussion of the broad range of physiological and ecological factors that can influence the health of salmonids, including potential negative effects of competition, disease, and predation under a warmer thermal regime. EPA also recommends that the final EIS consider additional temperature research regarding population level impacts and impacts on life stages other than juvenile rearing (e.g., spawning, egg incubation, fry emergence, and smoltification).

In the 10(j) meeting held on September 19, 2019, California DFW and the California Sport Fishing Protection Alliance noted similarities in the structural, hydraulic, and thermal conditions caused by large dams on the Tuolumne and Stanislaus Rivers submersing old dams a short distance upstream.[123]

Our Analysis

We evaluated the effects of the Districts' proposal and other stakeholder recommendations on water temperature and subsequently aquatic organisms using varied approaches. In this subsection, we evaluate the effects of alternative operations on

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[122] The Districts' system of temperature monitors are located in the lower Tuolumne River at the Don Pedro Powerhouse tailrace (RM 54.3), La Grange Powerhouse (RM 51.8), Riffle A7 (RM 50.7), Riffle 3B - Upstream of Basso (RM 49.1), Riffle 13B - Zanker (RM 45.9), Riffle 21 - Bobcat (RM 42.9), TLSRA (RM 42.0), Roberts Ferry Bridge (RM 39.5), Santa Fe Gravel - Ruddy (RM 36.5), Hughson (RM 23.6), Shiloh Bridge (RM 3.5); and in the San Joaquin River at Dos Rios (SJR RM 86.2) and Gardner Cove - SJR791 (SJR RM 79.1).

[123] On the Tuolumne River, the old dam that is submersed within Don Pedro Reservoir is located about 1.5 miles up-reservoir of the current dam. The new and old Melones Dams create a similar situation on the Stanislaus River.

temperature profiles in Don Pedro Reservoir and analyze the frequency that simulated 7DADM instream temperatures exceed target levels set to protect the various freshwater life stages of fall-run Chinook salmon, California Central Valley steelhead, and resident *O. mykiss*. In the *Minimum Flows and Pulse Flows* subsection below, we evaluate results of the Districts' production models for Chinook salmon and *O. mykiss* (Stillwater Sciences, 2017b,c). These production models include both short- and long-term effects of simulated daily average temperatures on these fishes. Both models focus on in-river factors that may affect the abundance of each species. The short-term effects simulated by the model include temperature-dependent probabilities for habitat use by *O. mykiss* adults and temperature triggers for spawning cessation and death of embryos, fry, juveniles, smolts, and adults. The long-term effects include tracking development of individual eggs as a function of temperature.

The lower Tuolumne River is currently on the 303(d) list for water temperature, and the temperature total maximum daily load is scheduled to be completed in 2021 (Water Board, 2019). This listing is based on EPA's evaluation of 1991 through 2009 7DADM temperatures compared to benchmarks of: 18°C in June 15–September 15 for steelhead summer rearing, 18°C in September 1–October 31 for Chinook salmon adult migration, 16°C in March 15–June 15 for Chinook salmon smoltification and juvenile rearing, and 13°C in October 1–December 15 for Chinook salmon spawning (EPA, 2011).[124] By letter (D.L. Forsgren, Deputy Assistant Administrator, EPA, Washington, D.C., to C. Hashimoto, General Manager, TID, Turlock, California, June 27, 2018), EPA states that it is aware of research with salmonid species from California rivers that suggests populations at the southern limit of their distribution may be locally adjusted to warmer temperatures relative to more northern populations, and that these research results challenge the use of a single thermal criterion for their entire range. EPA concludes the issue of whether salmonid populations are adaptable to warmer conditions in California is an open and legitimate scientific question and encourages use of the most up-to-date research to evaluate the impact on fish populations.

Several peer-reviewed studies conducted since the issuance of EPA's temperature guidance (EPA, 2003) support the ability of salmonid populations, including *O. mykiss* and Chinook salmon, to adapt to warm conditions (Chen et al., 2015; Narum et al., 2010, 2013; Poletto et al., 2017; Rodnick et al., 2004). Evaluation of the thermal performance of juvenile *O. mykiss* captured in the lower Tuolumne River between RM 49.1 and 51.5, and tested in a swim tunnel respirometer at temperatures between 13ºC and 25ºC concludes that 95 percent of peak aerobic capacity is at 17.8°C to 24.6°C (Farrell et al.,

[124] The 7DADM values used for the lower Tuolumne River 303(d) listing are consistent with temperature guidance values for the Pacific Northwest, which have the goal of protecting potential salmonid use (EPA, 2003).

2017; Verhille et al., 2016).[125] As a result of the study, the Districts propose use of a 22°C, instead of 18°C, 7DADM as a conservative upper performance limit for juvenile *O. mykiss*. An evaluation of the thermal performance of juvenile fall-run Chinook salmon from the Mokelumne River Hatchery[126] revealed aerobic scope values similar to those reported above for lower Tuolumne River *O. mykiss* (Poletto et al., 2017).[127] In a January 29, 2018, filing with the Commission, California DFW (10(j) recommendation M1) states that the 18°C temperature "criteria" should not be changed based on a single study,[128] and notes that other life stages of *O. mykiss* are present in the lower Tuolumne River. NMFS recommends use of the 18°C 7DADM temperature objective to protect steelhead juvenile rearing in the lower Tuolumne River (NMFS 10(j) recommendation 1.5). To estimate the upper Tuolumne River's capacity for steelhead and Chinook salmon, NMFS applied average daily optimum and tolerable temperatures[129] that were developed for assessing reintroduction to a Sierra Nevada river system[130] (Bratovich et al., 2012, as cited in Boughton et al., 2018), while recognizing increased temperature tolerance of juvenile steelhead and spring-run Chinook salmon holding based on results of the lower Tuolumne River swim tests (Verhille et al., 2016) and observations of temperatures experienced by holding Chinook salmon in Big Chico Creek (Cresswell, 2004).

Based on the above information, we conclude that some fish populations have adapted to local/regional thermal regimes, and it appears that *O. mykiss* in the lower Tuolumne River have likely adapted to the river's thermal regime (Farrell et al., 2017).

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[125] The fish for this study were captured in the Tuolumne River and determined to have fed well prior to the test, based on their condition factors, feces found in the swim tunnel, and regurgitation of large meals by two fish. The study's limiting of the upper temperature tested to the permit requirement of 25°C appears to bias the results to be more conservative than actual conditions.

[126] Currently, the most abundant population segment located in the Central Valley of California.

[127] The thermal tolerance of hatchery fish may not be fully representative of wild fish of the same population segment.

[128] EPA's (2003) 7DADMs are temperature guidance, not specifically criteria as stated by California DFW.

[129] NMFS's report on the upper river's capacity for reintroduction of steelhead and spring-run Chinook salmon states "Note that 'tolerable' temperatures should not be interpreted as poor— tolerable comprises conditions that are suitable but not the best quality" (Boughton et al., 2018).

[130] These temperature indices were specifically developed for parts of the Yuba River system.

However, we note that warm water temperatures may have contributed to the death of some early life stage of *O. mykiss* prior to capturing fish for the study; therefore, juvenile *O. mykiss* tested in the swim tunnel respirometer may not represent the entire population of younger life stages. Use of 7DADM water temperature targets is a commonly accepted approach to evaluate the temperature suitability for salmonid species and this index is supported by a large body of information; whereas, this is not likely to be the case if a new temperature metric were to be developed, as California DFW recommends. Therefore, to be conservative, we evaluate the thermal regimes resulting from baseline, proposed, and recommended project operations using the selected 7DADMs for the life cycle of Chinook salmon and *O. mykiss* and lower Tuolumne River juvenile *O. mykiss* presented in table 3.3.2-26.

Our review of existing conditions indicates that the Don Pedro Project directly affects flows and temperatures in the lower Tuolumne River downstream of Don Pedro Dam, but the La Grange Project has negligible effect on temperatures in the lower Tuolumne River because of the short retention time in the La Grange Reservoir and forebay. Although the Don Pedro Project influences temperatures in the lower Tuolumne River, its ability to reduce water temperatures is limited by non-hydroelectric project withdrawals[131] and irrigation returns, the old submersed dam within Don Pedro Reservoir, and past disturbance to the channel, floodplain, and riparian habitat. Project releases tend to remain relatively stable throughout the year with coolest releases in November–April, gradual warming in April–September, and rapid cooling in October. As water flows down the lower Tuolumne River, it tends to reach its minimum temperature in early January and its maximum temperature in June–July. During the non-irrigation season, little to no water is diverted into the Districts' water supply canals, and the magnitude and duration of releases from Don Pedro Dam directly affect flows and water temperature in the lower Tuolumne River. Increasing flows to reduce water temperatures in the spring and early summer would reduce storage for releases in the summer and fall from Don Pedro Reservoir. This relationship is a major factor when attempting to balance flow releases to meet temperature targets for protecting coldwater species such as *O. mykiss* and Chinook salmon.

[131] For example, average annual diversions from the Tuolumne River are 244,000 acre-feet from Hetch Hetchy Reservoir and 867,000 acre-feet at La Grange Diversion Dam leaving about 40 percent of the unimpaired flow to be released into the lower Tuolumne River (CCSF, 2005).

Table 3.3.2-26. 7DADM water temperature targets and periodicity to protect fall-run Chinook salmon, California Central Valley steelhead, and resident *O. mykiss* life stages (Source: EPA, 2011, 2003; Farrell et al., 2017; Stillwater Sciences, 2017b,c, as modified by staff).

Life Stage	7DADM[a]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall-Run Chinook Salmon													
Spawning and egg incubation[b]	13ºC												
Juvenile rearing and emigration[b]	16ºC												
Adult upstream migration[b]	18ºC												
California Central Valley Steelhead and Resident *O. mykiss*													
Spawning and egg incubation	13ºC												
Steelhead smoltification	14ºC												
Juvenile rearing and emigration (core)[c]	16ºC												
Juvenile over-summer rearing[b]	18ºC												
Juvenile rearing and emigration (non-core steelhead)[d]	18ºC												
Juvenile rearing and emigration (non-core resident)[d]	22ºC												
Adult rearing	18ºC												
Adult upstream migration	18ºC												

[a] The 7DADM for non-core resident *O. mykiss* is based on the thermal performance of 48 wild *O. mykiss* captured in the lower Tuolumne River from RM 51.6 to RM 49.1 (Farrell et al., 2017). All remaining 7DADMs are from EPA's temperature guidance for the Pacific Northwest (EPA, 2003).

[b] Species-life stage included in EPA's methodology for lower Tuolumne River 303(d) listings (EPA, 2011), although time period has been refined based on available information (Stillwater Sciences, 2017b,c).

[c] Core is intended for protection of moderate to high density rearing use (EPA, 2003).

[d] Non-core is intended for protection of low to moderate density and recognizes that fish will use waters that are warmer than their optimal thermal range (EPA, 2003).

Further complications would result from prolonged droughts leading to a major drawdown of Don Pedro Reservoir. As noted in section 3.3.2.1 *Aquatic Resources, Affected Environment, Water Quality*, Don Pedro Reservoir elevations of less than 700 feet tend to result in the reservoir's outflow having daily mean temperatures that are warmer than the typical range of 9.5 to 12°C. This condition is caused by several factors, including drawdown of the reservoir pool resulting in the powerhouse intake being closer to the water's surface, a deeper warm epilimnion throughout the reservoir, and the old dam blocking most flow below an elevation of 600 feet (figure 3.3.2-22).[132]

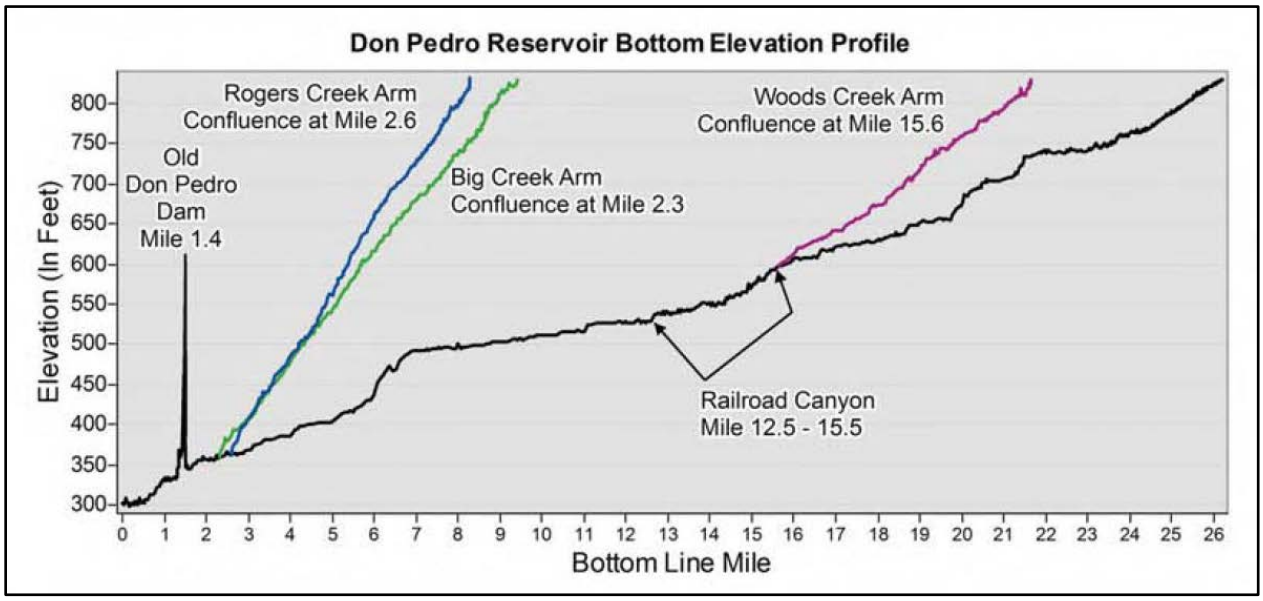

Figure 3.3.2-22. Don Pedro Reservoir bottom elevation profile including the crest of the old dam (Source: HDR, 2017b).

Another factor that would highly influence lower Tuolumne River water temperatures is operation of the infiltration galleries. Following completion of IG-1 and construction of IG-2, a total of up to 225 cfs could be withdrawn from the river through them instead of being diverted into TID's canal at the La Grange Powerhouse forebay. This would enable a subsequent increase in flows released into the Tuolumne River from the La Grange Diversion Dam and powerhouse and thereby act to lower Tuolumne River water temperatures downstream to about RM 26.

Regardless of whether the infiltration galleries are included as project facilities, TID could still operate them for municipal and industrial deliveries, and the Districts

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[132] Although this figure shows the crest of the old dam above 600 feet, it is presumed that water can also pass this dam over the 596.5-foot elevation crest of its original side-channel spillway and possibly through two sets of six 52-inch-diameter gates with centerline elevations of about 512 and 422 feet.

could compensate for this by increased instream flow releases from the La Grange Project.[133] Therefore, our evaluation of the Districts' proposed flow regime on water temperature includes operation of the infiltration galleries.

Increasing instream flow releases from La Grange Powerhouse, as proposed by the Districts and recommended by agencies and other stakeholders, would maintain lower water temperatures in the lower Tuolumne River, especially in the reach between the La Grange Diversion Dam and the infiltration galleries. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the Districts developed a suite of models to evaluate effects of alternative project operations on several resources, including water temperature. Models pertinent to water temperature include the operations model and separate water temperature models for Don Pedro Reservoir and the lower Tuolumne River.

The Districts used these models to simulate the proposed and recommended operation scenarios to provide the additional information requested by staff prior to issuance of the draft EIS and filed the results for water temperature on May 14 and July 30, 2018 (Districts, 2018a,b). Since issuance of the draft EIS, staff requested[134] additional water temperature modeling to better represent The Bay Institute's recommendation and to represent the draft Voluntary Agreement that would constitute a Tuolumne River-specific alternative to the Water Board's update to the Bay-Delta Plan. The Districts filed the simulated water temperatures on January 24, 2020 (Districts, 2020b). The general approach for this modeling was to represent the no-action scenario (base case), and proposed and recommended operations within the limits of the models.[135] Simulations of recommended operations were not altered to meet water temperature objectives or account for accretion/depletion between the La Grange gage and locations below the proposed two infiltration galleries. The baseline and five other scenarios do not include operation of the infiltration galleries; however, the Districts state

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[133] The January 2018 draft environmental impact report for the Regional Surface Water Supply Project states that the project, to be completed in two or more phases, would enable the use of the existing infiltration gallery to withdraw water from the Tuolumne River at rates of up to 41.4 cfs in Phase 1 to 69.6 cfs at full buildout (Horizon, 2018). This document indicates construction of phase 1 is scheduled to become operational in 2022. This project would enable integrated use of groundwater and surface water to supply municipal and industrial uses in the cities of Ceres and Turlock.

[134] This request was made by Commission staff in a September 17, 2019, AIR (accession no. 20190917-3039).

[135] The reservoir temperature model includes a representation of the old dam in Don Pedro Reservoir, although our confidence in the model's accuracy, especially for temperatures near the newer dam, decreases as the reservoir's elevation drops closer to the crest of the old dam.

that the other six scenarios include operation of the infiltration galleries. Each model scenario is described in detail, including a frequency of analysis for simulated average daily temperature for the scenario compared to the baseline, in the Districts' May 14 and July 30, 2018, and December 11, 2019, filings (Districts, 2018a,b; 2019c).

Table 3.3.2-27 compares the frequency of 7DADM water temperature target exceedances under baseline (base case) conditions and the proposed and recommended project operation regimes for all life stages of fall-run Chinook salmon, steelhead, and resident *O. mykiss*. This table provides exceedance values for each specified life stage-specific 7DADM temperature target at eight locations from RM 51.5 below the La Grange Powerhouse to RM 3 near the confluence with the San Joaquin River. The table shows that the frequency of simulated 7DADM temperature exceedances in the lower Tuolumne River for the Districts' two proposed scenarios (interim flows that would be provided until the infiltration galleries are operational, and "with-infiltration gallery" flows that would be in effect after the infiltration galleries are operational) are similar to the environmental baseline, and that the draft Voluntary Agreement and flow scenarios recommended by other stakeholders also continue to exceed 7DADM water temperature targets.[136]

To systematically compare the simulated temperature regimes of each proposed and recommended scenario, we computed the difference in 7DADM exceedances from the base case scenario; then categorized the relative magnitude of these differences based on their absolute value, and finally determined the percent of values in each category. The categorization considers differences as negligible if they were less than 2 percent, minor for 2 to 5 percent, moderate for more than 5 to 10 percent, and major for more than 10 percent. Table 3.3.2-28 shows simulations for all the proposed and recommended scenarios, which generally improve the temperature regime compared to the base case. The scenario representing the Districts' proposed interim flows shows improvement (reduced exceedances) in 33 percent of the exceedance values; whereas, the Districts' proposed flows for after the infiltration galleries are operational show improvement in 68 percent of the exceedance values.[137] The draft Voluntary Agreement shows an

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[136] Although simulated average daily temperatures at RM 50 to RM 16 are frequently cooler in May through September for the Districts' "with-infiltration gallery" flows than the baseline (Districts, 2018a,f), this trend is not evident in the frequency of exceeding life-stage-specific 7DADMs in table 3.3.2-27.

[137] Improvement means that simulated temperatures exceeded the 7DADM water temperature targets less frequently than the base case, indicating cooler water temperatures.

Table 3.3.2-27. Comparison of 7DADM simulated water temperature target exceedance between the environmental baseline conditions and proposed and recommended flow regimes for all life stages of fall-run Chinook salmon, California Central Valley steelhead, and resident *O. mykiss* in the lower Tuolumne River between RM 51.5 and RM 3 (Source: Districts, 2018a,b,f; 2020a,b, as modified by staff).

	Percent of Time 7DADM is Exceeded										
Location [a]	**Base Case**	**Districts Interim**	**Districts with IGs**	**VA [b]**	**FWS [c]**	**NMFS**	**Calif. DFW**	**Water Board**	**Cons. Groups**	**The Bay Institute [b]**	**ECHO**
Fall-Run Chinook Salmon, spawning and egg incubation in September–January, 13°C [d]											
RM 51.5	24%	22%	19%	21%	31%	32%	25%	32%	35%	21%	32%
RM 50	31%	30%	27%	28%	38%	38%	30%	36%	41%	27%	41%
RM 46	45%	47%	46%	46%	53%	55%	49%	50%	55%	48%	51%
RM 43	43%	44%	43%	44%	50%	53%	47%	47%	52%	47%	47%
RM 39	37%	39%	38%	38%	43%	45%	42%	40%	45%	42%	41%
RM 26	31%	31%	31%	31%	32%	32%	30%	31%	33%	31%	33%
RM 16	34%	35%	34%	34%	35%	36%	35%	34%	36%	34%	35%
RM 3	35%	35%	35%	35%	36%	36%	36%	34%	36%	35%	35%
Fall-Run Chinook Salmon, juvenile rearing and emigration in January–June, 16°C [d]											
RM 51.5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RM 50	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RM 46	13%	11%	11%	11%	10%	10%	2%	2%	9%	0%	2%
RM 43	17%	14%	14%	14%	12%	11%	7%	6%	11%	2%	4%
RM 39	18%	16%	16%	16%	13%	14%	14%	11%	13%	7%	8%
RM 26	17%	14%	14%	14%	12%	11%	6%	4%	11%	2%	4%
RM 16	25%	24%	23%	23%	16%	16%	19%	14%	16%	10%	10%
RM 3	27%	27%	26%	26%	19%	20%	22%	18%	19%	15%	14%

	Percent of Time 7DADM is Exceeded										
Location [a]	**Base Case**	**Districts Interim**	**Districts with IGs**	**VA [b]**	**FWS [c]**	**NMFS**	**Calif. DFW**	**Water Board**	**Cons. Groups**	**The Bay Institute [b]**	**ECHO**
Fall-Run Chinook Salmon, adult upstream migration in August–December, 18ºC [d]											
RM 51.5	5%	3%	1%	1%	2%	2%	1%	3%	3%	1%	4%
RM 50	6%	4%	2%	2%	2%	3%	2%	4%	5%	2%	8%
RM 46	16%	13%	8%	8%	10%	12%	7%	18%	13%	12%	19%
RM 43	19%	17%	11%	12%	16%	14%	12%	19%	18%	16%	22%
RM 39	19%	17%	12%	13%	17%	15%	15%	17%	19%	17%	22%
RM 26	26%	25%	18%	20%	23%	19%	21%	21%	25%	24%	28%
RM 16	32%	31%	29%	29%	31%	31%	30%	27%	32%	29%	34%
RM 3	34%	33%	32%	32%	34%	34%	33%	29%	35%	32%	35%
California Central Valley Steelhead and Resident *O. mykiss*, spawning and egg incubation in December–May, 13ºC											
RM 51.5	14%	11%	11%	11%	13%	13%	7%	10%	12%	3%	9%
RM 50	22%	19%	18%	18%	19%	19%	12%	14%	18%	5%	13%
RM 46	38%	38%	37%	37%	39%	40%	39%	35%	37%	34%	35%
RM 43	40%	40%	39%	40%	43%	43%	42%	41%	40%	40%	37%
RM 39	40%	40%	40%	40%	44%	43%	43%	42%	42%	43%	40%
RM 26	34%	34%	33%	34%	33%	32%	33%	32%	31%	31%	30%
RM 16	38%	38%	38%	38%	39%	36%	39%	39%	37%	37%	35%
RM 3	42%	42%	42%	42%	43%	41%	43%	43%	42%	41%	40%
California Central Valley Steelhead, smoltification in January–June, 14ºC											
RM 51.5	12%	9%	6%	5%	4%	4%	1%	2%	3%	0%	2%
RM 50	16%	16%	15%	16%	11%	11%	6%	4%	10%	1%	6%
RM 46	37%	36%	36%	36%	29%	33%	33%	27%	30%	21%	23%

	Percent of Time 7DADM is Exceeded										
Location [a]	**Base Case**	**Districts Interim**	**Districts with IGs**	**VA [b]**	**FWS [c]**	**NMFS**	**Calif. DFW**	**Water Board**	**Cons. Groups**	**The Bay Institute [b]**	**ECHO**
RM 43	42%	41%	40%	40%	35%	39%	39%	35%	35%	32%	32%
RM 39	44%	44%	43%	44%	42%	43%	44%	42%	41%	40%	38%
RM 26	39%	39%	38%	38%	35%	35%	36%	33%	34%	31%	31%
RM 16	47%	46%	46%	46%	42%	42%	45%	44%	41%	40%	37%
RM 3	51%	51%	51%	51%	50%	48%	51%	50%	49%	48%	46%
California Central Valley Steelhead and Resident *O. mykiss*, juvenile rearing and emigration (core) year-round, 16ºC											
RM 51.5	11%	5%	4%	3%	3%	4%	3%	11%	6%	2%	6%
RM 50	17%	9%	5%	5%	5%	6%	4%	14%	8%	4%	14%
RM 46	35%	35%	32%	33%	33%	30%	28%	24%	34%	24%	31%
RM 43	39%	38%	36%	37%	36%	37%	33%	30%	37%	29%	34%
RM 39	40%	39%	38%	39%	38%	39%	38%	35%	39%	33%	36%
RM 26	40%	39%	37%	38%	36%	37%	35%	30%	37%	30%	34%
RM 16	46%	46%	45%	46%	41%	42%	43%	39%	42%	38%	39%
RM 3	49%	49%	49%	49%	45%	46%	46%	44%	45%	44%	43%
California Central Valley Steelhead and Resident *O. mykiss*, juvenile over-summer rearing in June–September, 18ºC [d]											
RM 51.5	9%	3%	1%	1%	1%	1%	1%	5%	3%	1%	4%
RM 50	15%	7%	3%	3%	3%	3%	3%	10%	7%	3%	15%
RM 46	59%	60%	40%	44%	45%	36%	35%	47%	49%	37%	57%
RM 43	69%	70%	56%	61%	62%	46%	54%	51%	64%	50%	66%
RM 39	72%	73%	66%	69%	68%	59%	65%	56%	70%	59%	70%
RM 26	79%	81%	75%	78%	75%	68%	73%	58%	76%	66%	73%
RM 16	85%	86%	85%	86%	83%	85%	85%	72%	83%	77%	80%
RM 3	87%	88%	88%	88%	85%	88%	88%	78%	86%	81%	83%

	Percent of Time 7DADM is Exceeded										
Location [a]	**Base Case**	**Districts Interim**	**Districts with IGs**	**VA [b]**	**FWS [c]**	**NMFS**	**Calif. DFW**	**Water Board**	**Cons. Groups**	**The Bay Institute [b]**	**ECHO**
California Central Valley Steelhead, juvenile rearing and emigration (non-core) year-round, 18ºC											
RM 51.5	4%	1%	0%	0%	1%	1%	0%	2%	1%	1%	2%
RM 50	6%	3%	1%	1%	1%	1%	1%	4%	3%	1%	6%
RM 46	23%	22%	16%	17%	17%	14%	13%	17%	19%	13%	21%
RM 43	27%	27%	22%	24%	24%	19%	19%	19%	25%	17%	24%
RM 39	28%	28%	25%	26%	27%	24%	23%	20%	27%	20%	25%
RM 26	32%	31%	29%	30%	29%	27%	25%	21%	30%	23%	26%
RM 16	38%	36%	36%	36%	35%	35%	32%	28%	35%	28%	31%
RM 3	40%	39%	38%	39%	37%	37%	35%	31%	37%	31%	33%
California Central Valley Resident *O. mykiss*, juvenile rearing and emigration (non-core) year-round, 22ºC											
RM 51.5	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RM 50	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
RM 46	11%	2%	0%	0%	0%	0%	0%	8%	1%	1%	8%
RM 43	11%	2%	0%	0%	0%	0%	0%	8%	1%	1%	8%
RM 39	12%	4%	1%	1%	1%	1%	1%	9%	2%	1%	9%
RM 26	20%	18%	10%	11%	9%	6%	8%	13%	11%	9%	16%
RM 16	26%	25%	24%	24%	22%	18%	19%	17%	22%	17%	22%
RM 3	28%	27%	26%	26%	25%	24%	23%	18%	25%	20%	23%
California Central Valley Steelhead and Resident *O. mykiss*, adult rearing year-round, 18ºC											
RM 51.5	4%	1%	0%	0%	1%	1%	0%	2%	1%	1%	2%
RM 50	6%	3%	1%	1%	1%	1%	1%	4%	3%	1%	6%
RM 46	23%	22%	16%	17%	17%	14%	13%	17%	19%	13%	21%
RM 43	27%	27%	22%	24%	24%	19%	19%	19%	25%	17%	24%

	Percent of Time 7DADM is Exceeded										
Location [a]	**Base Case**	**Districts Interim**	**Districts with IGs**	**VA [b]**	**FWS [c]**	**NMFS**	**Calif. DFW**	**Water Board**	**Cons. Groups**	**The Bay Institute [b]**	**ECHO**
RM 39	28%	28%	25%	26%	27%	24%	23%	20%	27%	20%	25%
RM 26	32%	31%	29%	30%	29%	27%	25%	21%	30%	23%	26%
RM 16	38%	36%	36%	36%	35%	35%	32%	28%	35%	28%	31%
RM 3	40%	39%	38%	39%	37%	37%	35%	31%	37%	31%	33%
Central Valley Steelhead, adult upstream migration in July–March, 18ºC											
RM 51.5	4%	2%	1%	1%	1%	1%	1%	3%	2%	1%	3%
RM 50	6%	4%	2%	2%	2%	2%	2%	5%	4%	1%	9%
RM 46	22%	21%	13%	15%	18%	14%	14%	22%	20%	17%	27%
RM 43	26%	25%	19%	21%	25%	18%	21%	23%	26%	22%	30%
RM 39	27%	26%	23%	24%	27%	23%	25%	23%	28%	25%	30%
RM 26	30%	30%	27%	28%	30%	27%	28%	26%	31%	28%	33%
RM 16	35%	34%	33%	34%	35%	34%	33%	31%	35%	33%	36%
RM 3	37%	36%	36%	36%	36%	36%	36%	33%	37%	35%	37%

Note: See table 3.3.2-17 for a description of each model scenario.

[a] Location descriptions are: RM 51.5 below La Grange Powerhouse, RM 50 La Grange Bridge, RM 46 about 1.5 mile downstream of Basso Bridge, RM 43 near Turlock State Park, RM 39 about 0.5 mile downstream of Robert's Ferry Bridge, RM 26 Geer Road Bridge upstream of Districts' proposed infiltration galleries, RM 16 about 0.2 mile downstream of Dennett Dam, and RM 3 near Shiloh Bridge.

[b] Between the draft and final EIS, newly available information was used to re-model The Bay Institute scenario to better represent its recommendation and model the draft Voluntary Agreement and the Districts interim with additional 175-cfs boating flows below the infiltration galleries (IGs) on one June weekend of wet, above normal, and below normal water years.

[c] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

[d] Species-life stage included in EPA's methodology for lower Tuolumne River 303(d) listings (EPA, 2011), although time period has been refined based on available information (Stillwater Sciences, 2017b,c).

Table 3.3.2-28. Relative difference between 7DADM simulated water temperature target exceedances from base case scenario for all species and life stages (Source: Districts, 2018a,b,f; 2020a,b, as modified by staff).

Relative Change[a]	Districts Interim	Districts with IGs	VA[b]	FWS[c]	NMFS	Calif. DFW	Water Board	Cons. Groups	The Bay Institute[b]	ECHO
Major improvement	0%	8%	7%	8%	11%	13%	15%	0%	23%	7%
Moderate improvement	8%	15%	14%	13%	17%	26%	27%	19%	31%	20%
Minor improvement	25%	45%	42%	47%	43%	34%	32%	43%	31%	36%
Negligible	64%	32%	38%	25%	18%	22%	18%	28%	11%	17%
Minor deterioration	3%	0%	0%	2%	5%	6%	7%	3%	5%	16%
Moderate deterioration	0%	0%	0%	6%	6%	0%	1%	5%	0%	3%
Major deterioration	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%
Sum of improvement	33%	68%	63%	68%	71%	73%	74%	62%	85%	63%
Sum of deterioration	3%	0%	0%	8%	11%	6%	8%	9%	5%	19%

[a] Relative change was categorized based on the difference in percent exceedance: negligible if less than 2, minor for 2 to 5, moderate for more than 5 to 10, and major for more than 10.

[b] Between the draft and final EIS, newly available information was used to re-model The Bay Institute scenario to better represent its recommendation.

[c] FWS withdrew the flow scenario recommended in its REA response letter (former 10(j) recommendations 2 and 7) in its October 2, 2018, filing.

improvement in 63 percent of the exceedance values. The Districts' proposed operations with infiltration galleries and draft Voluntary Agreement both show no deterioration (increased exceedances), and the Districts' proposed operations without the infiltration galleries only show deterioration in 3 percent of the exceedance values.[138] The scenarios recommended by other stakeholders show improvements in 62 to 85 percent of the exceedance values and deterioration in 5 to 19 percent of the exceedance values. We note that this evaluation of relative change places equal weighting on all 7DADMs against one another and throughout the entire lower Tuolumne River. The effects of different flow regimes on specific species and life stages are further discussed below in subsection *Minimum Flows and Pulse Flows*.

The Districts' modeling of each scenario to represent corresponding proposed and recommended project operations captures the issues that would influence temperature in the lower Tuolumne River in most years. It is also consistent with the conclusion that Don Pedro Reservoir elevations of less than 700 feet would result in warmer than typical releases to the lower Tuolumne River. However, flow and water temperature conditions in sequential low-flow years vary depending on specific timing and magnitude of conditions leading up to worst-case conditions. As discussed above in *Drought Management*, sequential low-flow years present unique challenges for balancing water use throughout the region. To maintain more usable storage under these conditions, the Districts propose lowering the existing minimum Don Pedro Reservoir pool elevation from 600 to 550 feet and providing lower pulse flows in sequential dry and critical years than in initial dry and critical years. Simulations of the Districts' two proposals and the Districts' comments on the draft EIS imply that the period of record analyzed, which includes the severe 1987–1992 drought (Roos, 1992; Nash, 1993), did not include any series of low-flow years that were severe enough to require use of the additional storage that would result from the proposed lower minimum reservoir pool.

Water temperature monitoring during extended drought conditions would aid in understanding the effects of low reservoir levels on water temperatures, which would allow operations to be adjusted in the future if needed to prevent or limit adverse effects on aquatic resources. Insight into the volume of available cool-water storage in Don Pedro Reservoir could be tracked through time by monitoring vertical temperature profiles in Don Pedro Reservoir near the dam. Conducting monthly measurements would update the status of available cool water. However, deploying a series of temperature loggers arranged vertically in the water column and downloading them monthly would provide much more information on the response to project operations, and, depending on its feasibility, may have little additional costs.

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[138] Deterioration means that simulated temperatures exceeded the 7DADM water temperature targets more frequently than the base case, indicating warmer water temperatures.

There would be little value in monitoring temperature between Don Pedro Dam and the La Grange Diversion Dam because the short retention time and geomorphic characteristics limit warming in this reach, and the La Grange Project has virtually no influence on lower Tuolumne River flows. Temperature effects of the Don Pedro Project diminish as water flows downstream where non-project diversions, irrigation returns, and tributaries have increasing influence on the river's temperature; therefore, any temperature monitoring below the infiltration galleries, as recommended by California DFW and FWS, would not directly link to project operations. However, temperature monitoring below the infiltration galleries could provide valuable information for addressing salmonid upstream adult migration, growth of early life stages, and outmigration of juveniles and smolts.

Because instream thermal regimes can have marked effects on salmonid migration, spawning, egg incubation, growth, and survival, instream temperature data could be used to guide the timing of project operations and evaluate the effectiveness of releases at meeting their goals to benefit aquatic organisms in the lower Tuolumne River. Any temperature data intended to be used in selecting the timing of project operations would need to be provided in a timely manner, including real-time; whereas, temperature data to be solely used for effectiveness evaluations could be collected with temperature loggers that are downloaded at specific intervals to provide the data in time for analyses and minimize data gaps. For example, real-time instream monitoring at the La Grange gage and at a site near the temporary fish counting weir could be used in scheduling fall pulse flows during a period with a beneficial thermal regime and then evaluating the effectiveness of the actual pulse flows at meeting their goals. Monitoring temperature with loggers at additional sites in the lower Tuolumne River could facilitate a more robust evaluation of the effectiveness of meeting the preferred thermal regime. Pairing temperature data from these sites with biological data for the same period would lead to a better understanding of the effects of specific project operations on aquatic organisms and could lead to adaptation in the management of the available cool-water pool in Don Pedro Reservoir during prolonged droughts, and annual spring and fall pulse flows.

In the draft EIS, we recommended temperature monitoring at the La Grange gage (RM 51.7), Basso Bridge (RM 47.5), Roberts Ferry (RM 39.5), and just above the infiltration galleries (RM 26) to aid in management of the Don Pedro Reservoir cool-water pool during prolonged droughts. As noted above, monitoring temperature below the La Grange gage and at a site near the temporary fish counting weir would provide valuable information, and we recognize potential benefits of monitoring temperature below the infiltration galleries. Based on gaining an understanding of the agencies' intended links between recommended temperature monitoring, biological monitoring, and project operations, we recognize that it may be more beneficial to monitor temperature at different sites than Basso Bridge, Roberts Ferry, and just above the infiltration galleries (e.g., it may be better to monitor temperature at or near RSTs used for monitoring juvenile salmonid downstream migration). The Districts could maximize the benefits of

temperature monitoring at three logger sites by consulting with the resource agencies to develop a plan that includes how the data would be used.

In summary, temperature data collected at the two real-time and three selected logger sites could help guide decisions about scheduling releases and balancing temperatures in the lower Tuolumne River with maintaining cool-water storage availability for the future.

Based on the above information, we conclude that conducting water temperature monitoring when Don Pedro Reservoir elevations decrease to lower than 700 feet would provide information that could be used with forecasts of flow and water demand to determine whether to reduce minimum instream flows and/or pulse flows to reserve available cool-water storage in Don Pedro Reservoir. We also conclude that it would be advantageous to monitor instream temperature in the lower Tuolumne River to evaluate whether management of the available cool-water storage provides a thermal regime that sufficiently protects aquatic resources and to enable scheduling pulse flows so they benefit salmonids. Conducting real-time temperature monitoring at the La Grange gage and a site near the temporary fish counting weir would inform decision-making for scheduling spring- and fall pulse flows that maximize benefit to aquatic resources. Monitoring temperature with loggers at three additional sites selected through consultation with resource agencies would enable a more thorough evaluation of the effectiveness of the actual pulse flows and management of the cool-water reservoir. Insight gained from this monitoring could be used to adapt project operations within limits set by the new license (e.g., alter the timing of future pulse flows and drought management).

Minimum Flows and Pulse Flows

Operation of the projects affects the seasonal flow pattern of the lower Tuolumne River between Don Pedro Dam (RM 54.8) and its confluence with the San Joaquin River.[139] These altered flow conditions affect the river's capacity to support spawning, rearing, and other life stages of resident and anadromous fish and may also affect additional physical processes including sediment transport, floodplain connectivity, water temperature, and the maintenance of riparian vegetation. Changes in the annual hydrograph can also affect locally adapted anadromous species and their habitats by altering the timing of immigration and emigration and ability to ascend natural and artificial barriers. The annual hydrograph in the lower Tuolumne River is most altered

[139] Project effects on flow patterns in the Tuolumne River also affect flows in the San Joaquin River downstream of the confluence, where flows are affected by inflows from other major tributaries. We address the project effects on flow in the San Joaquin River as cumulative effects.

during the spring months when snowmelt runoff (April through June) is stored in Don Pedro Reservoir, with effects varying in magnitude across water years.

In regulated river reaches that contain productive aquatic habitat, resource managers often establish instream flow regimes to maintain ecological functions and processes that are important for sustaining aquatic and riparian biota. However, balancing the different resource values associated with a given flow regime often involves a complex series of tradeoffs that affect conditions for different fish species and life stages, consumptive water uses, recreation, and power generation.

In their amended final license application, the Districts propose to implement base flows designed for specific salmonid life stages in the Tuolumne River, flushing flows to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, pulse flows to facilitate the outmigration of juvenile fall-run Chinook salmon, and gravel mobilization flows to redistribute augmented gravel in years when sufficient spill is projected to occur. For all flow-related measures, the flow schedules are based on five water year types determined using the 60-20-20 San Joaquin River Index (see section 3.3.2.2, *Aquatic Resources, Environmental Effects, Streamflow and Reservoir Level Compliance Monitoring*). The five types are wet, above normal, below normal, dry, and critical.

The Districts propose two sets of base flows: interim base flows that would be implemented until the infiltration galleries are operational and a second set of flows that would be implemented after the infiltration galleries are operational (table 3.3.2-29). Once the infiltration galleries are operational, the proposed with-infiltration galleries flows would provide additional flow in the 26-mile-long reach between the La Grange Powerhouse and the infiltration galleries. The Districts propose to install a gage in the flow line from the infiltration galleries (infiltration gallery pipeline gage), and to monitor compliance with the flows downstream of the infiltration galleries (RM 25.5) by subtracting the flow volume measured at the infiltration gallery pipeline gage from the flow measured at the La Grange gage.

Also, to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, the Districts propose to release a flushing flow of 1,000 cfs (as measured at the La Grange gage, not to exceed 5,950 acre-feet) on October 5, 6, and 7 with the infiltration galleries shut off. These flows would be provided in wet, above normal, and below normal water years only.

Table 3.3.2-29. Proposed lower Tuolumne River flows to benefit aquatic resources and accommodate recreational boating (Source: Districts, 2017a).

	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
Water Year/Period	**RM 51.7[a] (La Grange Gage)**	**RM 25.5**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[b]	150
July 1 through October 15	350	150[c]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	75	125
July 1 through October 15	300	75 [b]	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75	125
July 1 through October 15	300	75	150
October 16 through December 31	200	200	200

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7[a] (La Grange Gage)	RM 25.5	RM 51.7 (La Grange Gage)
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[a] USGS gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

In addition, to facilitate the outmigration of juvenile fall-run Chinook salmon, the Districts propose to provide spring pulse flows in the amounts as follows (the timing of pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F,[140] of the Don Pedro amended final license application):

- Wet and above normal water years—150,000 acre-feet
- Below normal water years—100,000 acre-feet
- First dry water year—75,000 acre-feet

[140] The purpose of this adaptive management plan is to develop an improved understanding of the benefits and risks associated with the recommended pulse flows so as to optimize the use of the water year-driven pulse flow volumes. Optimization strategies within the scope of the adaptive management plan would include timing and duration of pulse flows within the fixed volumes that are allocated to this measure. The proposed pulse flow management program includes real-time monitoring and salmon production modeling for a period of seven years, after which flow the management program would be assessed to determine adjustments in pulse flow triggers and duration as well as whether other pulse flow management options should be considered.

- Dry water year following a dry or critical water year—45,000 acre-feet[141]
- First critical water year—35,000 acre-feet
- Critical water year following a dry or critical water year—11,000 acre-feet

At the La Grange Project, the Districts propose to formalize the practice of releasing a minimum flow of 5 to 10 cfs to the plunge pool below the La Grange Diversion Dam.

NMFS (10(j) recommendation 1) recommends that the Districts provide minimum instream flows and pulse flows, by dates and water years, in accordance with the schedule shown in table 3.3.2-30 as measured at the gage below La Grange Diversion Dam (USGS 11289650). Water year types would be determined using the estimated median value for annual unimpaired flow at La Grange.

In addition to the flows listed in table 3.3.2-30, NMFS recommends the Districts also maintain a flow of no less than 300 cfs in all years as measured at a new flow gage to be installed near RM 25, downstream of the proposed infiltration galleries.

NMFS's recommended minimum instream flows are the mean daily instream flows in cfs. NMFS further recommends that instantaneous instream flows may deviate below the recommended minimum instream flows by up to 10 percent or 5 cfs, whichever is less. However, NMFS recommends the Districts always make a good faith effort to meet the specified minimum instream flows. Temporary deviations would be allowed in the case of equipment malfunction or as directed by law enforcement authorities, or in emergencies.

NMFS also recommends the Districts implement fall pulse flows, as shown below in table 3.3.2-31, given as the volume of water to be released in addition to the minimum instream flows listed in table 3.3.2-30. TRTAC would recommend the timing, magnitude, and duration of the fall pulse flows. TRTAC would also have the option to reshape the spring hydrograph during the February−June period. If TRTAC exercises this option, the minimum flow volumes used for reshaping and absolute minimum flows shown in table 3.3.2-31 would be used.

[141] In their April 12, 2019 comments on the draft EIS, the Districts' modified their proposal to reduce the flow volume allocated for spring pulse flows from 75,000 acre-feet to 45,000 acre-feet in dry years following a dry or critical water year (Districts, 2019a).

Table 3.3.2-30. NMFS-recommended minimum instream flows in cfs below La Grange Diversion Dam (Source: NMFS, 2018a, table 2, as modified by staff).

Dates	Wet	Above Normal	Below Normal	Dry	Critical
October 1	500	400	300	300	300
October 16	500	400	400	300	300
November 1	500	400	400	300	300
November 16	500	400	400	300	300
December 1	500	400	400	300	300
December 16	500	400	400	300	300
January 1	500	400	400	300	300
January 16	500	400	400	300	300
February 1	3,000	400	400	300	300
February 15	3,000	400	400	300	300
March 1	3,000	2,000	2,000	1,500	300
March 16	3,000	2,000	2,000	1,500	1,000
April 1	4,000	3,500	2,000	1,500	300
April 16	4,000	3,500	2,000	2,000	300
May 1	4,000	3,500	3,500	350	300
May 16	4,000	3,500	3,500	350	300
June 1	700	600	500	350	300
June 16	700	600	500	350	300
July 1	700	600	500	350	300
July 16	700	600	500	350	300
August 1	700	600	500	350	300
August 16	700	600	500	350	300
September 1	600	500	400	300	300
September 16	500	400	300	300	300

Table 3.3.2-31. NMFS-recommended volume of water (acre-feet) allocated for fall and spring pulse flows, and absolute minimum flows, by water year in the lower Tuolumne River (Source: NMFS, 2018a, tables 3 and 4, as modified by staff).

	Wet	Above Normal	Below Normal	Dry	Critical
Fall Pulse Flows (acre-feet) (determined by TRTAC)	25,000	25,000	25,000	15,000	10,000
Spring Pulse Flows (acre-feet) (February–June)	876,181	596,042	500,675	253,318	110,268
February–June minimum instream flows (cfs)	500	400	400	300	300

FWS does not recommend an instream flow regime for the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 2) preparation of a Spill Management Plan that would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing by identifying the preferred timing of releases, minimum durations, and preferred flow rates. Additional discussion of the Spill Management Plan is included below in the subsection *Spill Management Plan.*

In its 10(j) recommendation M1-2, California DFW recommends the Districts establish minimum base flows ranging from 200 to 3,570 cfs (depending on water year type) measured at the La Grange gage and at a gage located downstream of the infiltration galleries (tables 3.3.2-32 and 3.3.2-33). The water year types would be based on the California DWR Bulletin 120, 50 percent exceedance estimated annual unimpaired flow of the Tuolumne River at the La Grange gage. California DFW also recommends the Districts release spring floodplain activation flows at rates and timing (after February 16th and before May 1st) according to recommendations by the TREG and approved by California DFW, FWS and NMFS (tables 3.3.2-32 and 3.3.2-33). In addition, California DFW recommends the Districts implement spring recession flows and adult Chinook salmon fall attraction pulse flows as recommended by the TREG and approved by California DFW, FWS, and NMFS using the timing windows and volumes presented in tables 3.3.2-32 through 3.3.2-35.

Table 3.3.2-32. California DFW-recommended base flows for the Tuolumne River at the La Grange gage (Source: California DFW, 2018a, table M1-2, as modified by staff).

Start Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
January 1	200	280	280	420	420	
January 16	200	280	280	440	440	
February 1	370	370	370	420	420	
February 16	380	380	380	430	430	**Floodplain activation pulse flow window**[a] Volume of pulse flow would be 10,000 acre-feet in critical and dry years and 15,000 acre-feet in below normal, above normal, and wet years with rates and timing to be recommended by TREG
March 1	410	460	460	640	640	
March 16	490	650	650	750	750	
April 1	710	810	810	1,070	1,070	
April 16	830	1,000	1,000	1,690	1,690	
May 1	1,170	1,420	1,420	2,240	2,240	
May 16	1,410	2,110	2,110	3,570	3,570	
		Recession Rates begin (see table 3.3.2-34)				**Spring recession** Reduction in flow and length of recession varies with highest flow requirement
July 1	300	300	300	350	350	
October 1	200	280	280	350	350	**Fall pulse flows window**[b] Volume of fall pulse flow would be 10,000 acre-feet in critical
October 16	440	440	470	470	470	
November 1	430	430	470	470	470	

Start Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
November 16	350	350	420	420	420	years, 15,000 acre-feet in dry and below normal years, and 20,000 acre-feet in above normal and wet years, with rates and timing to be recommended by TREG
December 1	330	330	390	390	390	
December 16	240	275	350	350	350	

[a] The primary purpose of the floodplain activation pulse flows is to provide floodplain rearing habitat for juvenile Chinook salmon rearing.

[b] These fall pulse flows are meant to encourage returning adults to migrate towards spawning habitat once water temperatures begin to trend towards acceptable levels.

Table 3.3.2-33. California DFW-recommended base instream flow recommendations for the Tuolumne River below the infiltration galleries (Source: California DFW, 2018a, table M1-3, as modified by staff).

Start Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
January 1	200	280	280	420	420	
January 16	200	280	280	440	440	
February 1	370	370	370	420	420	
February 16	380	380	380	430	430	**Floodplain Activation Pulse Flow Window** Volume of pulse flow would be 10,000 acre-feet in critical and dry years and 15,000 acre-feet in below normal, above normal, and wet years with rates and timing to be recommended by TREG
March 1	410	460	460	640	640	
March 16	490	650	650	750	750	
April 1	710	810	810	1,070	1,070	
April 16	830	1,000	1,000	1,690	1,690	
May 1	1170	1,420	1,420	2,240	2,240	
May 16	1,410	2,110	2,110	3,570	3,570	
		Recession rates begin (see table 3.3.2-34)				**Spring recession** Reduction in flow and length of recession varies with highest flow requirement
July 1	250	250	300	300	300	
October 1	250	250	300	350	350	**Fall pulse flows window** Volume of fall pulse flow would be 10,000 acre-feet in
October 16	440	440	470	470	470	
November 1	430	430	470	470	470	

Start Date	Critical	Dry	Below Normal	Above Normal	Wet	Additional Requirements
November 16	350	350	420	420	420	critical years, 15,000 acre-feet in dry and below normal years, and 20,000 acre-feet in above normal and wet years, with rates and timing to be recommended by TREG
December 1	330	330	390	390	390	
December 16	240	275	350	350	350	

Table 3.3.2-34. California DFW-recommended spring recession flows for the Tuolumne River at La Grange Diversion Dam gage (Source: California DFW, 2018a, table M1-4, as modified by staff).

Date	Critical	Dry	Below Normal	Above Normal	Wet
May 31	1,410	2,110	1,715	3,570	3,570
June 1	1,157	1,484	1,484	2,918	2,918
June 2	1,009	1,320	1,320	2,537	2,537
June 3	904	1,193	1,193	2,267	2,267
June 4	823	1,089	1,089	2,057	2,057
June 5	756	1,001	1,001	1,886	1,886
June 6	700	925	925	1,741	1,741
June 7	651	858	858	1,615	1,615
June 8	608	798	798	1,505	1,505
June 9	570	743	743	1,406	1,406
June 10	535	694	694	1,316	1,316
June 11	503	648	648	1,234	1,234
June 12	474	606	606	1,159	1,159
June 13	447	566	566	1,089	1,089
June 14	422	530	530	1,024	1,024
June 15	398	495	495	964	964
June 16	376	462	462	907	907
June 17	355	432	432	853	853
June 18	335	402	402	802	802
June 19	300	375	375	754	754
June 20	300	348	348	708	708
June 21	300	323	323	664	664
June 22	300	300	300	623	623
June 23	300	300	300	583	583
June 24	300	300	300	544	544
June 25	300	300	300	507	507

Date	Critical	Dry	Below Normal	Above Normal	Wet
June 26	300	300	300	472	472
June 27	300	300	300	438	438
June 28	300	300	300	405	405
June 29	300	300	300	373	373
June 30	300	300	300	350	350

Table 3.3.2-35. California DFW-recommended recession flows for the Tuolumne River downstream of the Geer Road infiltration galleries (Source: California DFW, 2018a, table M1-5, as modified by staff).

Date	Critical	Dry	Below Normal	Above Normal	Wet
May 31	1,410	2,110	1,715	3,570	3,570
June 1	1,157	1,484	1,484	2,918	2,918
June 2	1,009	1,320	1,320	2,537	2,537
June 3	904	1,193	1,193	2,267	2,267
June 4	823	1,089	1,089	2,057	2,057
June 5	756	1,001	1,001	1,886	1,886
June 6	700	925	925	1,741	1,741
June 7	651	858	858	1,615	1,615
June 8	608	798	798	1,505	1,505
June 9	570	743	743	1,406	1,406
June 10	535	694	694	1,316	1,316
June 11	503	648	648	1,234	1,234
June 12	474	606	606	1,159	1,159
June 13	447	566	566	1,089	1,089
June 14	422	530	530	1,024	1,024
June 15	398	495	495	964	964
June 16	376	462	462	907	907
June 17	355	432	432	853	853

Date	Critical	Dry	Below Normal	Above Normal	Wet
June 18	335	402	402	802	802
June 19	300	375	375	754	754
June 20	250	348	348	708	708
June 21	250	323	323	664	664
June 22	250	300	300	623	623
June 23	250	250	300	583	583
June 24	250	250	300	544	544
June 25	250	250	300	507	507
June 26	250	250	300	472	472
June 27	250	250	300	438	438
June 28	250	250	300	405	405
June 29	250	250	300	373	373
June 30	250	250	300	350	350
July 1	250	250	300	300	300

In its preliminary terms and conditions, the Water Board (preliminary 401 condition 2) indicates that it would likely condition minimum instream flows in light of the whole record. The whole record includes, but is not limited to, the FERC record (including recommendations by resource agencies), the final NEPA document, the final California Environmental Quality Act document, the updated Bay-Delta Plan, and the Basin Plan. The Water Board also indicates that it would likely determine the criteria to classify water year types for the project-affected reaches based on the San Joaquin Valley 60-20-20 Index (preliminary 401 condition 1). The Districts used the 40 percent unimpaired flow regime included in the Water Board's supplemental environmental document to represent this flow scenario.

The Conservation Groups recommend the Districts provide the minimum instream flows described in table 3.3.2-36 (based on the California DWR Bulletin 120, 50 percent exceedance estimated annual unimpaired flow of the Tuolumne River at the La Grange gage).

Table 3.3.2-36. Conservation Groups-recommended instream flows for the Tuolumne River at La Grange Diversion Dam gage by water year type[142] (Source: Conservation Groups, 2018).

Date	Super Critically Dry	Critical	Dry	Below Normal	Above Normal	Wet
Feb–Jun	1. February–June required flow is 300 cfs at the La Grange gage. 2. Provide an additional 12,500 acre-feet of water for pulse flows in the March 15 through April 15 period, with release specifics to be determined by an implementation committee. 3. Irrigation deliveries in a super critically dry year are 70% of demand.	1. February–June required flow is 300 cfs at the La Grange gage. 2. Provide an additional 35,000 acre-feet of water for pulse flows in the March 15 through April 15 period, with release specifics to be determined by an implementation committee. 3. Allowed irrigation deliveries in a critically dry year are 75% of demand.	1. Minimum instream flow in February is 300 cfs at the La Grange gage. 2. Meet 50% of March–April unimpaired flow at the La Grange gage. 3. 300 cfs at the La Grange gage is a March–April default floor value if 50% of unimpaired drops below 300 cfs in March–April in a dry year. 4. Allowed irrigation deliveries in a dry year are 80% of demand. 5. Apply a managed flow recession in dry	1. Meet 50% of February–May unimpaired flow at the La Grange gage. 2. 300 cfs at the La Grange gage is a February–May default floor value if 50% of unimpaired drops below 300 cfs in a below normal year. 3. Allowed irrigation deliveries in a below normal year are 80% of demand. 4. Apply a managed flow recession in below normal years according to a set ramp-down schedule beginning on the final day of any water year	1. Meet 50% of February–May unimpaired flow at the La Grange gage. 2. 300 cfs at the La Grange gage is a February–May default floor value if 50% of unimpaired drops below 300 cfs in February–May in an above normal year. 3. Allowed irrigation deliveries in an above normal year are 90% of demand, 90,000 acre-feet of which shall be managed recharge deliveries to the groundwater water bank if July 1 Don Pedro storage is greater	1. Meet 50% of February–June unimpaired flow at the La Grange gage. 2. 300 cfs at the La Grange gage is a February–June default floor value if 50% of unimpaired drops below 300 cfs in February–June in a wet year. 3. Allowed irrigation deliveries in a Wet year are 100% of demand, 90,000 acre-feet of which shall be managed recharge

[142] The Conservation Groups define water year types as follows (in thousands of acre feet): wet–equal to or greater than 2,725; above normal–equal to or greater than 2,000 and less than 2,725; below normal–equal to or greater than 1,400 and less than 2,000; dry–equal to or greater than 1,075 and less than 1,400; critically dry–equal to or greater than 830 and less than 1,075; super critically dry–less than 830.

Date	Super Critically Dry	Critical	Dry	Below Normal	Above Normal	Wet
			years according to a set ramp-down schedule beginning on the final day of any water year on which minimum flows are determined by a percent of unimpaired flow (approximately May 13). 6. If recession flow drops to 300 cfs during May or June, the minimum instream flow for the remainder of May and/or June is 300 cfs at the La Grange gage. 7. Dry years immediately preceded by 2 critical years would be considered to be critical years.	on which minimum flows are determined by a percent of unimpaired flow (approximately June 13). 5. If recession flow drops to 300 cfs prior to the end of June, the minimum instream flow for the remainder of June is 300 cfs at the La Grange gage.	than 1.6 MAD, as described infra. 4. Apply a managed flow recession in above normal years according to a set rampdown schedule beginning on the final day of any water year on which minimum flows are determined by a percent of unimpaired flow (approximately June 13). 5. If recession flow drops to 300 cfs prior to the end of June, the minimum instream flow for the remainder of June is 300 cfs at the La Grange gage.	deliveries to the groundwater water bank, as described infra.
Jul–Sept	1. July–September required flow in all water year types is 300 cfs at the La Grange gage. 2. July–September required flow in all water year types is 200 cfs at a gage 1 mile or less downstream of the Geer Road infiltration gallery ("Downstream gage").					
Oct–Jan	1. October–January required flow in all water year types is 300 cfs at the La Grange gage.					

In addition to the flow schedule presented in table 3.3.2-36, the Conservation Groups recommend the Districts release fall pulse flows to attract salmon, with release specifics to be determined by an implementation committee. Flow volumes of pulse flows in addition to October baseflow volume shall be 20,000 acre-feet in wet and above normal years, 15,000 acre-feet in below normal and dry years, 10,000 acre-feet in critical years, and 7,500 in super critically dry years.

The Conservation Groups also recommend the Districts provide recession flows only in above normal, below normal and dry years. These recession flows provide a multi-day rampdown to base flow from the flow value on the final day of any water year ("Recession Initiation Flow Value") on which minimum flows are determined by a percent of unimpaired flow. The recommended recession rate is 180 cfs/day when the Recession Initiation Flow Value is greater than or equal to 1,400 cfs, and they would remain at that rate until the daily flow value decreases to 1,400 cfs or less. Recession rate for flows equal to or less than 1,400 cfs is meant to require a reduction in stage height of 9 centimeters (cm) per day (3.5 inches per day) for the first six days, and 3 cm per day (1.2 inches per day) thereafter, until base flow is reached.

If the Recession Initiation Flow Value is equal to or less than 1,400 cfs, or otherwise once the flow value becomes equal to or less than 1,400 cfs in the course of the implementation of the 180 cfs/day recession, the Conservation Groups recommend the Districts ramp down according to the values in table 3.3.2-37. If the Recession Initiation Flow Value is less than or equal to 1,254 cfs, then the Districts should initiate the rampdown at the smallest value greater than the Recession Initiation Flow Value, and ramp down each day according to the descending values on the table.

Table 3.3.2-37. Conservation Groups-recommended recession values for flows equal to or less than 1,400 cfs (Source: Conservation Groups, 2018).

Day	Flow	Day	Flow
1	1,400	14	612
2	1,254	15	584
3	1,157	16	556
4	1,068	17	527
5	979	18	499
6	890	19	499
7	801	20	471
8	771	21	443
9	742	22	414
10	720	23	386

Day	Flow	Day	Flow
11	697	24	358
12	669	25	330
13	640	26	301

If flood releases occur on the day that the recession is to be initiated or Districts must make flood releases in excess of the prescribed value for any given day in the flow recession sequence, the Conservation Groups recommend the Districts should reinitiate the flow recession once flood control requirements allow the Districts to resume the recession. In such case, the Districts should resume the flow recession using the highest flow at which the Districts can maintain system control as the new Recession Initiation Flow Value.

Furthermore, the Conservation Groups recommend a suite of measures, including development of a groundwater water bank to keep the existing water bank from going negative and help to preserve CCSF's total system storage at a level where CCSF can limit the frequency of water rationing. The Districts would adjust the water year types based on the 50 percent exceedance estimated unimpaired inflow to La Grange as given in the February, March, April, and May California DWR Bulletin 120 reports (with adjustment of the water year type on a monthly basis). More detailed information describing the Conservation Groups' recommended groundwater water bank and modeling notes are provided in Conservation Groups (2018).

The Bay Institute recommends that the Districts provide the flows presented in table 3.3.2-38 below La Grange Diversion Dam and remain instream at least as far as the Delta so that they can contribute to ecologically necessary increases in Delta inflow and outflow.

ECHO recommends the Districts provide 60 percent unimpaired flow from February to June to protect salmon.

Table 3.3.2-38. The Bay Institute-recommended instream flows below La Grange Diversion Dam.[a]

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
October 1–15	200			350 plus 700 for 2 days	400 plus 1,000 for 2 days	400 plus 1,500 for 2 days
October 16–31	200		350 plus 700 for 2 days	350	400	
November 1–15	350	350 plus 700 for 2 days	350 plus 1,000 for 2 days		400 plus 1,500 for 2 days	400 plus 2,000 for 2 days
November 16–30	350 plus 500 for 2 days	350			400	
December	350				400	
January	350				400	
February	550		500 or 50% of unimpaired flow		400 or 50% of unimpaired flow	
March	550 or 40% of unimpaired flow			500 or 50% of unimpaired flow	400 or 50% of unimpaired flow	400 or 40% of unimpaired flow
April	550 or 40% of unimpaired flow		500 or 50% of unimpaired flow		350 or 50% of unimpaired flow	400 or 40% of unimpaired flow
May 1–15	550 cfs or 40% of unimpaired flow. Up to 0.33 of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in		500 or 50% of unimpaired flow		350 or 50% of unimpaired flow	400 or 40% of unimpaired flow; 5-day average may be exceeded to allow 14-day

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
	the season and/or summer storage for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives					inundation in lower river. Water for this can be shifted from June water budget.
May 16–31	550 or 40% of unimpaired flow		500 or 50% of unimpaired flow		350 or 50% of unimpaired flow	400 cfs or 40% of unimpaired flow; 5-day average may be exceeded to allow 14-day inundation in lower river. Water for this can be shifted from June water budget.
June 1–15	550 riparian recession		500 cfs or 50% of unimpaired flow. Up to 1/3 in dry water years and 1/2 in below average years of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in the season and/or summer storage for release in fall		350 cfs or 50% of unimpaired flow	400 cfs or 40% of unimpaired flow; 5-day average may be exceeded to allow 14-day inundation in lower river.

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
			if temperature benefit of carryover would allow attainment of summer or fall objectives.			Water for this can be shifted from June water budget.
June 16–30[b]	550 riparian recession		500 cfs or 50% of unimpaired flow. Up to 1/2 of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in the season and/or summer storage for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives.		350 cfs or 50% of unimpaired flow. Up to 1/2 of % unimpaired flow volume from this period may be shifted among habitat inundation earlier in the season and/or summer storage for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives.	400 cfs or 40% of unimpaired flow. Up to 1/2 of any excess flow beyond that needed to attain salmonid objectives may be carried over for release in fall if temperature benefit of carryover would allow attainment of summer or fall objectives.
July	100		200 riparian recession		250 riparian recession	300 riparian recession

Dates	Flow in cfs for Each Water Year Type					
	Extremely Dry	**Critically Dry**	**Dry**	**Below Average**	**Above Average**	**Wet**
August	100		200		250 riparian recession	300 riparian recession
September 1–15	100			200	250	300 riparian recession
September 16–30	100			200	250	300 riparian recession

[a] The Bay Institute's recommendation includes allowing the CCSF water bank to go negative. Source: Letter from G. Bobker, Program Director, The Bay Institute, San Francisco, California, to K. Bose, Secretary, Federal Energy Regulatory Commission, Washington, D.C. Re: Don Pedro Hydroelectric Project, FERC Project No. 2299-082. January 29, 2018 (accession no. 20180129-5262).

[b] In extremely wet years 400 cfs or 40% of unimpaired flow.

As described in section 3.3.2.1, *Aquatic Resources, Affected Environment, Water Quantity, Bay-Delta Plan Amendments*, on March 1, 2019, California DFW and California DWR submitted a package of voluntary agreements to the Water Board that includes a suggested flow regime for the lower Tuolumne River. The package—supported by the Districts; CCSF; and more than 40 other water agencies, resource agencies, and NGOs—was offered as an alternative to the 40–60 percent of unimpaired flow regime in the Tuolumne River, as recommended by the Water Board. The draft Voluntary Agreement for the Tuolumne River includes flow measures based on those proposed in the Don Pedro amended final license application with some modifications. The Tuolumne River draft Voluntary Agreement flow schedule is largely based on what was proposed by the Districts in their amended final license application with the addition of a spring floodplain rearing pulse flow that includes dry year relief.

Differences between the Districts' proposed and the draft Voluntary Agreement's suggested minimum flow regime (base flows) are summarized in table 3.3.2-39. A complete description of the Districts' proposed base flows, as proposed in the amended final license application, is presented in table 3.3.2-29.

Table 3.3.2-39. The Districts' proposed and the draft Voluntary Agreement's suggested **(*in bold italics*)** lower Tuolumne River instream flows to benefit aquatic resources and accommodate recreational boating (Source: staff).

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)**
Water Year/Period	**RM 51.7[a] (La Grange Gage)**	**RM 25.5**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[b]	150
July 1 through October 15	350, ***300***	150[c]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7[a] (La Grange Gage)	RM 25.5	RM 51.7 (La Grange Gage)
Dry Water Year			
June 1 through June 30	200	75, ***125***	125
July 1 through October 15	300	75[b], ***125***	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	75, ***125***	125
July 1 through October 15	300	75, ***125***	150
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

Note: Where two numbers are shown, the first number is the Districts' proposal and second number in italics is the draft Voluntary Agreement flow. If only a single number appears, the Districts' proposal and draft Voluntary Agreement flows are identical.

[a] USGS gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

Our Analysis

Balancing different resource values associated with instream flow releases often involves a complex series of tradeoffs among multiple resource demands, as the timing, magnitude and duration of instream flows can have a substantial effect on water temperature, physical habitat availability for specific fish species and life stages, the outmigration timing and survival of juvenile and adult anadromous salmonids, riparian vegetation recruitment, recreation, irrigation, domestic water supply, flood control, and other beneficial uses.

As described above, the Districts' proposed and the draft Voluntary Agreement's suggested instream flows include base flows designed for specific salmonid life stages in the Tuolumne River, flushing flows to clean gravels of accumulated algae and fines prior to peak Chinook salmon spawning, pulse flows to facilitate the outmigration of juvenile fall-run Chinook salmon, and gravel mobilization flows to redistribute augmented gravel in years when sufficient spill is projected to occur. These flows are generally greater than what was mandated in the 1995 Settlement Agreement. Flow recommendations by NMFS, California DFW, the Conservation Groups, ECHO, and The Bay Institute are considerably higher than those proposed by the Districts and suggested by the draft Voluntary Agreement.

During the ILP process, the Districts conducted a series of instream flow studies and modelling exercises to help develop their proposed seasonal instream flow releases for the lower Tuolumne River. These studies included a one-dimensional (1-D) physical habitat simulation (PHABSIM) model (Stillwater Sciences, 2013c), conducted per a July 16, 2009, FERC Order (128 FERC 61,035). The Districts also conducted the *Lower Tuolumne River Instream Flow Study–Evaluation of Effective Usable Habitat Area for Over-Summering O. mykiss* (Stillwater Sciences, 2017d) to estimate the "effective" weighted usable area (eWUA)[143] of select lower Tuolumne River habitat reaches for various life history-stages of *O. mykiss* during June to September). Unlike the traditional weighted usable area (WUA) computed for stream habitat analysis, which is based on the relationship between physical parameters (i.e., depth, velocity, and/or substrate and cover) and flow (Bovee, 1982), the eWUA evaluation also accounts for temperature. Furthermore, as a supplement to their PHABSIM study (Stillwater Sciences, 2013c), the Districts developed WUA versus flow analyses for Sacramento splittail and Pacific lamprey, using existing habitat suitability criteria (Stillwater Sciences, 2014).

In addition to the above studies, the Districts conducted a *Lower Tuolumne River Instream Flow Study–Non-Native Predatory Bass 1-D PHABSIM Habitat Assessment* (Stillwater Sciences, 2017e) in response to the Commission's April 29, 2014, determination on requests for study modifications (FERC, 2014), which required an

[143] eWUA is an index of aquatic habitat calculated for specific species and life stages that incorporates water temperature.

assessment of the relationship between flow and bass habitat in the lower river (see the subsection *Fish Enumeration and Predator Control*). The study was conducted using existing habitat suitability criteria for smallmouth, largemouth, and striped bass.

As described below under *The Districts' Modeling Results*, the Districts also developed a project operations model, a reservoir water temperature model, Chinook salmon and *O. mykiss* production models, a socioeconomic model, and a floodplain hydraulic model, as needed to evaluate the effects of various project alternatives on fish productivity, water supply, recreation, socioeconomics, and project economics.

Results of the Districts' PHABSIM analysis of WUA versus flow relationships for each species and life stage are presented in Figures 3.3.2-23 through 3.3.2-27. To facilitate comparison and analyses, the flow verses habitat relationships are shown with a normalized y-axis scale representing "percent of maximum" WUA. Results for *O. mykiss* fry show peak WUA values (e.g., ≥95 percent of maximum) below approximately 75 cfs, with relatively high WUA values (e.g., ≥80 percent of maximum) at flows ≤125 cfs (figure 3.3.2-23). *O. mykiss* juveniles show peak WUA values at approximately 75–275 cfs, with relatively high WUA values at flows ≤500 cfs, and results for *O. mykiss* adults show peak WUA values at flows ≥350 cfs, with relatively high WUA values at flows ≥200 cfs. Results for *O. mykiss* spawning show peak WUA values at ≥375 cfs, with relatively high WUA values at flows ≥225 cfs.

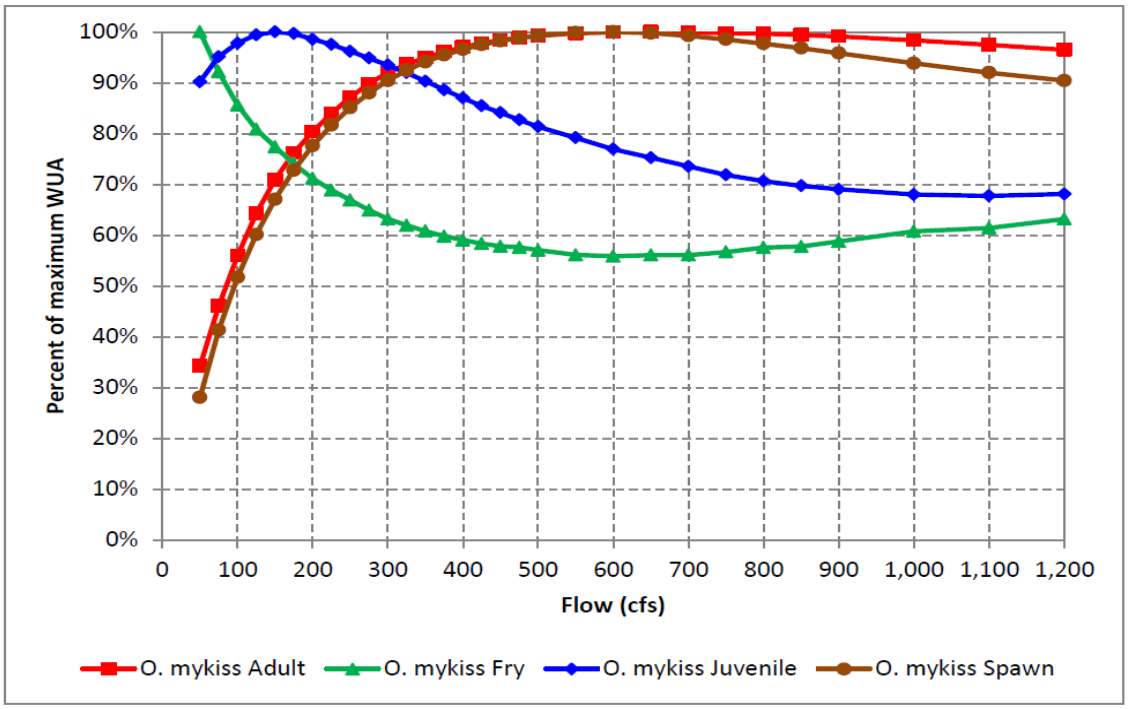

Figure 3.3.2-23. *O. mykiss* WUA versus flow for the lower Tuolumne River (Source: Stillwater Sciences, 2013c).

Results for Chinook salmon fry show peak WUA values at approximately 50 to 100 cfs, with relatively high WUA values below 125 cfs (figure 3.3.2-24). Chinook salmon juveniles show peak WUA values at approximately 75 to 225 cfs, with relatively high WUA values below 400 cfs, and salmon spawning show peak WUA values at approximately 250 to 350 cfs, with relatively high WUA values from 175 to 475 cfs.

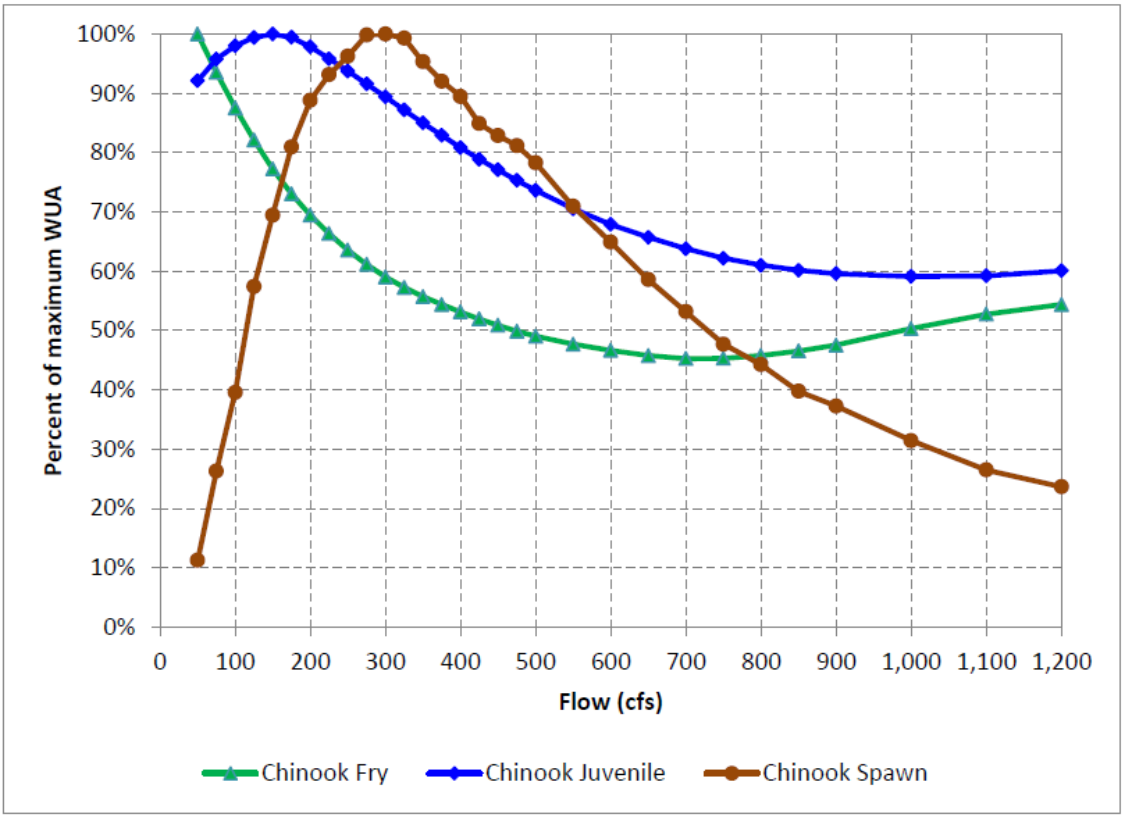

Figure 3.3.2-24. Chinook salmon WUA versus flow for the lower Tuolumne River (Source: Stillwater Sciences, 2013c).

Sacramento splittail[144] juveniles show peak WUA values at approximately 50 to 175 cfs, with relatively high WUA values below 300 cfs (figure 3.3.2-25). Results for Sacramento splittail spawning show high WUA at about 300 to 400 cfs, with relatively small increases in WUA over the remaining simulation range.

[144] Sacramento splittail is a cyprinid fish (minnow) native to the low-elevation waters of the Central Valley in California. This fish was previously listed as threatened under the ESA.

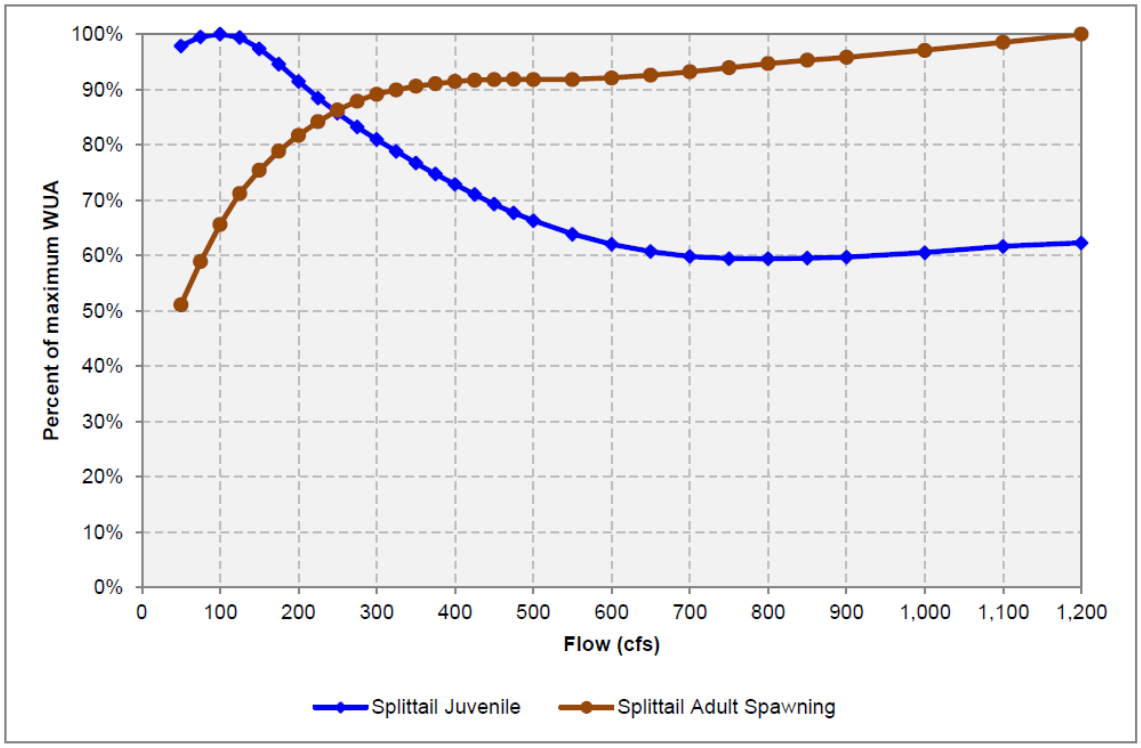

Figure 3.3.2-25. Sacramento splittail WUA versus flow for the lower Tuolumne River (Source: Stillwater Sciences, 2014).

Results for Pacific lamprey[145] larva (ammocoetes) show that potential habitat is maximized at low flows, with peak WUA at flows less than about 150 cfs, followed by a slight decline, but still relatively high WUA over the remaining range of simulated flows (figure 3.3.2-26) (Stillwater Sciences, 2014). Pacific lamprey spawning shows peak WUA values at 75 to 150 cfs, with a steady decline in WUA values (but still relatively high) up to about 250 cfs, followed by a more gradual decline over the remaining range of simulated flows (figure 3.3.2-26).

[145] Pacific lamprey is a native anadromous fish species that were historically distributed from Mexico north along the Pacific Rim to Japan. Their populations have declined in abundance and have become restricted in distribution throughout California, Oregon, Washington, and Idaho. They are culturally important to indigenous people throughout their range and play a vital role in the ecosystem as food for mammals, fish and birds, nutrient cycling and storage, and as a prey buffer for other species.

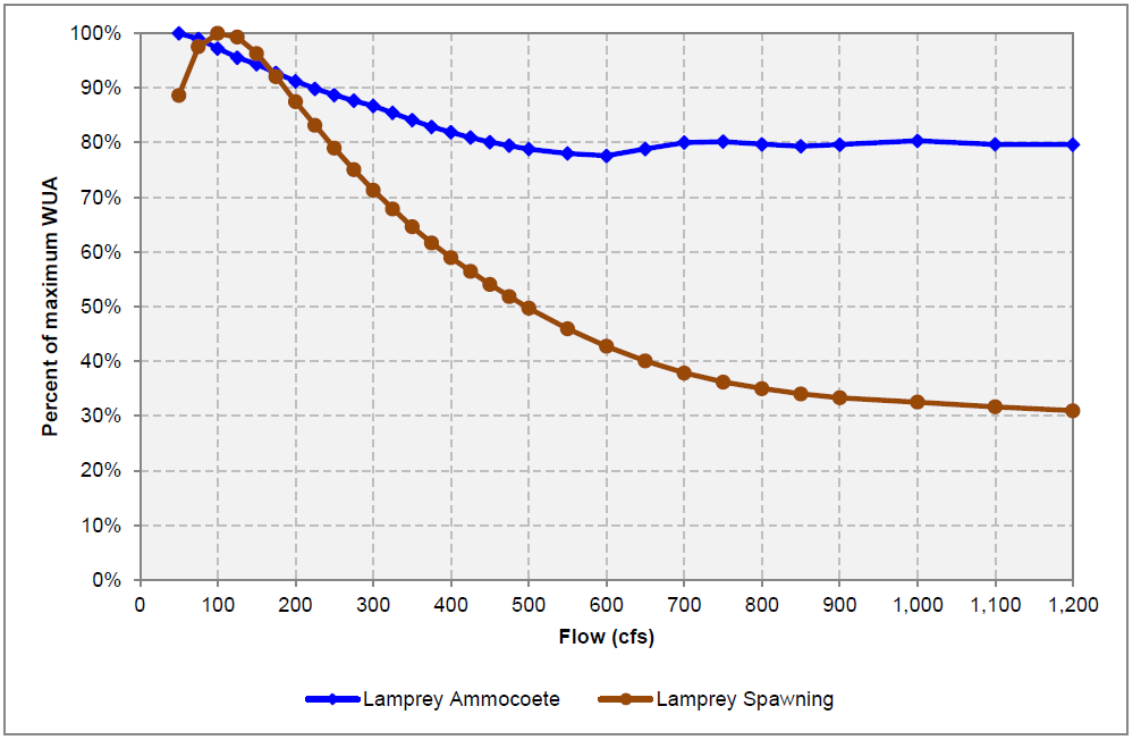

Figure 3.3.2-26. Pacific lamprey WUA versus flow for the lower Tuolumne River (Source: Stillwater Sciences, 2014).

Results for striped bass, an important non-native predatory fish species in the lower Tuolumne River, show that potential habitat is maximized at high flows (figure 3.3.2-27) (Stillwater Sciences, 2017e). Based on results for flows up to 1,200 cfs, both adult and juvenile peak WUA values (e.g., ≥95 percent of maximum) are approximately 1,100–1,200 cfs and relatively high WUA values (≥80 percent of maximum) occur above about 600 cfs. Striped bass spawning peak WUA is at 1,200 cfs and steadily decreases down to 50 cfs.

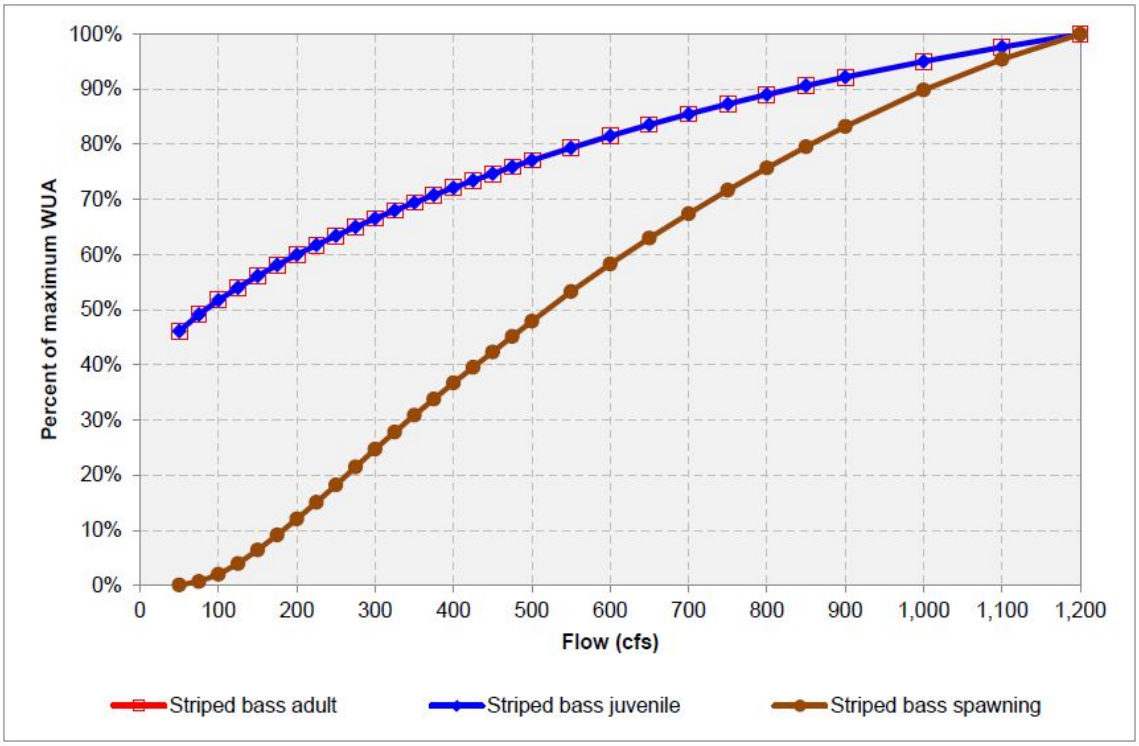

Figure 3.3.2-27. Striped bass WUA versus flow for the lower Tuolumne River (Source: Stillwater Sciences, 2017e).

Habitat time series[146] conclusions for each of five water year types (using the San Joaquin River 60-20-20 Index) for *O. mykiss* and Chinook life stage combinations are presented in Stillwater Sciences (2013c) and are summarized in figures 3.3.2-28 and 3.3.2-29. The time periods used in the habitat time series analysis were when individual life stages are most typically observed, or expected to be present, within the study reach. Figure 3.3.2-28 documents that *O. mykiss* WUA exhibits a similar pattern of annual fluctuation across all water year types, although juvenile and fry WUA tends to be lower in both above normal and wet water years. Adult *O. mykiss* WUA is typically higher and more stable in above normal and wet water years. Figure 3.3.2-29 shows that Chinook salmon WUA exhibits a similar trend as *O. mykiss*, except for juvenile and fry habitat that declines in wet water years.

[146] Habitat time series illustrate the dynamics of the historic temporal habitat change for a particular species and life stage during each season or critical time period under evaluation.

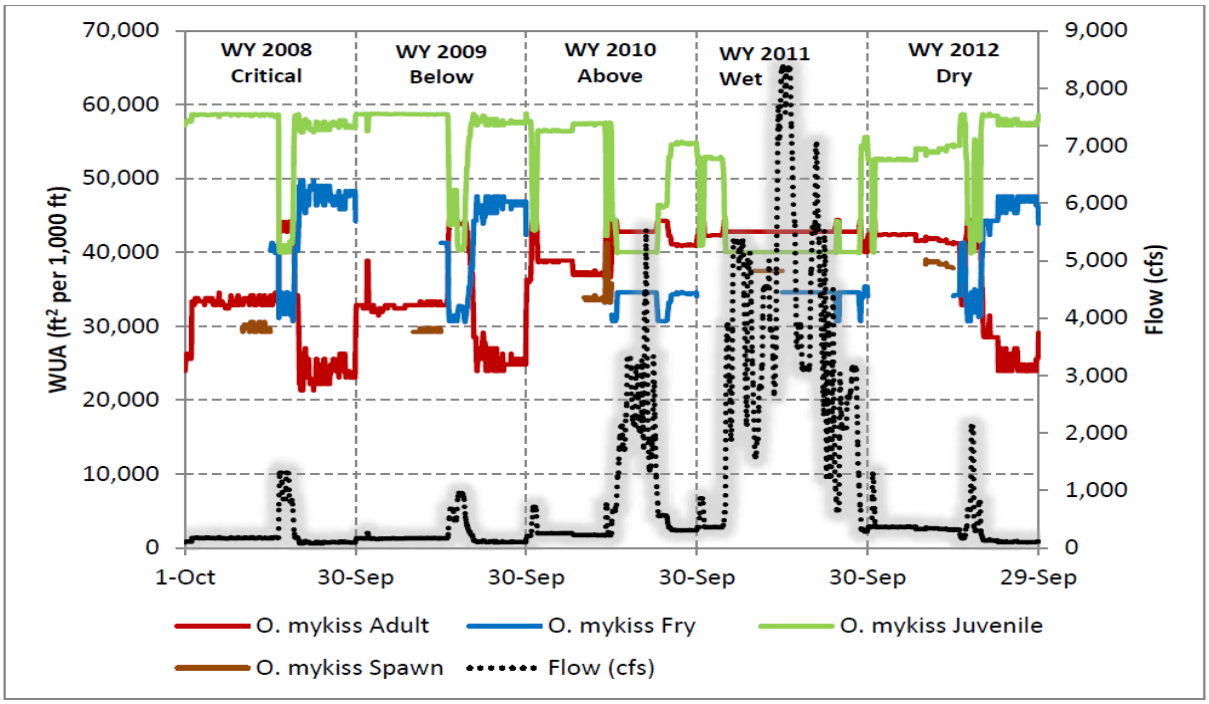

Figure 3.3.2-28. Habitat time series results for lower Tuolumne River *O. mykiss* across all water year types (Source: Stillwater Sciences, 2013c).

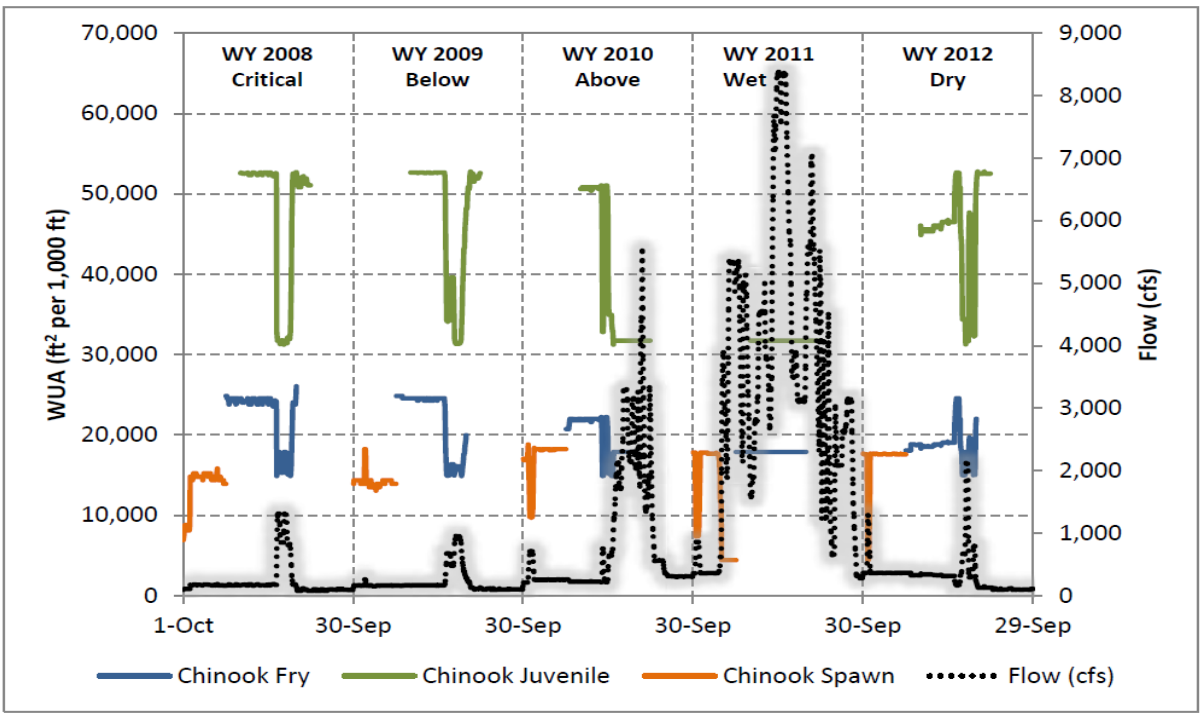

Figure 3.3.2-29. Habitat time series results for lower Tuolumne River Chinook salmon across all water year types (Source: Stillwater Sciences, 2013c).

The Districts' Sacramento splittail habitat time series analyses show that under critical, dry, and below normal water years, juvenile WUA is maximized during periods of low flow and quickly drops when flow increases (Stillwater Sciences, 2014). In contrast, Sacramento splittail spawning WUA is minimized at lower flows and increases as flows increase above 1,000 cfs. Under above normal and wet water years, Sacramento splittail juvenile WUA is minimized when flow increases above approximately 600 cfs, and spawning WUA is maximized as flow increases up to 1,200 cfs. The Districts' Pacific lamprey habitat time series analyses for critical, dry, and below normal water years show that Pacific lamprey ammocoete WUA remains relatively stable, but spawning WUA fluctuates with flow until flow nears 1,200 cfs, where WUA is minimized (Stillwater Sciences, 2014).

The Districts' Proposed and the Draft Voluntary Agreement's Suggested Instream Flows

Early Summer Flows (June 1–June 30)—The Districts' proposed and the draft Voluntary Agreement's suggested early summer base flows (June 1 through June 30) are intended to improve early rearing habitat conditions for *O. mykiss* fry since most juvenile fall-run Chinook salmon (smolts) have left the Tuolumne River by the end of May (Stillwater Sciences, 2013a). Therefore, the primary benefit of these early summer flows would be the maintenance of cool water temperatures for *O. mykiss*. In the lower Tuolumne River, *O. mykiss* are predominately found upstream of RM 43,[147] with peak fry densities occurring into June. Flow management for the benefit of *O. mykiss* in June consists of striking a balance between providing hydraulic habitat suitability and temperature suitability for fry and adult life stages. Under both the Districts' proposed and the draft Voluntary Agreement's suggested flow regimes, base flows would be 200 cfs at the La Grange gage from June 1 through June 30 in all water year types (table 3.3.2-29). Downstream of RM 25.5 (i.e., downstream of the infiltration galleries), the Districts' proposed base flows would be 100 cfs in wet, above normal, and below normal water years and 75 cfs in dry and critical years.[148] Under the draft Voluntary Agreement,

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[147] The gravel-bedded reach of the lower Tuolumne River extends to approximately RM 30, and habitats preferred by *O. mykiss*, based on the Districts' directed searches and snorkel surveys, are located generally upstream of RM 43.

[148] The infiltration galleries would be operated from June through mid-October to enable the release of increased flows to preferred *O. mykiss* habitats located upstream of RM 42, while continuing the Districts' use of a portion of this instream flow for water supply purposes by withdrawing flows through the infiltration galleries. Lower flows in the sand-bedded reach located downstream of the infiltration galleries would accommodate the warmwater species that inhabit and may improve fishing success for non-native predator species inhabiting these reaches.

base flows downstream of RM 25.5 would be 100 cfs in wet, above normal, and below normal water years and 125 cfs in dry and critical water years (table 3.3.2-39).

According to the Districts' PHABSIM analysis (Stillwater Sciences, 2013c), *O. mykiss* fry WUA would be 85 percent of maximum at 100 cfs, 78 percent of maximum at 150 cfs, and 71 percent of maximum at 200 cfs (figure 3.3.2-23). *O. mykiss* adult WUA would be 78 percent of maximum WUA at 200 cfs. Considering water temperature suitability for *O. mykiss* during June, the Districts' water temperature modeling shows that a flow of 200 cfs would maintain average daily water temperatures at less than 18°C at RM 47, and less than 20°C at RM 43, except when maximum daily ambient air temperatures exceed 100°F, which on average occurs only one day in June (HDR, 2017a). At 150 cfs, average daily water temperatures at RM 43 would be less than 20°C until maximum daily air temperature exceeds 95°F, which on average occurs one to two days in June. In addition, based on staff's analysis of the Districts' water temperature modeling results (appendix G), the draft Voluntary Agreement and Districts' proposed operations with infiltration galleries flow regimes result in cooler simulated June through September water temperature conditions (compared to all other proposed/recommended flow regimes) at RM 46 to RM 16. The largest differences in temperature occur in dry and below normal water years. In a wet water year, both flow and temperature are virtually the same for the Districts' proposed interim, proposed with infiltration galleries, and draft Voluntary Agreement scenarios (e.g., figure G-2 in appendix G).

Consequently, it is expected that early summer flows of 200 cfs at the La Grange gage in all water years would reasonably protect *O. mykiss* fry while also being protective of *O. mykiss* adults. Under the existing project license, in 20 percent of the water years the required instream flow at La Grange is 50 cfs, in 30 percent of the water years it is 75 cfs, and in 50 percent of the water years it is 250 cfs. Therefore, in 50 percent of the water years, the instream flow provided under the Districts proposal and the draft Voluntary Agreement would be substantially greater than the current flow (up to 4 times greater 20 percent of the time). In 50 percent of the water years (wet and above normal), an instream flow of 200 cfs that would be provided under the Districts proposed and the draft Voluntary Agreement's flows would be 20 percent lower than the current flow (200 versus 250 cfs) but would nonetheless be more protective of *O. mykiss* fry due to increased habitat suitability at the slightly lower flow.

Late Summer Flows (July 1–October 15)—By July, the *O. mykiss* in the lower Tuolumne River are predominately adult and juvenile life stages, which are known to be stronger swimmers than fry and can maintain their positions in the river at higher flows. As is the case for June, the primary habitat concern during this period is to maintain adequate river temperatures for *O. mykiss* upstream of approximately RM 43. Consequently, the Districts developed their proposed July 1 through October 15 base flows to maintain cool water temperatures from La Grange Diversion Dam to approximately RM 42. Based on this rationale, the Districts' proposed late-summer base flows (July 1 through October 15) would be 350 cfs at the La Grange gage in wet, above

normal, and below normal water years and 300 cfs in dry and critical water years. Downstream of RM 25.5, the Districts' proposed instream flows would be 150 cfs in wet, above normal, and below normal water years and 75 cfs in dry and critical water years. In wet, above normal, and below normal water years, the Districts would also provide a 1,000-cfs flushing flow (not to exceed 5,950 acre-feet) on October 5, 6, and 7, with appropriate up and down ramps to clean gravels of accumulated algae and fines. In dry and critical water years, the flows at La Grange would continue to be 300 cfs, while minimum flows downstream of RM 25.5 would be 75 cfs. Under the draft Voluntary Agreement, late summer base flows would be 300 cfs at La Grange gage in all water year types. Downstream of RM 25.5, late summer base flows would be 150 cfs in wet, above normal, and below normal water year types, and 125 cfs in dry and critical water year types (table 3.3.2-39).

The Districts' PHABSIM analysis (Stillwater Sciences, 2013c) indicates that at 350 cfs at La Grange gage, *O. mykiss* adult WUA would be 95 percent of maximum and juvenile WUA would be 90 percent of maximum (figure 3.3.2-23). At 300 cfs, both juvenile and adult *O. mykiss* WUA would be 91 percent of maximum, indicating a similar level of protection as 350 cfs (figure 3.3.2-23).

Compared to the Districts' proposed flows, the draft Voluntary Agreement would further increase the minimum flow required downstream of the infiltration galleries by 50 cfs in dry and critical water years, and reduce the minimum flow required at the La Grange gage by 50 cfs in wet, above normal, and below normal water years. This increase in flow downstream of the infiltration galleries in dry and critical water years would help to maintain cooler water temperatures in the downstream reaches of the Tuolumne River, and the decrease in flow upstream of the infiltration galleries in wet, above normal, and below normal water years would provide slightly more habitat area for juvenile *O. mykiss* (which is a limiting factor in the Tuolumne River) and slightly less adult *O. mykiss* habitat area than that realized under the Districts' proposed flows (see below). As noted above, implementation of the draft Voluntary Agreement's flow regime would also result in the coolest simulated June through September water temperature conditions at RM 46, with the largest differences in temperature occurring in critical, dry, below normal, and above normal water years (appendix G). In addition, according to the Districts, a flow of 350 cfs would maintain average daily water temperatures below 18°C at RM 43 until daily maximum air temperatures exceed 105°F (40.6°C). A flow of 300 cfs would maintain the average daily water temperature below 19°C as far downstream as RM 43, even when daily maximum temperature exceeds 100°F, providing favorable thermal conditions for Tuolumne River *O. mykiss* through the

summer months.[149] These flow/temperature effects would have little or no effect on Chinook salmon as most juvenile fall-run Chinook salmon have left the Tuolumne River by the end of May, and maximum air and water temperatures occur during the summer.

Fall-run Chinook Spawning (October 16–December 31)—Fall-run Chinook salmon spawning in the lower Tuolumne River occurs predominately from mid-October through the end of December based on data collected at the Districts' counting weir located at RM 24.5.

To improve fall-run Chinook salmon spawning habitat in the Tuolumne River, both the Districts' proposed and the draft Voluntary Agreement's suggested October 16–December 31 instream flows would be 275 cfs (in below normal, above normal, and wet water years), 225 cfs (dry water years), and 200 cfs (critical water years). At a flow of 275 cfs, hydraulically suitable spawning habitat is 98 percent of maximum WUA; at 225 cfs, spawning habitat is at 92 percent of maximum WUA; and at 200 cfs, it is 89 percent of maximum WUA. These flows, in combination with the other spawning habitat improvements provided by the draft Voluntary Agreement, are expected to improve overall spawning habitat quantity and quality for fall-run Chinook salmon compared to the base case.

Fall-run Chinook Fry-Rearing (January 1–February 28/29)—To provide habitat for fall-run Chinook fry rearing, the Districts' proposed and the draft Voluntary Agreement's suggested minimum instream flows from January 1–February 28/29 would be 225 cfs in below normal, above normal, and wet water years; 200 cfs in dry water years; and 175 cfs in critical water years. These flow levels are slightly lower than those provided during the spawning period; however, they remain sufficiently high so as not to result in significant riverine hydraulic changes or redd dewatering.

A study of adult fall-run Chinook otoliths taken from Tuolumne River fish (Stillwater Sciences, 2016) shows that fall-run Chinook salmon that leave the lower Tuolumne River as fry typically make up a very small proportion of the subsequent adult escapement. Under existing conditions in the lower reaches of the lower Tuolumne River, the San Joaquin River, and Bay-Delta, fry mortality is high. Efforts to increase suitable fry habitat in the upper reaches of the lower Tuolumne River (above RM 30) are expected to increase the number of fall-run Chinook leaving the river as parr and smolts,

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[149] Recently, researchers from the University of California at Davis, in conjunction with *O. mykiss* experts from University of British Columbia, conducted field tests of the thermal capacity of wild Tuolumne River *O. mykiss* juveniles (Verhille et al., 2016). This study, and additional observations of in-situ wild juveniles (Farrell et al., 2017), demonstrated that Tuolumne River *O. mykiss* juveniles had optimum metabolic capacity between 21°C and 22°C, and maintained 95 percent of optimum capacity between 18°C and 24°C.

and thereby increase fall-run Chinook production on the lower Tuolumne River and, all else being equal, increase subsequent adult returns.

Based upon the District's PHABSIM modeling of in-channel habitat conditions in the lower Tuolumne River, the maximum suitable Chinook salmon fry habitat occurs at 50 cfs. At 100 cfs, Chinook salmon fry habitat is reduced to 88 percent of maximum WUA; at 150 cfs, it is 75 percent of maximum; at 225 cfs, it drops to about 67 percent; and at 300 cfs, it is less than 60 percent of maximum WUA. High flows in the river during the early fry rearing period (January–February) tend to result in downstream displacement of fry into the lower, more confined reaches of the lower Tuolumne River and potentially into the San Joaquin River, areas with higher densities of predatory fish species, thereby adversely affecting later adult returns and escapement. Providing minimum flows of 225 cfs or less in the upper river during this period would act to maintain fry habitat and improve fry survival.

Fall-Run Chinook Juvenile Rearing (March 1–April 15)—In the lower Tuolumne River, the juvenile Chinook salmon rearing period extends from March through mid-to-late April. To provide habitat for juvenile Chinook rearing, the Districts propose, and the draft Voluntary Agreement suggests March 1–April 15 minimum flows of (1) 250 cfs (below, above normal, and wet water years), (2) 225 cfs (dry water years), and (3) 200 cfs (critical water years).

The Districts' PHABSIM results (Stillwater Sciences, 2013c) indicate that hydraulically suitable habitat for juvenile fall-run Chinook salmon rearing is maximized at 150 cfs and exceeds 97 percent of the maximum WUA at flows from 100 to 200 cfs. At 300 cfs, it drops to 90 percent of maximum WUA. At 250 cfs, average daily water temperatures stay below 18°C at RM 39.5 until maximum daily air temperatures exceed about 27°C (80°F), which occurs on average for about three to four days in April, and stays below 20°C (68°F) at RM 39.5 until maximum daily air temperature exceeds 85°F, which occurs for about one day in April.

Another consideration during the March to mid-April time frame is the maintenance of *O. mykiss* spawning habitat. At 250 cfs, spawning habitat for *O. mykiss* is about 85 percent of maximum WUA and at 200 cfs, it is about 78 percent of maximum WUA. At RM 43, which is the approximate downstream limit of preferred *O. mykiss* habitat, average daily water temperatures stay below 15°C at a flow of 225 cfs until maximum air temperatures exceed 75°F (on average two days in March and eight days in April). Therefore, the base flows in the draft Voluntary Agreement intended to promote and protect fall-run Chinook salmon juvenile rearing are not inconsistent with protecting *O. mykiss* spawning in the upper 9 miles of the lower Tuolumne River.

Outmigration Base Flows (April 16–May 15)—Fall-run Chinook salmon leaving the lower Tuolumne River as large parr or smolts return as adults in a much higher percentage than those leaving as fry (almost a 20:1 ratio based upon testing of otoliths of adults from the outmigration years of 1998, 1999, 2000, 2003, and 2009) (Stillwater Sciences, 2016). Therefore, maintaining favorable growth conditions and reducing

predation throughout the fry to smoltification life stages is beneficial to fall-run Chinook salmon production on the lower Tuolumne River. As juvenile fall-run Chinook salmon grow, their ability to hold station and simultaneously conduct life functions under higher flows also increase.

Increasing base flows above those provided from March 1 through April 15 would maintain favorable river temperatures during the mid-April through mid-May period. Consequently, the Districts' proposed and the draft Voluntary Agreement's suggested instream flows from March 1 to April 15 would be: (1) 275 cfs (in below normal, above normal, and wet water years), (2) 250 cfs (dry water years), and (3) 200 cfs (critical water years).

At RM 39.5, a flow of 275 cfs maintains average daily river temperatures below 21°C until maximum daily air temperatures exceed 100°F, which occurs on average one day in May. At RM 39.5, at a flow of 225 cfs, water temperatures are below 21°C until maximum air temperatures exceed 95°F, which occurs on average about two days in May. In April and potentially through mid-May, incubation of *O. mykiss* eggs may be occurring. At RM 43, a flow of 275 cfs maintains average daily water temperatures below 15°C until maximum daily air temperatures exceed 80°F, which occurs about three to four days in April and 15 days in May. However, in May, *O. mykiss* fry habitat is more of a concern because this is late in the incubation period and most fry have emerged. At 275 cfs, fry habitat is 64 percent of maximum WUA. An outmigration pulse flow to augment these base flows is described below.

Outmigration Base Flows (May 16–May 31)—While in most years juvenile fall-run Chinook salmon have left the lower Tuolumne River by mid-May, in some years large parr and smolts remain in the river beyond May 15. To reduce water temperatures during this period, the Districts' proposed and the draft Voluntary Agreement's suggested instream flows would be provided from May 16 through May 31 as follows: (1) 300 cfs (in below normal, above normal, and wet water years), (2) 275 cfs (dry water years), and (3) 225 cfs (critical water years).

This increase in flow above that provided in the April 16–May 15 period would tend to favor fall-run Chinook salmon over *O. mykiss* fry; however, increased rearing habitat provided by improvements to in-channel habitat complexity, as discussed later in the subsection *Large Woody Material Augmentation*, would improve *O. mykiss* fry rearing habitat, especially if preference to placing LWM is given to along the stream margins preferred by *O. mykiss* fry and juveniles.

Floodplain Rearing Pulse Flow—Floodplain inundation has multiple benefits, including providing necessary habitat for individual fish species, supporting an increase in floodplain processes (e.g., nutrient cycling and aquifer recharge), reducing flood risk to life and property and fostering climate change resilience (Tockner and Stanford, 2002; Opperman et al., 2010). For floodplain rearing pulse flows to be effective on the Tuolumne River, releases should be high enough to exceed the habitat otherwise available at lower in-channel flows. Floodplain rearing pulse flows must also be of

sufficient continuous duration to be effective as foraging opportunities so as not to require constant movement by juvenile Chinook salmon in response to frequent flow fluctuations. The preferred duration of the floodplain rearing pulse flow is estimated to be 14 days or greater (Matella and Merenlender, 2014), although shorter periods may be adequate if it is continuous and without large flow fluctuations. The draft Voluntary Agreement states that the volume for the recommended floodplain rearing pulse flow was developed using the Flow West Model and the work of California DFW, the Districts, and CCSF.

The draft Voluntary Agreement includes a floodplain pulse flow of 2,750 cfs, which was not proposed by the Districts in the amended final license application. To maximize the benefit of the floodplain rearing pulse flow, the start of the draft Voluntary Agreement's pulse would be timed to coincide with Chinook salmon rearing, which would be determined by the TPAC, on an annual basis relying upon such information as date of egg deposition, date of emergence, water temperatures, visual observations, RST data, and other relevant information.

Except in successive below normal, dry and critical water years, the spring floodplain rearing pulse flow rate of 2,750 cfs would be inclusive of the minimum instream flow identified in table 3.3.2-29, which the draft Voluntary Agreement states would provide greater overall juvenile fall-run Chinook salmon carrying capacity compared to the minimum instream flows alone. The floodplain pulse flow durations proposed in the draft Voluntary Agreement are as follows:

- Wet and above normal water years 20 days
- Below normal water years 18 days
- Dry water years 14 days
- Critical water years 9 days.

The draft Voluntary Agreement's floodplain pulse flow also contains a "dry-year relief" plan specific to the floodplain pulse. For the floodplain pulse flow, dry-year relief occurs in sequences of dry, critical, and below normal water years. Specifically, in a successive dry or critical water years, the floodplain pulse goes to zero for that year and any following successive dry or critical water years. In any below normal water years occurring in a sequence of critical and/or dry water years, the floodplain pulse flow would be 2,750 cfs for a duration of 14 days, instead of 18 days. Any below normal water year occurring within a sequence of dry and/or critical water years does not restart the dry and/or critical sequence.

Any floodplain pulse flow would be inclusive of the base flow. For example, if the base flow is 200 cfs, then the additional flow to achieve the floodplain pulse flow is 2,550 cfs, resulting in a total flow of 2,750 cfs.

Overall, implementation of the draft Voluntary Agreement's suggested floodplain rearing pulse flow, and its associated durations based on water year type, would benefit

fry and juvenile *O. mykiss* and fall-run Chinook salmon, as floodplain inundation would likely reduce predation rates, increase habitat availability, and increase food supply (FWS, 2008; Bennett and Moyle, 1996). In addition, most of the energy that drives aquatic food chains in rivers is derived from terrestrial sources (Allan, 1995) and aquatic productivity is related to flood magnitude and the area inundated in some rivers (Large and Petts, 1996). Flooding, particularly the rising limb of the hydrograph, typically results in high concentrations of both dissolved and particulate organic matter being released into the river (Allan, 1995). Furthermore, juvenile salmonids that use floodplain areas tend to consume more prey and grow faster than those in mainstem habitats.

Spring Outmigration Pulse Flows—To encourage fall-run Chinook salmon smolt outmigration and increase overall survival, the Districts' proposed and the draft Voluntary Agreement's suggested spring outmigration pulse flows would be carefully timed to occur when fall-run Chinook salmon are either large parr or smolt-sized (length greater than approximately 65 mm), typically between April 16 and May 31. The draft Voluntary Agreement includes active monitoring of spawning timing and river temperatures, supplemented by snorkel surveys and/or seining, to calibrate degree days and juvenile size for the purpose of timing the spring outmigration pulse flows to coincide with the smoltification of large numbers of juveniles. Adaptive management principles would be applied over time to optimize the timing, duration, and flow rate of the pulse flows as data are collected on the resulting outmigration survival as measured at the Districts' RSTs. The Districts' proposed AMP for the spring outmigration pulse flow is described in appendix E-1, attachment F of the amended final license application (Districts, 2017a).

The Districts' proposed and the draft Voluntary Agreement's suggested spring outmigration pulse flow volumes are as follows and are in addition to the proposed and suggested base flows.

- Wet and above normal water years 150 thousand acre-feet (TAF)
- Below normal water years 100 TAF
- Dry water years 75 TAF
- Successive dry water years 45 TAF
- First year critical water years 35 TAF
- Successive critical water years 11 TAF.

The proposed and suggested pulse flow volumes would be substantially increased over baseline levels, except in successive dry or critical water years and in any dry water year that follows a dry/critical water year or in all critical water years that follow a dry/critical water year. Consequently, providing these spring pulse flows in the lower Tuolumne River could facilitate outmigration and increase the survival of juvenile salmon and steelhead (if present), particularly during periods of high turbidity associated with spill events. In addition, spring pulse flows would mobilize and redistribute

sediments that provide potential germination sites for riparian tree species if these flows do not recede too quickly.

Finally, in spill years, the Districts state that they would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions.

The Resource Agencies' and Stakeholders Recommended Instream Flows

NMFS states that it developed its recommended instream flows to better mimic the components of a natural hydrograph that benefit salmonids and riparian ecosystem function. The five components of a natural hydrograph in the eastern Central Valley are: (1) fall or winter freshets (first inundation flows of the wet season), (2) winter storm/peak flows, (3) spring snowmelt flows, (4) snowmelt recession flows, and (5) summer base flows. NMFS believes that the Districts' proposed flows do not provide the components of the natural hydrograph that would provide timely migration cues and foraging habitat for juvenile salmonids in the floodplain and other areas outside of the main channel, or adequately mitigate for the fish passage impacts of the projects. NMFS also states that the Districts' summer base flows (June 1–October 15) would only provide suitable *O. mykiss* habitat in the uppermost approximately 5 miles of the lower Tuolumne River (from RM 46.9 upstream to RM 51.6), while NMFS believes its recommended flows would create habitat for juvenile salmonid rearing for approximately 12 miles in the lower Tuolumne River in wet, above normal, and below normal water years. In dry and critically dry water years, rearing could extend downstream for approximately 5 miles, depending on meteorological conditions. NMFS notes that its recommended flows in dry and critically dry water years are lower due to concerns regarding water availability, but still provide protection for salmonid rearing below La Grange Diversion Dam.

The NMFS recommended fall/winter flows for salmonid immigration, spawning, and incubation (October 15–February 15) are meant to mimic natural hydrologic processes for habitat creation and maintenance and to facilitate fish migration and spawning. The NMFS recommended springtime flows for salmonid migration, floodplain inundation, and rearing (February 15–May 31) are designed to annually inundate floodplain habitat for between 30 and 90 days to allow for primary productivity of the BMI food web, which NMFS states would benefit salmonids throughout most of the lower Tuolumne and San Joaquin Rivers. In addition to providing critical rearing habitat, NMFS indicates its recommended elevated flows in springtime would decrease energetic expenditure for emigrating salmonids and reduce the risk of predation, thereby improving outmigration success in the Tuolumne River, San Joaquin River, and the Delta. The NMFS recommended recession rates are intended to mimic a natural decrease in flow from springtime snowmelt to summertime base flow, which would extend the in-river salmonid rearing period through June in normal to wet water years.

Like NMFS, California DFW believes that the Districts' proposed instream flows do not adequately address components of a natural hydrograph that benefit salmonids and

riparian ecosystem function, and are not sufficient to support salmonid holding, spawning, and rearing in the lower Tuolumne River. Accordingly, California DFW's recommended instream flows for the lower Tuolumne River are designed to: (a) simulate the shape of the natural hydrograph in duration, magnitude, timing, rate of change, and frequency to the extent necessary to restore or protect applicable ecological functions; (b) provide fall attraction pulse flows; (c) maximize riparian floodplain inundation to increase prey availability; (d) mimic a snowmelt recession; (e) provide recession rates necessary for conservation of riparian ecosystem function, including regeneration of riparian plant species; and (f) provide boatable flows on the Tuolumne River.

Rather than requiring a minimum flow based on unimpaired flows during February through June in all water year types, California DFW first developed a set of flows that would inundate springtime salmonid habitats relying on results of PHABSIM studies conducted on the Tuolumne River (Stillwater Sciences, 2012). After developing flows informed by WUA, California DFW states that they used the HEC-5Q, Project Operations and Water Temperature Models[150] to develop base flows that would meet the EPA temperature requirements a majority of the time. California DFW then added additional recommended flows to activate the floodplains in the early spring so that when later high flows spill onto the floodplains, the floodplain ecosystem has already begun its spring growth. California DFW also recommends a spring snow-melt recession rate, so that floodplain use by juvenile salmonids is maximized and so that floodplain plants, including riparian trees and shrubs, can continue to grow their root system as the water level recedes gradually. Lastly, California DFW recommends a fall pulse flow to attract adult fall-run Chinook into the system. California DFW's rationale for these flows is similar to that provided by NMFS.

According to the Conservation Groups, their recommended February through June percent-of-unimpaired requirement in above normal, below normal, and dry years considers: (1) the life stages of salmon and *O. mykiss* that benefit from flow in each month; (2) the relative biological benefit that derives from the hydrology under the percent-of-unimpaired requirement in each month; and (3) downstream conditions in each month. It selected 50 percent of unimpaired value as a compromise based on analyses of the hydrology of the Tuolumne River and the competing uses.[151] In addition, it suggests that eliminating its recommended percent-of-unimpaired requirement in June for above normal and below normal years would do more to balance water supply

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[150] Information on the HEC-5Q models is available at: https://www.hec.usace.army.mil/publications/TechnicalPapers/TP-111.pdf.

[151] The Water Board's 2010 Delta Flow Criteria Report established that 60 percent of February–June unimpaired flow is what fish need as in-river flow in each of the three major San Joaquin tributaries and as outflow from the San Joaquin River.

towards water for storage and irrigation. The Conservation Groups also eliminated February and May from a percent-of-unimpaired requirement in dry years.

In above normal, below normal, and dry years, the Conservation Groups' flow recommendation is also designed to extend the benefit of the percent-of-unimpaired flow requirement by immediately following its flow recommendation with a managed down-ramp that mimics the snowmelt recession (to improve riparian recruitment). In critically dry and super critically dry years, the Conservation Groups' recommended spring block flows are designed to at least facilitate successful outmigration of salmonids that are able to survive flatline baseflow conditions. In addition, the Conservation Groups recommend releases of fall pulse flows to attract salmon upstream because a strong correlation exists between flow pulses and upstream migration, as documented in the Mokelumne River on the declining limb of the pulse.

The Bay Institute's recommended instream flows below La Grange are designed to contribute to ecologically important increases in Delta inflow and outflow and restore/maximize Tuolumne River cottonwood and willow recruitment, and ECHO recommends the Districts provide 60 percent of the unimpaired flow in the Tuolumne River from February to June to protect salmon.

The Districts' Modeling Results—In response to staff's February 16, 2018, AIR, the Districts prepared an analysis of each of the above instream flow proposals/recommendations consisting of (a) running each recommended/proposed flow regime through the suite of models developed during the ILP study process, including the project operations model, the reservoir temperature model, the Chinook salmon and *O. mykiss* production models, the socioeconomic model, and the floodplain hydraulic model; (b) evaluating non-flow measures[152] proposed by the Districts and recommended by stakeholders that may need to be included in runs through the project operations and fish production models; and (c) analyzing the results of the model runs to inform potential benefits, impacts, and costs of the proposed flow and non-flow measures. As requested by this same AIR, the Districts also compared and contrasted the costs associated with each flow recommendation (including minimum flows, pulse flows, recession flows, ramping rate restrictions, and minimum water storage). The base case under the Commission's procedures and protocols represents the scenario of future project operations under the current license conditions. Specific to the Tuolumne River Operations Model, the base case depicts the operation of the Don Pedro Project in accordance with the current license, Corps flood management guidelines, and the Districts' irrigation and municipal and industrial water management practices.

[152] These would include the coarse sediment management program, gravel mobilization flows, gravel cleaning, instream habitat improvement, and predator control.

In response to staff's September 17, 2019, AIR, the Districts also completed additional fish production modeling[153] and filed it with the Commission on December 11, 2019 (Districts, 2019c). This modeling effort included simulations of The Bay Institute's flow recommendation, the draft Voluntary Agreement, and various other simulations needed to facilitate our evaluation of the Districts' proposed non-flow measures. On June 17, 2020, the Districts filed results of modeling to correct an error identified in the fish production models (Districts, 2020c).

Based on our review of these modeling results (excluding the proposed or recommended non-flow measures), it is apparent that the Districts' proposed, the draft Voluntary Agreement's suggested, and the resource agencies' recommended instream flows would likely increase annual *O. mykiss* young-of-year production in the Tuolumne River compared to the base case, although the State Water Resources Control Board's recommendation may result in decreases in production (figure 3.3.2-30). The Districts' proposed, the draft Voluntary Agreement's suggested, and most of the resource agencies' recommended instream flows would also result in *O. mykiss* adult replacement rates that are similar to one another (figure 3.3.2-31). While the relative increases in production would be similar under the noted flow alternatives, effects on May through October daily average water temperatures would be slightly more beneficial (cooler) under the draft Voluntary Agreement's suggested and Districts' proposed instream flows with infiltration galleries than resulting temperatures under the resource agencies' recommendations (figure 3.3.2-32 and appendix G). These cooler water temperatures would likely further improve *O. mykiss* habitat in the lower Tuolumne River, particularly for rearing, spawning, and egg incubation and would be necessary to achieve the ESA recovery goals for steelhead in the lower Tuolumne River.

[153] The question of whether this modeling should include full life-cycle population modeling (including effects during migration through the San Joaquin River, the Delta, and ocean survival) was addressed in the Commission's December 22, 2011 study plan determination. The determination concluded that the model objective is not to predict the precise population size of any particular life-stage, as in a life-cycle model, but rather to identify project effects on all in-river life stages affected by the project to support the evaluation of appropriate protection, mitigation, and enhancement measures. Accordingly, the results of the Districts' fish production models do not represent the absolute number of fish but instead are relative values that allow comparison of the effects of various flow and non-flow measures on specific fish species/life stages.

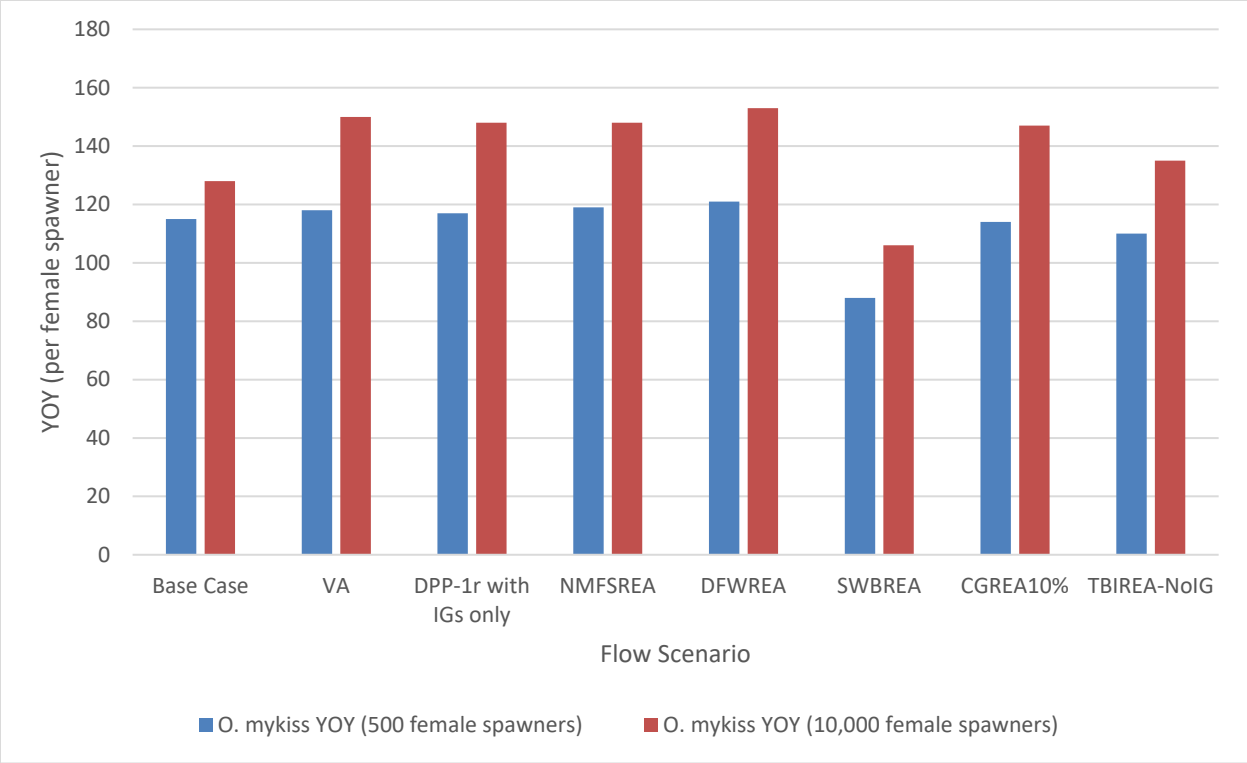

Figure 3.3.2-30. Simulated average annual O. mykiss YOY production for the proposed/recommended flow regimes (without non-flow measures) under the base case, the draft Voluntary Agreement, the Districts' proposal, and stakeholder recommendations (Source: Districts, 2018a,b; 2020c, as modified by staff).

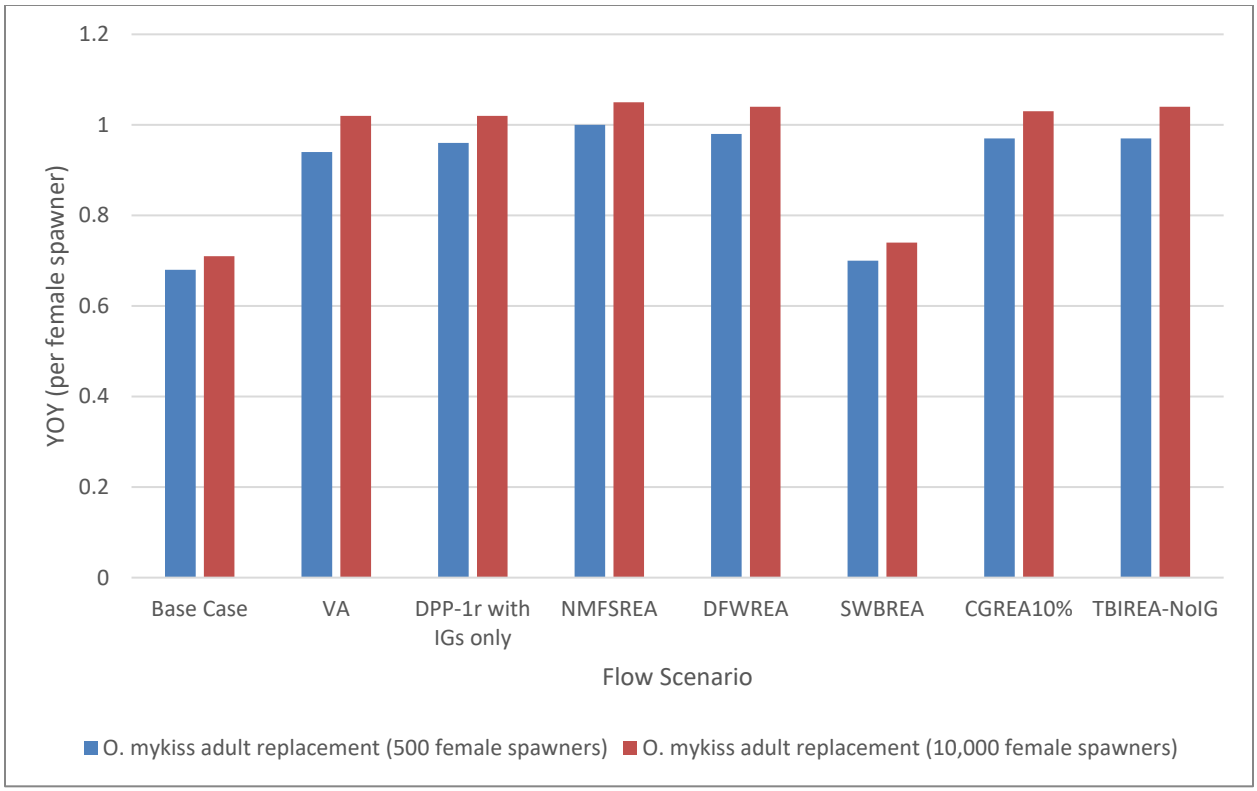

Figure 3.3.2-31. Simulated average annual O. mykiss adult replacement rates for the proposed/recommended flow regimes (without non-flow measures) under the base case, the draft Voluntary Agreement, the Districts' proposal, and stakeholder recommendations (Source: Districts, 2018a,b; 2020c, as modified by staff).

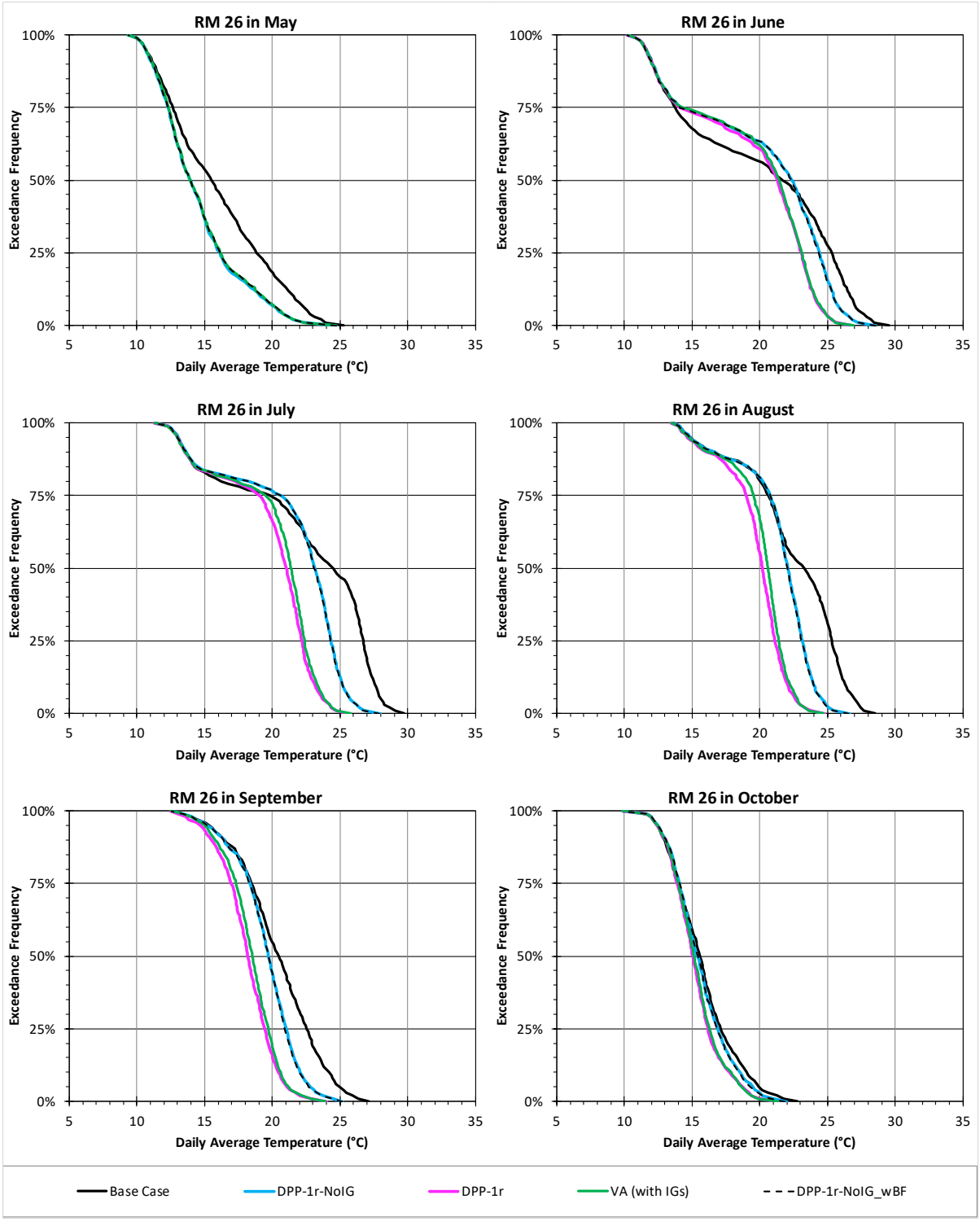

Figure 3.3.2-32. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 26 under the base case, the Districts' proposal, and draft Voluntary Agreement, May through October (Source: Districts, 2018b,f; 2020a,b).

The draft Voluntary Agreement's suggested instream flows would also likely reduce water temperatures and increase the relative production of juvenile fall-run Chinook salmon compared to the base case (figure 3.3.2-33); however, increases in relative production would be slightly less than those realized under the Districts proposed and the resource agencies recommended flow regimes. Nevertheless, the Districts' proposed and draft Voluntary Agreement's suggested flow regime would have far less of a negative effect on water supply[154] (see section 3.3.8, *Socioeconomics*) and section 4.0, *Developmental Analysis*).

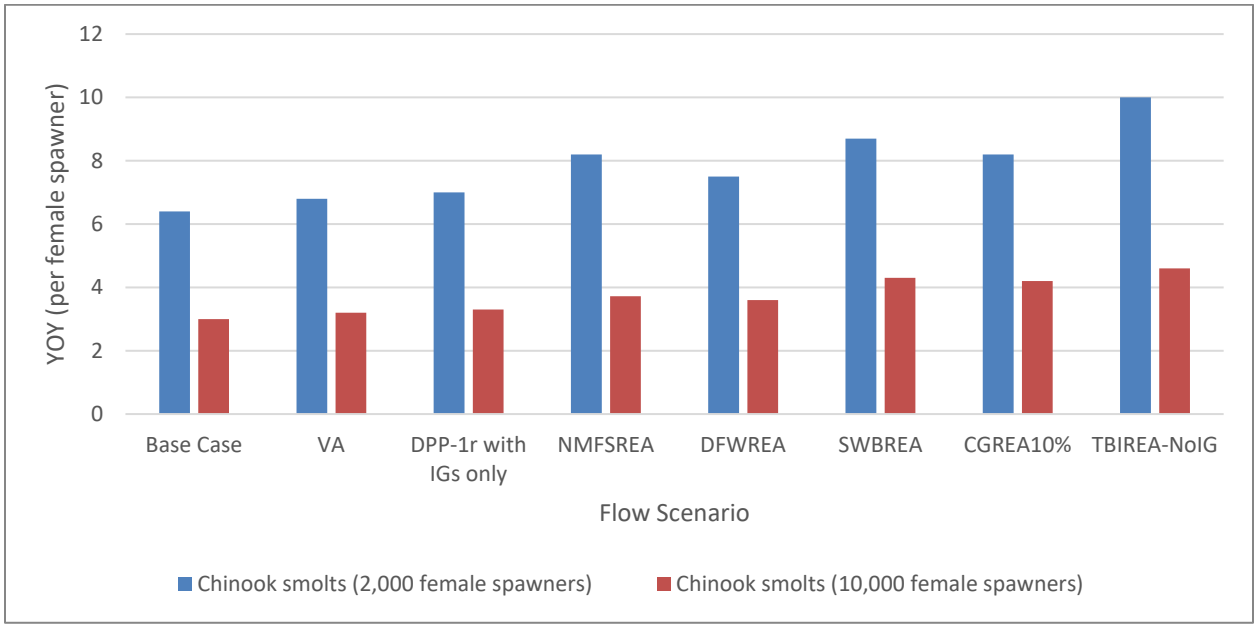

Figure 3.3.2-33. Simulated average annual fall-run Chinook salmon smolt production (per female spawner) for the proposed/recommended flow regimes (without non-flow measures) under the base case, the draft Voluntary Agreement, the Districts' proposal, and stakeholder recommendations (Source: Districts, 2018a,b; 2020c, as modified by staff).

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[154] Based on the Districts' and CCSF's review of the historical flow record, each of the alternative minimum flow recommendations (agencies and NGOs) would cause significant water shortages to the CCSF RWS (includes BAWSCA agencies and SFPUC retail customers) service area, including a much higher level of rationing and much higher frequency of rationing, over the period of hydrologic record (see section 3.3.8, *Socioeconomics*). However, as discussed in section 3.3.8, *Socioeconomics*, there is disagreement among stakeholders regarding the ability of water users to mitigate these effects via water conservation and the development of other water sources.

As discussed later in section 3.3.8, *Socioeconomics*, according to the Districts' modeling, The Bay Institute's recommended instream flows would result in an 85 percent water shortage for CCSF's 2.6 million Bay Area customers in each year of the modeled 1990 to 1992 period. Many other years would have a greater than 50 percent water shortage. The Districts note that these shortages would crash the Hetch Hetchy System portion of the model and prevent reasonable modeling. ECHO's flow recommendation triples the Districts' water shortages during the modeled 1987 to 1992 drought period, increasing from an average of 12 percent under base case conditions to 36 percent on average over the 6-year period. The Districts' water shortages would exceed 30 percent in 32 of 42 years used to populate the model. CCSF's water shortages would increase from 10 percent each year in the 1988 to 1992 period under base case conditions to 90 percent water shortages each year in the 1988 to 1992 period. The Districts note that these levels of water shortages make further modeling uninformative.

Based on the above analyses, it is apparent that the the unregulated hydrograph would be more closely mimicked by the resource agencies' and other stakeholders' recommended streamflow regimes than the Districts' proposal or the draft Voluntary Agreement. However, modeling of the resource agencies'/stakeholders' recommended flow regimes did not indicate a major increase in fish production over the Districts' and draft Voluntary Agreement's proposed flows. In addition, the resource agencies' and other stakeholders' recommended flow regimes would have a substantial negative effect on the water supplies of the Districts and CCSF, and any incremental ecological benefits of these flow regimes over those proposed by the Districts should be weighed against the effects on water supplies. The primary purpose of the Don Pedro Project is to provide adequate water supplies through extended dry periods, which have occurred historically with some frequency. This is also the case with CCSF's water supplies to the Bay Area; the primary purpose of the Hetch Hetchy System is to provide adequate municipal and domestic water supplies to its RWS service area.

Operating within these constraints, we agree that implementing the Districts' proposed spring pulse flows (and their associated recession rates) would likely increase the survival of outmigrating juvenile Chinook salmon in the lower Tuolumne River, particularly during periods of high turbidity associated with spill events. Spring pulse flows would also mobilize and redistribute sediments that provide potential germination sites for riparian tree species if these flows do not recede too quickly. The Districts' proposed spring pulse flows would augment outmigration base flows, which would further reduce water temperatures at a given location and extend the beneficial plume of colder water farther downstream relative to that provided by the base flows alone, which would also benefit *O. mykiss*. Furthermore, high flows during these months in the lower Tuolumne River have the potential to disrupt bass spawning and possibly diminish predator abundance, as shown in the Districts' *Lower Tuolumne River Instream Flow Studies: Pulse Flow Study Report* (Stillwater Sciences, 2012).

Under the Districts' existing Don Pedro license, the spring pulse flow schedules that have been implemented in the past were only weakly informed by conditions

affecting juvenile fall-run Chinook on the lower Tuolumne River, and no empirical evidence of how to maximize the benefit of the pulse flows has been collected or evaluated. Maximizing the benefit of these flows for Tuolumne River juveniles and smolts requires a greater understanding of the emigration behavior of Tuolumne River fall-run Chinook. The purpose of the Districts' proposed pulse flows AMP is to develop this improved understanding to optimize the use of the water year-driven pulse flow volumes.

The Districts propose to implement an experimental pulse flow management program including real-time monitoring and salmon population modeling for seven years. A Tuolumne science team (TST) would be formed to guide the efforts of the seven-year program. After seven years, the results of the pulse flow management program would be assessed to determine adjustments in pulse flow triggers and duration as well as whether other pulse flow management options should be considered.

As discussed at the 10(j) meeting, NMFS supports monitoring and adaptive management of pulse flows to respond to local conditions such as temperature and Chinook salmon presence in the Tuolumne River to maximize the effectiveness of the pulse flows. Additionally, adaptively managing flow timing would allow the agencies to align flows with the other San Joaquin tributaries and coincide with natural precipitation events.

As described in their December 11, 2019, AIR response, the Districts found significant benefits to outmigration survival under the real-time approach of the AMP. For example, under the Districts' proposed interim flow regime (without infiltration galleries), implementation of the AMP increased smolts per female spawner productivity from the base case value of 6.7 to a value of 8.2 smolts per female spawner, representing an increase of 28 percent over the base case and 22 percent over the interim flow scenario (Districts, 2020c). Accordingly, we conclude the implementation of the Districts' proposed AMP for spring pulse flows would be beneficial.

Regarding the need for fall pulse flows, in the draft EIS, we noted that there was little evidence supporting the need for fall pulse flows and stated the following:

> On the Stanislaus River, Peterson et al. (2016) found that pulse flows resulted in immediate increases in passage, but the response was brief and represented a small portion of the total run. No substantial differences in migration rates in the Klamath and Trinity Rivers were observed between years with managed pulse flows and years without pulse flows (Strange, 2007). In addition, no evidence exists that low flows in the San Joaquin River impede migration (Mesick, 2001). Finally, pre-spawn mortality on the Tuolumne River is low under existing conditions, and it is not apparent how a fall pulse flow would substantially improve migration or spawning conditions for fall-run Chinook salmon.

Consequently, we did not recommend including a requirement for fall pulse flows in any license issued for the Don Pedro Project. However, subsequent to issuance of the draft EIS, the resource agencies provided compelling multi-year site-specific evidence that fall pulse flows appear to facilitate/initiate the upstream migration of Chinook salmon in both the lower Tuolumne and Stanislaus Rivers. Examples of this relationship in the lower Tuolumne River during years with (2013 and 2016) and without (2014 and 2015) fall pulse flow are provided in figures 3.3.2-34 through 3.3.2-37.

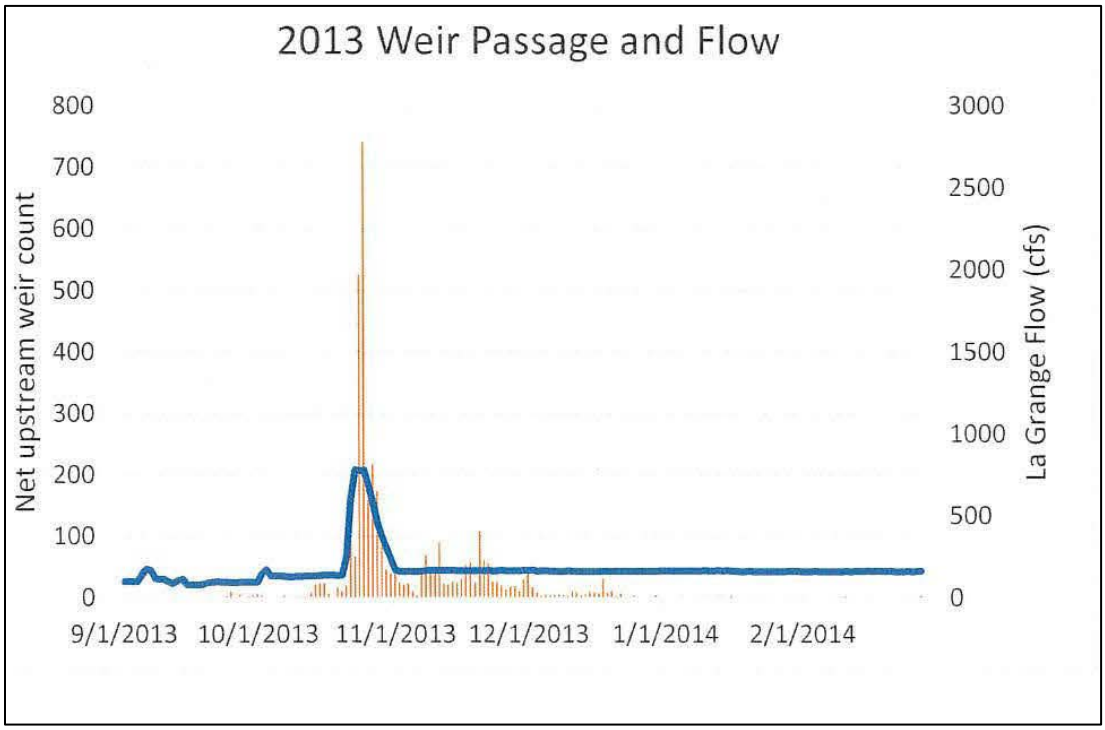

Figure 3.3.2-34. Weir counts of adult Chinook salmon (orange bars) and river flow (blue line) during a pulse flow year in the lower Tuolumne River from September 1, 2013, through February 1, 2014 (Source: NMFS, 2019).

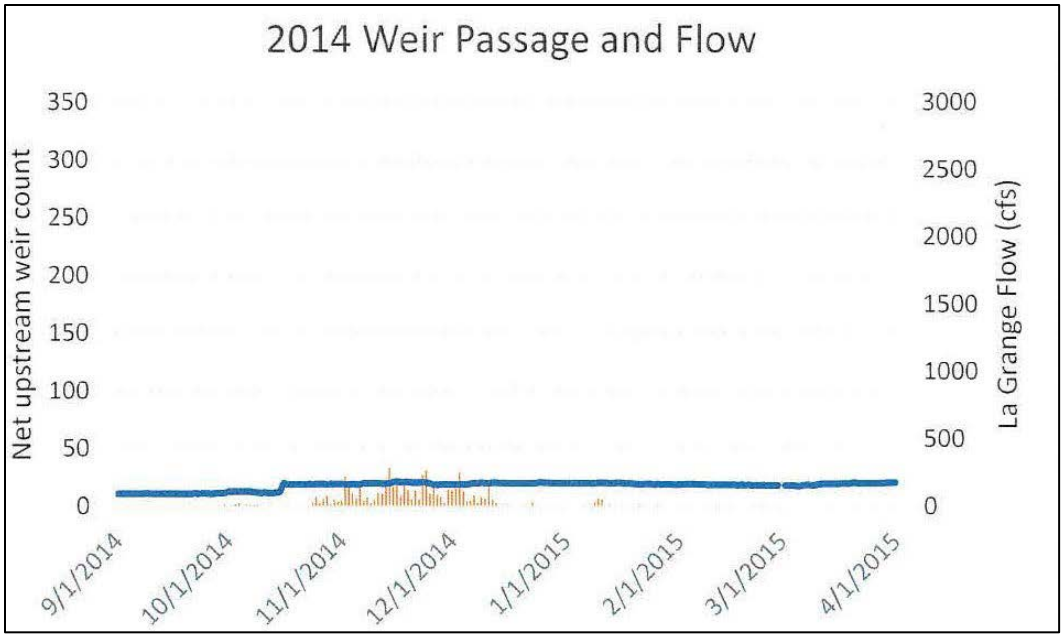

Figure 3.3.2-35. Weir counts of adult Chinook salmon (orange bars) and river flow (blue line) during a non-pulse flow year in the lower Tuolumne River from September 1, 2014, through April 1, 2015 (Source: NMFS, 2019).

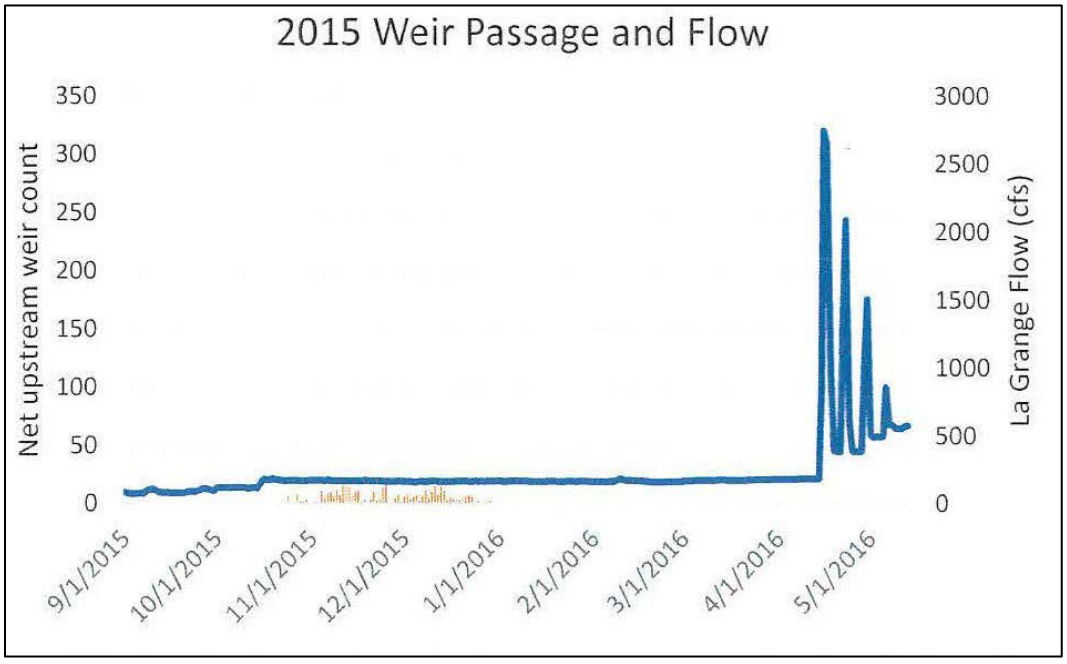

Figure 3.3.2-36. Weir counts of adult Chinook salmon (orange bars) and river flow (blue line) during a non-pulse flow year in the lower Tuolumne River from September 1, 2015, through May 1, 2016 (Source: NMFS, 2019).

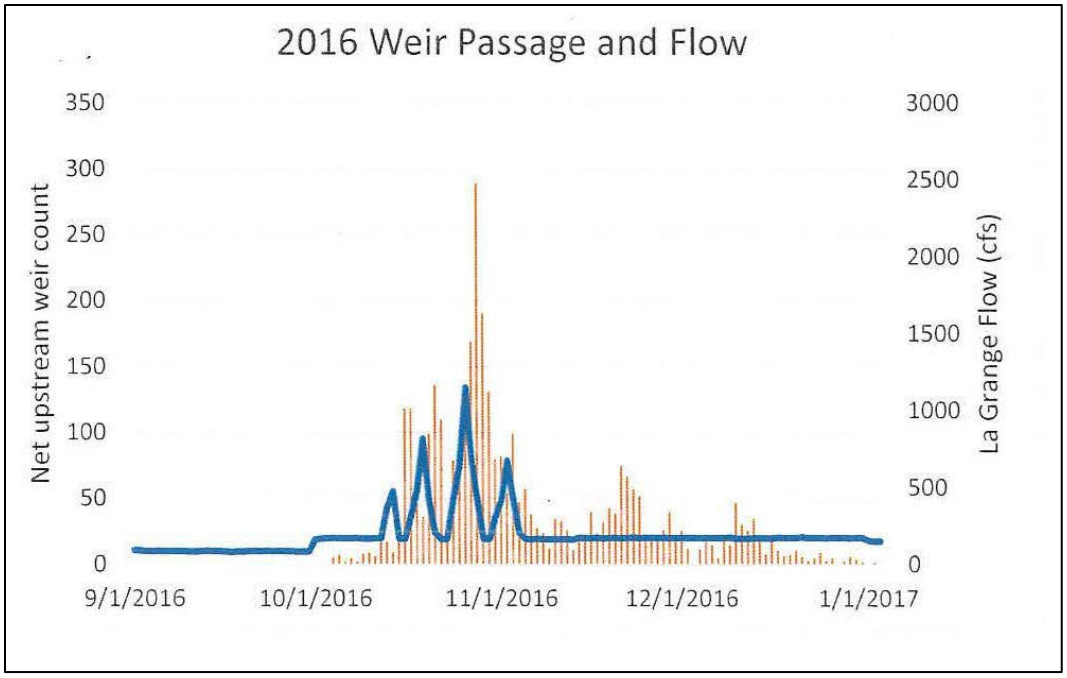

Figure 3.3.2-37. Weir counts of adult Chinook salmon (orange bars) and river flow (blue line) during a pulse flow year in the lower Tuolumne River from September 1, 2016, through January 1, 2017 (Source: NMFS, 2019).

In their response to staff's October 28, 2019, summary of the 10(j) meeting, the Districts strongly disagree with the statement that all meeting attendees were in "general agreement" about the biological benefits of fall pulse flows recommended by the resource agencies, because the only discussion that occurred on this topic at the meeting involved a series of slides presented by the resource agencies for the first time. The Districts also note that a "rigorous review of the information presented at the 10(j) meeting is necessary before any conclusions can be reached about what the slides actually demonstrate. Such a detailed assessment would entail consideration of several important factors, including the time required for flows to travel from La Grange to where the adult salmon are holding, the amount of attenuation of the flow that occurs, and, of course, knowledge of the location of holding salmon."

The additional information regarding effects of fall pulse flows on upstream migration shows that there is a relationship between fall pulse flows and weir counts (adult migration) (see figures 3.3.2-34 through 3.3.2-37). Based on these data, we now conclude that the annual implementation of fall pulse flows timed to promote upstream migration would be beneficial. Ongoing weir monitoring to determine timing/effectiveness for promoting upstream migration and the preparation of a summary report within 10 years of license issuance to evaluate effectiveness of this measure and to determine the need for any additional monitoring would also be appropriate. Once these questions are answered, the Commission can then balance any benefits associated with

these flows with their effects on water supply and determine if these pulse flows should continue or be discontinued in support of other beneficial uses.

Turbine Unit Upgrades

The Districts propose to upgrade three of the four turbines at the Don Pedro Project, which would increase the hydraulic capacity of Units 1, 2 and 3 from 1,510 cfs each to approximately 1,700 cfs each. The hydraulic capacity of Unit 4 would be unchanged at 1,000 cfs. The upgrade of the turbines at Units 1, 2 and 3 would increase the total hydraulic capacity of the powerhouse by 10 percent, from 5,530 to 6,100 cfs. This would increase the proportion of the total flow that passes through the powerhouse (and reduce spill) during spill periods and could also allow for a slightly larger variation in flows released into La Grange Reservoir when generation is adjusted to increase power production during high demand periods. These changes in operations could affect environmental resources downstream of the Don Pedro Powerhouse.

Our Analysis

The increased hydraulic capacity of the Don Pedro Powerhouse would have minimal if any effect on flows in the lower Tuolumne River downstream of the La Grange Diversion Dam, since the Districts would need to comply with minimum flows and ramping rates measured at the La Grange gage below La Grange Diversion Dam. Increasing the proportion of flow drafted through the Don Pedro Powerhouse intake during spill periods could have minor but likely undetectable effects on water quality in the La Grange Reservoir due to less water being spilled. This would reduce aeration, which could slightly reduce DO and total dissolved gas levels in the La Grange Reservoir. However, DO levels in both water drafted through the powerhouse intake and released through the spillways would likely be at levels sufficient to support aquatic biota during spill periods.

Hourly DO data collected from the Tuolumne River just downstream of the Don Pedro Dam and powerhouse in 2012 ranged from 5.8 to 12.4 mg/L (table 3.3.2-7). Although 17 days in October and November of 2012 have at least one hourly DO measurement less than 7.0 mg/L, the Districts report that all average daily values meet the 7.0-mg/L objective. In addition, during spill periods DO levels are likely to be near saturation and well in excess of the levels needed to support aquatic biota, and any effects on DO levels would equilibrate with ambient conditions as water passes through La Grange Reservoir, and no detectable effects in the Tuolumne River downstream of La Grange Diversion Dam are expected.

Spill Management Plan

On October 2, 2018, FWS filed revised 10(j) recommendation 2 for the Don Pedro Project,[155] calling for the development of a spill management plan that would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing. The spill management plan would offer a means for the agencies to provide recommendations on how to control the magnitude, timing, and duration of spill events into the lower Tuolumne River to improve fall-run Chinook salmon floodplain rearing habitat. The Districts would retain ultimate control over actual spill amounts, timing and management, but would make all reasonable efforts to implement recommendations of the TPAC as to spill management whenever possible.

In its revised Don Pedro 10(j) recommendation 2, FWS defines *spills* as flows released into the Tuolumne River "in excess of required flows." The spill management plan would identify the preferred timing of releases, minimum durations, and preferred flow rates. FWS states in supporting documentation that the target months for management of available flow volumes in the spill management plan should be March and April, and at a duration of at least 15 days. FWS further states that the Districts should target a managed spill release of no less than 1,750 cfs to maximize benefits and to try to limit occurrences of spill releases between 500 cfs and 1,700 cfs at the La Grange gage except during recession flows. The Districts would seek recommendations on implementation of the spill management plan from the TPAC. The TPAC, which would be created pursuant to FWS's revised Don Pedro 10(j) recommendation 4, would consist of at least the Districts, FWS, and CCSF and would meet monthly or more frequently starting in the first January after any license issuance on or about the 10th of each month to review the Districts' projections of potential spills, and discuss use of any identified spill volumes.

For spring pulse flows, FWS states that if the spill volume estimated by the Districts in March is less than 55,000 acre-feet, the managed spill volume may be added to the spring pulse flow proposed by the Districts. However, FWS also states that based on recommendations of the TPAC, any spill volume less than 55,000 acre-feet may be used to improve in-channel rearing, riparian recruitment, and survival or temperature management consistent with the spill volume mentioned above.

For fall pulse flows, FWS states that if there is excess water available on September 1 of any year, the TPAC may recommend release of such water, subject to the following: (1) on September 1, if the Don Pedro Reservoir water surface elevation is

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[155] In the same filing, FWS also filed revised 10(j) recommendations 3 (LTRHIP) and 4 (Creation of the TPAC) for the Don Pedro Project, and withdrew its original 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects. FWS states that this filing resulted from meaningful discussions between FWS and the Districts subsequent to FWS's January 29, 2018 comments in response to the REA notice.

above 801.9 feet, the TPAC will meet and confer on the use of the unused portion of the spill volume; (2) any such water will be used before October 7; and (3) use of the water will not, by itself, result in the Don Pedro Reservoir water surface elevation being less than 801.9 feet as of October 7.

FWS (revised Don Pedro 10(j) recommendation 2) also recommends that within six months of the 12th anniversary of any license issuance, the Districts would initiate the necessary studies to develop a revised rearing habitat versus flow relationship on the lower Tuolumne River, which would reflect and document the changes that have occurred since license issuance using the results of the Districts' Spawning Gravel in the Lower Tuolumne River Study Report (Stillwater Sciences, 2013d) as baseline habitat conditions.

In response to FWS's revised 10(j) recommendations filed on October 2, 2018, the Districts support the withdrawal of 10(j) recommendations 2, 3, 4 and 7 for both the Don Pedro and La Grange Projects, and support FERC's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal. The Districts also acknowledge in their letter filed October 17, 2018, that in many years, sufficient flexibility exists to also manage releases from Don Pedro Reservoir that exceed the minimum flow requirements, in order to benefit native fish species downstream of the reservoir, while continuing to meet the Districts' primary obligations and responsibilities related to water supply, instream flow requirements, flood control, and project safety. The Districts note that the spill management plan is intended as a discretionary plan, subjected to the primary project obligations and responsibilities.

Our Analysis

To assess how often a spill flow of at least 1,750 cfs could be maintained for the entire March through April period, we reviewed the storage and flow record for the project and prepared an assessment based on water year types. Table 3.3.2-40 shows that a flow of at least 1,750 cfs could be maintained for the entire March through April period in wet and above normal water years, and for an average of 13 days in below normal water years. However, in dry or critical water years, essentially no spill flow of at least 1,750 cfs would be available. Table 3.3.2-40 also shows the average total annual volume of water passing La Grange Dam in excess of the Districts' proposed minimum flows by water year type. This excess water could be used to provide either additional pulse flows to benefit outmigrating smolts or potentially optimize juvenile floodplain rearing habitat. The spill management plan would allow key water-supply-entities (Districts and CCSF) to work collaboratively with the resource agencies (FWS and potentially NMFS and California DFW) to develop management strategies to make the best use of this excess water.

The flows included in the draft Voluntary Agreement would provide a lower volume of water available for spill management; however, this is primarily a result of

including floodplain pulse flows, which also serve to provide fall-run Chinook salmon with floodplain rearing habitat.

Table 3.3.2-40. Water volumes available for management[a] under the Districts' proposed minimum flows by water year type and number of days that flows of at least 1,750 cfs could be maintained in March and April via spill management (Source: staff).

Water Year Type	Average Total Annual Water Volume Passing La Grange Dam in Excess of the Districts' Proposed Minimum Flows (acre-feet)	Number of Days that Flows of at Least 1,750 cfs can be Maintained in March and April via Spill Management[b]
Wet	1,446,482	61
Above Normal	617,908	61
Below Normal	38,290	13
Dry	1,034	<1
Critical	0	0

[a] Assumes that all flows in excess of the Districts' proposed minimum flows can be stored for later usage.

[b] Note that the Districts' interim flows are the same as the proposed "with infiltration galleries" flows for this time period (250 cfs from March 1 to April 15 and 275 cfs from April 16 to April 30). The number of days shown were calculated using a minimum flow of 250 cfs.

FWS revised 10(j) recommendation 2 also recommends that the Districts seek recommendations on implementation of the spill management plan from the TPAC (FWS's revised Don Pedro 10(j) recommendation 4). While we agree that the formation of the TPAC could provide valuable guidance on the best use of excess water, we note that the Commission does not have the authority to require any agency or other stakeholder to join or participate in the group. An alternative approach would be for the Districts to consult with FWS, NMFS, and California DFW during development of the plan to get their recommendations on how to best manage and allocate spill flows in years when spill flows are projected to occur.

Ramping Rates and Fish Stranding

Rapid changes in streamflow associated with hydroelectric project operations have the potential to adversely affect aquatic resources by stranding fish in shallow, low gradient gravel bar areas and off-channel habitat; temporary loss of fish habitat or loss of habitat access; and dewatering of amphibians, aquatic insects, and plant life (Hunter, 1992). Fry and juvenile fish less than 2 inches long are normally the most vulnerable to

stranding because of their weak swimming ability; preference for shallow, low-velocity habitat such as edge-water and side channels; and a tendency to burrow into the substrate to hide. Rapid changes in stream flows also can affect fish behavior and reduce spawning success. Limits governing the rate and timing of project-induced stage changes (ramping rate restrictions) are often established at hydroelectric projects to protect aquatic organisms (Hunter, 1992; CH2M Hill, 1990). However, stranding is also a natural and complex occurrence on unregulated streams in association with flow changes resulting from runoff events. Although stranding may affect only a small percentage of the fish population at a time, and may occur naturally, repeated flow fluctuations such as hydropower-related pulsed flows can cause cumulative mortalities that can result in a significant fish loss.

In the Tuolumne River, unit outage at the La Grange Powerhouse can result in a disruption of otherwise continuous flows downstream of the powerhouse. During such outages, one or both of the TID sluice gates open and water is released into the sluice gate channel. Once power generation can be resumed, the sluice gates are closed, and the flow is reduced to the 5 to 10 cfs minimum flow. However, the alternating flow releases can attract migratory fishes into the sluice gate channel, where they are vulnerable to being stranded when flow resumes through the La Grange Powerhouse. Salmon redds are also vulnerable to being dewatered during these changes in flow releases, and these are located primarily between RM 51 and 47, or 1.2 to 5.2 miles downstream of the La Grange Diversion Dam (FISHBIO, 2013a).

The Districts do not propose any measures to limit ramping rates downstream of the La Grange Diversion Dam; however, they do propose to install a fish exclusion barrier at the entrance to the sluice gate channel. The fish exclusion barrier would prevent fish from entering the sluice gate channel during an outage, where dewatering or stranding could occur once hydropower generation is restored. The barrier would be designed to function during flows of up to 7,000 cfs.

California DFW recommends (10(j) recommendation M1-6) that the Districts follow the spring recession rates shown in tables 3.3.2-34 and 3.3.2-35 for the Tuolumne River at the La Grange gage and downstream of the infiltration galleries, respectively. California DFW further recommends (10(j) recommendation M1-8) that for all controllable flow rate changes above 200 cfs, and not already managed by the recession rates in tables 3.3.2-34 and 3.3.2-35, that flow increases should be less than or equal to double the amount of release during any 1-hour period, and decreases in flow should be no more than 2 inches per hour, and less than or equal to 500 cfs in any single 24-hour period.

NMFS recommends (10(j) recommendation 1.7) for both projects that incremental upramping should occur evenly over a 24-hour period, with a maximum of 500 cfs per 24-hour period, in all water years. Compliance would be measured at La Grange gage and a new gage located near RM 25. For downramping, when flows downstream of the La Grange Diversion Dam are less than 4,000 cfs from April 1 through July 31 in wet,

above normal, and below normal water years, NMFS recommends the Districts not reduce flows by more than 7 percent of the previous 24-hour average flow, unless required due to flood control operations or emergencies. When flows downstream of the La Grange Diversion Dam are less than 2,000 cfs from April 1 through July 31 in dry water years, NMFS recommends the Districts not reduce flows by more than 10 percent of the previous 24-hour average flow, unless required due to flood control operations or emergency. When the above two downramping scenarios are not in effect, downramping should occur evenly over a 24-hour period, and the Districts should not reduce flows by more than 500 cfs in any single 24-hour period. Compliance would be measured at La Grange gage and a new gage located near RM 25.

In their reply comments dated March 15, 2018, the Districts state California DFW fails to present evidence of either juvenile stranding or redd dewatering under existing operations, or potentially associated with proposed project operations. The Districts also state that NMFS's recommended ramping rates are specific, and NMFS does not provide evidence showing the need for these rates, what species they are expected to protect, or demonstrate an ongoing effect. The Districts further state that in the absence of evidence of an existing effect resulting from current operations or specific benefits to fish populations expected to be attained, there is no basis for the California DFW and NMFS's recommendations, and the benefits cannot be evaluated.

Our Analysis

The susceptibility of fish to stranding is a function of their behavioral response to changing flows, which depends on the species, body size, water temperature, time of year, and time of day. In general, there appears to be a consensus that reduced water flow, gently sloped shorelines, heavily structured littoral zones, cooler water temperatures, abrupt water level changes and poor water quality are conditions that increase the likelihood of fish stranding events (Nagrodski et al., 2012). Downstream of hydroelectric projects, a common conclusion has been that more rapid flow fluctuations have a greater potential to strand fishes; however, salmonid fry stranding studies on the Skagit and Sultan Rivers in Washington have shown that fry stranding in side channels and potholes was more related to ramping range than to down-ramping rate (Pflug and Mobrand, 1989; Olson, 1990; and Woodin, 1984). Numerous studies in California have shown that ramping rates in the 1 to 2 inches per hour range minimize any adverse effects on aquatic biota. For example, in 2004, PacifiCorp completed a literature-based assessment of the potential effects associated with ramping regimes in river reaches affected by the Klamath Hydroelectric Project. The study found that ramping rates ranging from 0.1 to 0.6 foot per hour resulted in minimal stranding and were well within the natural range of those found in unregulated river systems (PacifiCorp, 2004), and recommendations described in Hunter (1992) suggest that reductions in river stage of 1 to 2 inches per hour are generally protective of juvenile anadromous salmonids.

In 2001, the Districts filed a comprehensive report that reviewed the results of long-term stranding assessments conducted in the lower Tuolumne River between 1986

and 2000; evaluated the effectiveness of the 1995 Settlement Agreement's ramping rates; documented conditions under which stranding may occur; and identified potential areas for floodplain improvements. The review indicated that several factors contribute to the magnitude of juvenile stranding, including: (1) salmon density, (2) extent of flow reduction and the minimum flow in the fluctuation cycle (which determines the amount of potential stranding area exposed), (3) ramping rate, and (4) physical characteristics of sites in terms of slope and substrate. It also indicated the highest potential for stranding occurred between 1,100 and 3,100 cfs, which corresponds to a broad floodplain inundation zone in several areas of the spawning reach. In years of high juvenile salmon density, stranded salmonids were generally found on gently sloping stream banks and gravel bars on a wide range of substrates in the primary spawning reach (RM 36.5–50.7).

The Districts noted that little salmonid stranding has been documented following implementation of the 1995 Settlement Agreement, because the project no longer operates in a peaking mode in response to immediate system load demands. In addition, the 1995 Settlement Agreement also established the following limits on the rate of downramping from October 16 to March 15: (1) no more than 500 cfs per hour when flows are less than 2,000 cfs, (2) 700 cfs per hour when flows are between 2,000 and 2,700 cfs, and (3) 900 cfs per hour when flows are between 2,700 and 4,500 cfs.

However, some stranding of juvenile Chinook salmon has been documented during stranding surveys conducted since the ramping rates included in the 1995 Settlement Agreement went into effect. A report summarizing the results of stranding surveys conducted between 1986 and 2002 was provided in the 10-year summary report on monitoring conducted under the 1995 Settlement Agreement (Districts, 2005). The report documents counts of stranded salmon ranging from 0 to 67 during surveys conducted along transects at potential stranding sites. The highest counts of stranded salmon observed at these transects since 1995 included 54 salmon stranded when flows were reduced from 5,000 to 3,000 cfs on February 22, 1996, 21 salmon stranded when flows were reduced from 3,500 to 500 cfs on May 17, 1999, and 67 salmon stranded when flows were reduced from 7,000 to 4,000 cfs on March 20, 2000. Although the report does not identify the rate of stage change during the flow reductions, some stranding was observed in cases where flow changes were relatively minor, including 12 stranded salmon documented when flows were reduced from 243 to 193 cfs on May 17, 2002.

To evaluate the Districts' proposed and the resource agencies' recommended recession/ramping rates, we compared the hourly changes in modeled stage heights predicted at the La Grange gage during April through July across the period of record (1971–2012). We then calculated the percentage of time with modeled hourly stage decreases of less than or equal to 2.5 cm (1 inch) (table 3.3.2-41). Based on our analysis, the proposed and recommended flow regimes for the Don Pedro Project are compatible with maintaining an hourly stage change downstream of La Grange of 1-inch per hour, or less, from 97 to 100 percent of the time. However, more rapid changes in stage could

occur, with an associated increase in the risk of fish stranding, if the rate at which flows are diverted into TID or MID canals at the La Grange Project were to change rapidly.

Accordingly, it is likely that implementing a year-round downramping rate not to exceed 2 inches per hour would continue to protect juvenile salmonids in the lower Tuolumne River. Furthermore, decreasing flows at night (when possible), when Chinook salmon are less vulnerable to stranding (Connor and Pflug, 2004; Hunter, 1992; Olson and Metzgar, 1987; and Woodin, 1984), would further reduce the possibility of fish being isolated and/or dewatered along the channel margins and gravel bars. While it is possible that limiting upramping rates as recommended by California DFW could reduce disturbance during spawning and the downstream displacement of juvenile salmonids, there is not sufficient information describing the effects of rapid increases in flow on salmonids to allow the potential benefits of limiting upramping rates to be quantified.

Under existing conditions, salmonid stranding may occur in the sluice gate channel adjacent to the La Grange Powerhouse. The Districts' 2017 Fish Presence and Stranding Assessment (FISHBIO, 2017b) documented four fall-run Chinook salmon carcasses in the sluice gate channel during the September 2015 to April 2016 and September 2016 to January 2017 monitoring periods. Three male carcasses recovered in the sluice gate channel were post-spawn individuals. In addition to the four carcasses documented, four other fall-run Chinook salmon were observed in the sluice gate channel during outages in the 2015–2016 monitoring, and 42 other fall-run Chinook salmon were observed in the sluice gate channel during outages in the 2016–2017 monitoring (table 3.3.2-42). Based on the documented occurrence of salmonids in the sluice gate channel and observations of salmonid mortality due to stranding, installing a fish exclusion barrier at the sluice gate channel entrance, as the Districts proposed, would minimize the potential for additional salmonid stranding and mortality.

Table 3.3.2-41. Frequency that simulated hourly stage changes downstream of La Grange Powerhouse tailrace meet a ramping rate of 1-inch per hour or less, for all proposed and recommended flow regimes, water years 1971–2012 (Source: Districts, 2018b,f; 2020a,b).

Month	Base Case	Districts Interim	Districts With-IGs [a]	VA	NMFS	Calif. DFW	Water Board	Cons. Groups [a]	The Bay Institute	ECHO
January	99%	99%	99%	99%	100%	99%	100%	100%	99%	100%
February	100%	100%	100%	100%	99%	100%	99%	99%	99%	99%
March	100%	100%	100%	99%	99%	100%	100%	99%	99%	99%
April	99%	99%	99%	97%	99%	100%	100%	100%	99%	100%
May	98%	100%	100%	100%	100%	99%	100%	100%	100%	100%
June	100%	100%	100%	100%	100%	100%	100%	99%	100%	100%
July	99%	99%	99%	99%	100%	99%	97%	99%	100%	97%
August	99%	99%	99%	99%	99%	99%	99%	99%	100%	100%
September	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
October	97%	99%	99%	99%	98%	99%	98%	96%	98%	97%
November	100%	100%	100%	100%	100%	100%	100%	100%	97%	100%
December	100%	100%	100%	100%	100%	100%	99%	100%	100%	100%
All	99%	100%	100%	99%	100%	100%	99%	99%	99%	99%
April–July	99%	99%	99%	99%	100%	100%	99%	100%	100%	99%

[a] Although values for the Districts with-IGs and Conservation Groups scenarios are based on the Districts' March 17, 2020, filing (Districts, 2020a) to correct an inadvertent modeling error that was incorporated into the draft EIS, these values remained the same as in the draft EIS.

Table 3.3.2-42. Fish observations during sluice gate channel stranding surveys during the 2015–2016 and 2016–2017 monitoring seasons (Source: FISHBIO, 2017b).

Date	Number of Fish	Estimated Length (mm)	Fish Condition	Comments
11/30/15	1	700	Good	Relocated to the pool directly below powerhouse
12/15/15	1	600	Good	Relocated to the pool directly below powerhouse
12/15/15	1	800	Good	Relocated to the pool directly below powerhouse
12/15/15	1	700	Good	Swam volitionally to tailrace channel
12/25/15	1	780	Mortality	Unspawned female
10/20/16	2	600	Good	Low risk of stranding
10/29/16	4	600	Good	Low risk of stranding
11/3/16	20	600-800	Good	Low risk of stranding
11/11/16	8	600-800	Good	Low risk of stranding
11/14/16	6	600-800	Good	Low risk of stranding
11/23/16	2	600-800	Good	Low risk of stranding
11/24/16	1	845	Mortality	Spawned male
11/24/16	1	710	Mortality	Spawned male
11/25/16	1	805	Mortality	Spawned male

Reservoir Fish Stranding

The Districts' proposed instream and pulse flows and those recommended by the Water Board, FWS, NMFS, and California DFW, Conservation Groups, The Bay Institute, and ECHO could cause the Don Pedro Reservoir water surface elevations to fluctuate differently than under existing conditions, and in turn, could lead to fish stranding and nest dewatering. As described previously in the section 3.3.2.2, *Aquatic Resources, Environmental Effects, Streamflow and Reservoir Level Compliance Monitoring*, the Districts have historically operated the project for flood control, water supply, recreation, hydropower, and environmental benefits. Project operations can result in annual and multi-year changes in Don Pedro Reservoir water levels. The minimum

annual reservoir water level generally occurs from October to November, and the maximum water level generally occurs from May to June. Don Pedro Reservoir typically operates between elevation 690 and 830 feet. During the spring spawning season (March through June) reservoir elevations typically vary between 750 and 830 feet.

The Districts propose to lower the required minimum pool of Don Pedro Reservoir from the current elevation of 600 feet to 550 feet but are not proposing any other changes in the elevation of the reservoir. Stakeholders did not make recommendations regarding the Don Pedro Reservoir levels; however, their various instream flow recommendations could affect the reservoir levels, with higher minimum flows resulting in greater drawdowns.

Our Analysis

Don Pedro Reservoir offers anglers year-round fishing for cold- and warm-water species and hosts multiple fishing tournaments annually. However, routine project operations and maintenance can result in reservoir stage reductions during the black bass spawning period (March through June). The Districts evaluated the potential operational effects of the Don Pedro Project on bass nest survival (HDR, 2013c).

Under existing Don Pedro operations, black bass nest survival has equaled or exceeded a 20-percent survival rate at least 96 percent of the March through June spawning period from 1984 to 2010 (table 3.3.2-43). The Districts selected a spawning nest survival rate of at least 20 percent as necessary to maintain long-term population levels of highly fecund, warmwater fishes, such as black bass, based on Lee (1999). These data indicate that current operations of the reservoir are not adversely affecting black bass spawning.

Table 3.3.2-43. Percent of time that black bass estimated spawning nest survival has exceeded 20 percent in Don Pedro Reservoir for March through June, 1984–2010 (Source: HDR, 2013c).

Month	Largemouth Bass	Smallmouth Bass	Spotted Bass
March	100%	100%	100%
April	96.2%	96.2%	100%
May	100%	100%	100%
June	96.2%	96.2%	100%

Alternative instream flows could affect reservoir elevations differently; however, table 3.3.2-44 shows that the instream flows proposed by the Districts and those recommended by stakeholders generally would not result in daily changes in reservoir water surface elevation substantially different than under current Don Pedro Project operations. The various instream flow scenarios showed variable increases or decreases

Table 3.3.2-44. Simulated minimum, 90 percent exceedance, and median 1-day change in Don Pedro Reservoir pool elevation (feet) in all months, water years 1971–2012 (Source: Districts, 2018b,f; 2020a,b). [a]

Month	Base Case	Districts Interim	Districts With-IGs [a]	Draft Voluntary Agreement	NMFS	Calif. DFW	Water Board	Cons. Groups [a]	The Bay Institute	ECHO
Minimum										
January	-0.9	-0.9	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
February	-0.9	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
March	-0.8	-0.8	-0.8	-0.9	-0.8	-0.8	**-0.7**	-0.9	-0.8	-0.9
April	-0.8	**-0.7**	**-0.7**	-0.8	**-0.7**	**-0.7**	**-0.7**	-0.8	**-0.7**	-1.0
May	-0.7	**-0.6**	**-0.6**	**-0.6**	**-0.4**	**-0.6**	**-0.6**	-0.7	**-0.5**	-0.8
June	-0.7	-0.7	**-0.6**	-0.7	-0.7	**-0.6**	-0.7	-0.9	-1.1	-1.1
July	-1.0	-1.0	-1.0	-1.0	**-0.8**	**-0.7**	**-0.8**	-1.4	**-0.7**	**-0.7**
August	-0.8	-0.8	-0.8	-0.8	-0.8	-0.8	**-0.7**	-0.8	**-0.6**	-0.8
September	-0.6	-0.7	-0.6	-0.7	-0.7	**-0.5**	-0.6	-0.7	**-0.5**	**-0.5**
October	-0.5	-0.5	-0.5	-0.5	-1.0	-0.9	-0.5	-1.3	-0.6	-0.7
November	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.5	-0.3
December	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	**-0.4**	-0.5	-0.5	-0.5
90 Percent										
January	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
February	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
March	-0.3	-0.3	-0.3	-0.5	-0.3	**-0.2**	**-0.2**	**-0.2**	**-0.2**	-0.3
April	-0.3	-0.3	-0.3	-0.3	-0.4	-0.3	-0.3	-0.3	-0.3	-0.4
May	-0.1	-0.2	-0.2	-0.1	**0.0**	-0.1	-0.2	-0.1	-0.1	-0.4
June	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	**-0.3**	-0.4	-0.6
July	-0.6	-0.6	-0.6	-0.6	-0.6	**-0.5**	-0.6	-0.7	**-0.4**	**-0.4**

Month	Base Case	Districts Interim	Districts With-IGs [a]	Draft Voluntary Agreement	NMFS	Calif. DFW	Water Board	Cons. Groups [a]	The Bay Institute	ECHO
August	-0.6	-0.6	-0.6	-0.6	-0.6	**-0.5**	**-0.5**	-0.6	**-0.5**	**-0.5**
September	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	**-0.3**	**-0.3**
October	-0.3	-0.3	-0.3	-0.3	-0.5	-0.5	-0.3	-0.5	-0.3	**-0.2**
November	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.2	-0.1	-0.2	-0.1
December	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	0.0
Median										
January	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.1
February	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.3	0.2	0.2
March	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
April	-0.1	-0.1	-0.1	**0.0**	-0.1	-0.1	-0.1	**0.0**	-0.1	-0.1
May	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.1
June	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	-0.1	-0.2
July	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.4	-0.5	**-0.3**	**-0.3**
August	-0.4	-0.4	-0.4	-0.4	-0.5	-0.4	-0.4	-0.5	**-0.3**	**-0.3**
September	-0.2	-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2
October	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	**-0.1**	**-0.1**
November	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
December	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1

Notes: Bold values indicate less drawdown than base case conditions, and shaded values indicate a greater drawdown than base case conditions. Simulated minimum, 90 percent exceedance, and median one-day change values for the Districts' interim operations with additional 175-cfs boating flows below the infiltration galleries (IGs) on one weekend in June of wet, above normal, and below normal water years are within 0.1 foot of corresponding values for the Districts' interim flows without these additional boating flows.

[a] Although values for the Districts' with-IGs and Conservation Groups' scenarios are based on the Districts' March 17, 2020, filing (Districts, 2020a) to correct an inadvertent modeling error that was incorporated into the draft EIS, these values remained the same as in the draft EIS.

in reservoir levels; however, these differences were less than 6 inches. Therefore, regardless of which instream flows are required by any license issued for the Don Pedro Project, the potential for instream flows to dewater black bass nests or other aquatic habitat important to reservoir fishes would not change substantially from current conditions.

Fish Entrainment

Some fish entrainment likely occurs at powerhouse intakes in Don Pedro and La Grange Reservoirs. Fish entrained through powerhouses may be subject to injury or mortality during turbine passage, and this may affect the species composition and recruitment of fish to the reaches downstream of the projects. The fish populations subject to potential entrainment at the projects consist of resident species, since there are no anadromous species present upstream of La Grange Diversion Dam.

The Districts do not propose any measures to reduce fish entrainment at the Don Pedro or La Grange Projects. California DFW recommends (10(j) recommendation M8-1) that the Districts develop a facilities salmonid protection and monitoring plan for both projects, that includes provisions for: (1) assessments of all diversions from the Tuolumne River and of all gates where the Districts' canal systems enter the San Joaquin, Merced, Tuolumne, and Stanislaus River for potential access by salmonids; (2) proposed solutions to prevent salmonids from accessing the diversions and canal systems; (3) a monitoring program to determine entrainment rates at the diversions and canal systems at locations where return flow is spilled; (4) a reporting plan for annual and incidental notification requirements; and (5) a financial assurance plan to provide for the implementation of the facilities salmonid protection and monitoring plan.

FWS recommends (La Grange 10(j) recommendation 12) the Districts develop a fish rescue plan for the La Grange Project that would include provisions for rescuing fish that are entrained into the MID diversion tunnel from April 1 through June 15, and tagging and releasing rescued fish into the Tuolumne River downstream of La Grange Diversion Dam. The measure would also require the Districts to perform rescues weekly until 10 or more rescues are made during a rescue attempt, after which, rescue attempts would be performed daily. Rescue attempts could return to a weekly frequency when 10 or fewer rescues per day are performed and could cease entirely for the remainder of that year, if by May 16 less than two fish per day are rescued, for three consecutive sampling dates.

In their reply comments, the Districts state the MID diversion tunnel is not a project facility, and note that FWS's La Grange 10(j) recommendation 12 would require frequent dewatering and have significant potential effects on irrigation deliveries and costs to MID. The Districts note that the TID/MID canal system is also not part of the Don Pedro or La Grange Projects, but state that they are willing to develop jointly with California DFW protective measures to address straying salmon entering the canal system.

Our Analysis

Don Pedro Project—We assessed the potential for fish entrainment at the project by determining the elevation of the outlets from Don Pedro Reservoir and comparing that to the typical fish distribution in the reservoir. The Don Pedro power tunnel intake is located at elevation 534 feet, or about 296 feet to 156 feet below the water surface, given the typical operational elevation range of 830 feet to 690 feet for Don Pedro Reservoir. The inlet structure for the low-level outlet, which is used to pass up to 7,500 cfs when flows exceed the turbine capacity, is located at elevation 342 feet, or about 488 feet to 348 feet below the water surface. In 2012, the Districts surveyed reservoir fishes via gillnetting conducted at variable depths ranging as deep as 140 to 200 feet. During this sampling, the Districts collected 7.2 percent of the total adult gillnet catch in the deep-water net sets,[156] at a catch rate of 0.17 fish/hour, compared to a rate of 2.91 fish/hour in shoreline adult gillnet sets. Kokanee and Sacramento sucker were the two species captured in the deep-water gillnets, with kokanee accounting for 92 percent of the deep-water catch. Two of the gillnet sets were located near Don Pedro Dam at a depth of 100 feet. Only three fish were captured at these sites in 18.6 hours of fishing mid-water[157] and deep-water gillnets. Don Pedro Reservoir also contains several warmwater species (i.e., centrarchids) that were absent from deep-water gillnet samples, likely due to cooler water temperatures. Stocked coldwater species, however, occupy cooler, deeper water during the warmer periods of the year. The Districts' surveys, which sampled close to the depths for the zone of withdrawal for the power tunnel intake, indicate that few fish would be present in those deeper waters and be susceptible to entrainment. Because of the deeper depth and limited operation of the low-level outlet, fish entrainment through that outlet would be negligible.

Fish that are entrained into the power tunnel would enter the Don Pedro Powerhouse, which has four vertical Francis turbines. The survival rate for fish entrained through this type of turbine typically exceeds 70 percent (Cada, 2001). Considering the low number of fish occurring in deep water and the relatively high survival rate for fish entrained through the Don Pedro Powerhouse, the small number of fish lost to entrainment mortality is not likely to affect fish populations in Don Pedro Reservoir or the Tuolumne River downstream of the project. Therefore, there would be little need for any measures to limit fish entrainment at the project.

La Grange Project—The only diversions associated with operation of the La Grange Project that have the potential to entrain fish are the flow that is diverted into the La Grange Powerhouse via the TID intake, and 5-10 cfs that passes into the retired

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[156] The gillnets for the deepwater sampling were placed at 85 percent of the total depth, but no deeper than 100 feet.

[157] The gillnets for the mid-water sampling were placed at 50 percent of the total depth.

MID canal headworks[158] for release via the hillside sluice gates to maintain water quality in the plunge pool below La Grange Dam. Potential entrainment into the MID canal headworks is limited given that the headworks are only used to provide a small amount of bypass flow, and there appears to be only limited potential for injury for any fish that are entrained into the bypass flow that is released at this location.

The TID diversion tunnel intake is located on the east side of the reservoir, or left descending bank when looking downstream, at a depth of approximately 93 feet below the normal La Grange Reservoir water surface elevation. The intake for the La Grange Powerhouse, which contains two Francis turbine-generator units, is located on the TID canal just upstream of the TID main canal headworks, so fish entering the TID diversion tunnel could be exposed to entrainment through the La Grange Powerhouse. As previously mentioned in section 3.3.2.1, *Aquatic Resources, Affected Environment, Fishery Resources*, no known fish stocking has occurred in the reach of the Tuolumne River between the Don Pedro Dam and La Grange Diversion Dam, and species collected throughout this reach exhibited multiple age classes, indicating successful reproduction and population sustainability. Considering that the reservoir fish population appears to be self-sustaining, and any fish entrained through the powerhouse would likely have a survival rate of over 70 percent, entrainment-related effects associated with the proposed operation of the La Grange Powerhouse would be minimal, and measures to reduce fish entrainment at the project would provide little benefit.

The MID diversion tunnel and canal system and the TID canal system downstream of the intake for the La Grange powerhouse are not used for hydroelectric project operations and are not included in the license for either project. As a result, measures to rescue fish from or prevent fish from straying into the canal system would have no nexus to project operations, and it would not be appropriate to include these measures in any license issued for the project.

Anadromous Fish Passage/Reintroduction

Barriers to upstream fish passage can be natural or human-caused and often delay migrations and movements, fragment populations, or prevent access to critical habitat necessary to sustain populations. Natural barriers to fish passage can include waterfalls and debris obstructions (e.g., beaver dams); artificial barriers mainly include dams and road-stream crossings. Under existing conditions, both La Grange and Don Pedro Dams completely block upstream fish migration and impede downstream fish passage. Historic accounts indicate salmon were present in the upper Tuolumne River, perhaps as far upstream as Preston Falls, and in the lower Clavey River.

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[158] Because of maintenance and repair issues along the MID upper main canal, MID abandoned the headworks and upper portion of the canal on the west side of the dam and constructed a new intake and diversion tunnel to bypass this upper section.

Although the Districts do not propose to evaluate or provide fish passage facilities at the La Grange Diversion Dam or Don Pedro Dam, the Districts did implement a series of workshops and technical studies during the Integrated Licensing Process to evaluate the feasibility of reintroducing spring-run Chinook salmon and steelhead to the upper Tuolumne River. The Reintroduction/Fish Passage Assessment Framework processes (Assessment Framework) used in this evaluation were consistent with guidelines suggested by Anderson et al. (2014), which identify the need for a comprehensive approach to assess reintroduction feasibility with the goal of recovery of federally listed fish species. The Assessment Framework was intended to broaden the scope from only evaluating fish passage concepts and feasibility to evaluating the biological, regulatory and socioeconomic aspects as well.

In its preliminary section 18 fishway prescription, NMFS reserves its authority to prescribe the construction, operation, and maintenance of fishways at the projects, including measures to determine, ensure, or improve the effectiveness of such prescribed fishways, pursuant to section 18 of the FPA, as amended, until December 31, 2025.[159]

In its section 10(j) recommendation 5, Fish Passage Program Plan, NMFS recommends the Districts develop a fish passage program plan for providing safe, timely, and effective passage of juvenile and adult fish at the projects, to be developed with NMFS and the resource agencies. After approval by NMFS, the plan would be submitted to FERC for its approval and subsequent implementation by the Districts. To ensure that fishway design and operations can best accomplish safe, timely and effective fish passage, NMFS recommends the development of fishways include a phased Fish Passage Program Plan that assesses the feasibility and design of fishways and procedures for effective upstream and downstream passage. The Fish Passage Program Plan would include several fish passage actions (actions) that are intended to proceed in phases and use an adaptive management approach. The goal is to create facilities and operations that provide successful fish passage. The main phase consists of short-term actions within seven years from the issuance of licenses. Within the short-term phase, actions could occur concurrently as new information is gained, evaluated, and adaptively managed. These short-term actions are outlined in table 3.3.2-45. A more detailed description of these short-term actions is available in NMFS (2018a).

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[159] According to the San Joaquin River Restoration Settlement Act (SJRRSA, 2009), NMFS shall exercise its FPA section 18 authority to prescribe fish passage for Central Valley spring-run Chinook salmon reintroduced pursuant to the San Joaquin Settlement by reserving that authority until after the expiration of the term of the San Joaquin Settlement, December 31, 2025, or the expiration of the designation made pursuant to the reintroduction, whichever ends first. The SJRRSA (2009) does not provide similar FPA section 18 limitations for other anadromous fish species like California Central Valley steelhead.

Table 3.3.2-45. Short-term fish passage actions recommended by NMFS in its section 10(j) recommendation 5, Fish Passage Program Plan (Source: NMFS, 2018a).

Short-Term (ST) Fish Passage Actions	Years from Issuance of Licenses
ST-1. Form a Fish Passage Committee.	0.5
ST-2. Evaluate Salmonid Habitats Upstream of Don Pedro Reservoir.	1-4
ST-3. Develop a Stock Selection and Management Plan.	2-4
ST-4. Develop a 2-Year Pilot Fish Passage Program (Pilot Program).	2-5
ST-5. Implement the 2-Year Pilot Program.	5-7
ST-5.1. Design Adult Fish Collection and Handling Facilities.	7
ST-5.2. Evaluate Adult Fish Release Sites Above Don Pedro Reservoir and Juvenile Fish Release Sites Below La Grange Diversion Dam.	5-7
ST-5.3. Conduct Adult Collection and Transport Experiments.	7
ST-5.4. Conduct Downstream Juvenile Fish Passage Studies.	5-7
ST-5.5. Design Juvenile Fish Downstream Collection Prototype.	7
ST-5.6. Monitor and Evaluate the Pilot Program's Progress.	7
ST-5.6.1. Produce a Comprehensive Pilot Program 7-Year Report.	7

In their recommendation 2, the Conservation Groups advocate that NMFS should reserve its FPA section 18 authority to require fish passage for spring-run Chinook salmon and possibly steelhead to the upper Tuolumne River after 2025.

In their reply comments dated March 15, 2018, the Districts state that their completed Fish Passage Alternatives Assessment determined that reintroduction under the current conditions in the watershed is not feasible to support species recovery. This assessment included additional analyses of numerous factors relevant to available habitat in the upper Tuolumne River and comprises a comprehensive evaluation of reintroduction. The Districts also state that to the extent that additional studies are needed by NMFS to support its section 18 fishway prescription, these studies should have been performed by NMFS during the multi-year licensing process.

Our Analysis

Under existing conditions, both La Grange and Don Pedro Dams completely block upstream access to as much as 18.17 miles of accessible and 31.26 miles of potentially accessible[160] anadromous fish habitat in the upper Tuolumne River Basin, and also prevent or impede downstream fish passage (table 3.3.2-46). While a variety of fishways have been built at dams in California, Oregon, and Washington and have successfully transported salmon and steelhead past dams for many years, fish passage has not been provided in the Tuolumne River. However, NMFS is currently considering a requirement to provide fish passage at the La Grange and Don Pedro Projects for its potential to support the recovery of federally listed anadromous fish.

Table 3.3.2-46. Miles of riverine habitat accessible by anadromous salmonids if fish passage is provided at La Grange and Don Pedro Dams (Source: HDR, 2017d, as modified by staff).

River/Tributary	Accessible	Potentially Accessible
Mainstem Tuolumne River	17	24
North Fork Tuolumne River	0.52	1.69
Clavey River	0.2	2.05
South Fork Tuolumne River	0.45	1.9
Middle Fork Tuolumne River	0	0
Cherry Creek	0	1.62
Total	**18.17**	**31.26**

During implementation of their Fish Passage Facilities Alternatives Assessment (described below), the Districts identified significant biological and engineering data gaps that needed to be addressed to inform the development of fish passage alternatives at La Grange and Don Pedro Dams. To address these data gaps, the Districts, in consultation with the licensing participants, broadened the scope of their alternatives assessment to implement an Assessment Framework process for the upper Tuolumne River. This process, as approved by the licensing participants, was structured in a manner that was consistent with procedures described by Anderson et al. (2014),

[160] A potential barrier is a feature identified by the study team that may exhibit conditions that create an impediment to upstream fish passage of adult spring-run Chinook or steelhead on a partial or temporal basis, but where conclusions have not yet been developed to establish the duration, range of flows, or conditions when or if the feature is passable.

"Planning Pacific Salmon and Steelhead Reintroductions Aimed at Long-Term Viability and Recovery." Key elements incorporated into the Assessment Framework included ecological feasibility; biological constraints; and economic, regulatory, and other key considerations.

The Districts held their first two Assessment Framework Plenary Group workshops in early 2016, and meetings were attended by federal and state resource agencies, NGOs, and the public. Workshops identified important information gaps, outlined voluntary studies to be conducted by the Districts to address information gaps, identified information to be provided by NMFS, and established a series of technical subcommittees. The technical subcommittees were formed to help develop study plans, determine reintroduction goals and objectives, and identify appropriate water temperature targets and target species/life stages to be used in the reintroduction assessment.

On May 18, 2017, the Reintroduction Goals and Water Temperature technical subcommittees presented results of their tasks to Plenary Group members for review and approval. The final Tuolumne River reintroduction program goal statement is to "Contribute to the recovery of ESA-listed salmonids in the Central Valley by establishing viable populations in the Tuolumne River at fair and reasonable cost." Table 3.3.2-47 presents temperature guidelines for assessing reintroduction regarding thermal suitability.

As a component of the Assessment Framework, the Districts also conducted a Fish Passage Facilities Alternatives Assessment (HDR, 2017e). The goal of this assessment was to investigate the feasibility of providing upstream and downstream passage of spring-run Chinook salmon and steelhead at the La Grange and Don Pedro Dams.

During preparation of their preliminary fish passage alternatives, the Districts identified factors that influence both upstream and downstream fish passage and included information on species life history information and migration timing; access to collection and release locations; and operations, flows, water temperatures, and water surface fluctuations (reservoir and tailwater) above and below both La Grange and Don Pedro Dams. Together, these data played a key role in the preparation of fish passage facility alternatives that would comply with agency technical design criteria and guidelines.

Table 3.3.2-47. La Grange reintroduction assessment framework – upper Tuolumne River temperature and timing (Source: Watercourse Engineering and HDR, 2017).

	UOWTI (MWAT)	UTWTI (MWAT)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Spring-run Chinook Salmon[a,b]														
Adult upstream migration	64	68												
Adult holding	61	65												
Adult spawning	56	58												
Embryo incubation and emergence	56	58												
Fry rearing	65	68												
Juvenile rearing and downstream movement	65	68												
Smolt outmigration	63	68												
Steelhead[a,b]														
Adult upstream migration	64	68												
Holding	61	65												
Adult spawning	54	57												
Embryo incubation and emergence	54	57												
Fry rearing	68	72												
Juvenile rearing and downstream movement	68	72												
Smolt outmigration	55	57												

Note: UOWTI—Upper Optimum Water Temperature Index; UTWTI—Upper Tolerable Water Temperature Index; MWAT—Maximum Weekly Average Temperature.

[a] Dark-shaded areas represent known peak periods for the specified life stage, whereas light shaded areas represent presence.

[b] The absence of dark shaded areas for any life stage indicates that the Technical Committee did not identify any particular peak period based on the available date.

Using the results of this collaborative process, the Districts developed five potential upstream fish passage alternatives representing four upstream technologies to a conceptual level of design and evaluated these as part of the fish passage study. These alternatives included:

- Alternative U1A: Technical Fish Ladder – Bypass[161]
- Alternative U1B: Two Separate Technical Fish Ladders
- Alternative U2: Fish Lift with Technical Ladder at La Grange
- Alternative U3: Collection, Handling, Transport and Release (CHTR) Facility
- Alternative U4: Whooshh Fish Transport Tube.

Following an assessment of major functional elements, advantages, disadvantages, and assessment of technical feasibility based upon the evaluation factors defined above, the Districts determined that only Alternative U3: CHTR Facility was technically feasible. The remaining four alternatives were determined to not be technically feasible based upon the evaluation factors. Of the alternative concepts developed, none of the alternatives investigated that were volitional in nature could be considered likely to meet performance standards given the 213 feet of total reservoir fluctuation that can occur at Don Pedro Reservoir during the anticipated period of migration. Both the fish ladder and fish lift alternatives would require the integration of an experimental fish return flume or fish transport tube system at the fish passageway exit that would accommodate release of upstream migrating fish into Don Pedro Reservoir. Alternatives U1A, U1B, U2, and U4 also rely on adult upstream migration through Don Pedro Reservoir, which is likely to significantly reduce their overall adult passage efficiency (HDR, 2017e).

CHTR represents a relatively proven technology with numerous similar facilities in operation that, in general, exhibit high overall fish passage performance characteristics meeting resource agency performance criteria. When sited and designed to accommodate the unique site-specific conditions exhibited at La Grange Diversion Dam, this alternative is expected to meet performance criteria. Numerous examples of CHTR facilities exist in the Pacific Northwest that collect and transport adult spring-run Chinook and steelhead with high levels of performance and low levels of injury or direct mortality.

The Districts also developed and evaluated the following four potential downstream fish passage facility alternatives to a conceptual level:

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[161] Two potential fish ladder alternatives are considered in this study for the purposes of providing upstream fish passage. Alternative U1A includes a single continuous navigational pathway that bypasses both La Grange and Don Pedro Dams. Alternative U1B includes two separate technical fish ladders: one that bypasses La Grange Diversion Dam; and a second that bypasses Don Pedro Dam.

- Alternative D1: Fixed Multi-Port Collector with Helical Bypass near Don Pedro Dam
- Alternative D2A: Floating Surface Collector near Don Pedro Dam
- Alternative D2B: Floating Surface Collector near Head of Reservoir
- Alternative D3: Fixed In-River Collector.

None of the downstream alternatives were determined to be technically feasible based upon the evaluation factors defined above. Of the technologies evaluated, only one alternative has examples of facilities that are currently in operation: Alternative D2A.[162] The remaining alternatives represent types of downstream fish passage technologies that are yet to be applied in practice at a full scale, and it cannot be known how or whether such a facility will work. For all alternatives, the anticipated reservoir passage efficiency and collection efficiency standards are not likely to meet the performance standards required at other high dam facilities in operation.

Operation of a floating surface collector near Don Pedro Dam is highly unlikely to provide safe, timely or effective downstream fish passage for out-migrating anadromous salmonids. The high head nature of the dam combined with the dramatic (i.e., up to 213 feet) fluctuations in reservoir surface elevation in Don Pedro Reservoir and associated seasonal changes in temperature and velocity create challenging conditions for fish collection. No existing collection facilities currently operate under such dynamic conditions, and operation of a juvenile downstream collection facility at the head of reservoir would be experimental in nature (HDR, 2017e).

Based on the above information, it is apparent that the mainstem Tuolumne River and its tributaries upstream of Don Pedro Reservoir contain anywhere from 18 and 31 miles of potentially accessible anadromous fish habitat of varying quality and that upstream passage is feasible at La Grange Diversion Dam via Alternative U3.

If adult anadromous fish should successfully spawn and rear in the upper Tuolumne River Basin, out-migrating juveniles would also require safe, timely and effective downstream passage at Don Pedro and La Grange Dams. However, existing reservoir conditions (extreme drawdowns, low water velocities, high water temperatures, and risk of predation) would likely preclude or severely limit the efficacy of any reservoir or dam-based downstream fish collection facility. In addition, inflows ranging from approximately 90 to 10,600 cfs during the outmigration period, unstable channel conditions, and an existing Wild and Scenic River designation would likely prohibit the construction and operation of a permanent in-river collector upstream of Don Pedro Reservoir. Given these constraints, a temporary/portable in-river collection device or

[162] PacifiCorp's Lewis River Hydroelectric Projects, WA operates a floating surface collected near Swift Dam in Swift Reservoir, which is moderately successful at collecting downstream migrants.

series of these devices at the upstream end of Don Pedro Reservoir may be the only biologically viable option for downstream passage, and even then, the use of these devices may be restricted pursuant to the Wild and Scenic River designation.

As is the case for numerous hydroelectric projects in California, NMFS's request for reservation of authority to prescribe fishways under section 18 of the FPA would help maintain the flexibility necessary to respond to new information during the license term (e.g., fish passage needs, project modifications, management goals, environmental conditions, and technological innovations), and allow for potential future installation of fishways, if feasible and needed. However, we conclude that certain elements of NMFS's preliminary section 10(j) recommendations (table 3.3.2-45) are not justified, based on the Districts' analysis of the feasibility of establishing viable populations of federally listed salmonids in the upper Tuolumne River Basin. In addition, NMFS has not shown that fish passage above the La Grange Diversion Dam would be reasonably certain to occur in the near future.

However, with the NMFS reservation of authority under section 18, and with the standard fish and wildlife reopener article, fish passage could be provided in the future if an appropriate administrative record were developed and provided to the Commission supporting the need for upstream or downstream anadromous fish passage at the La Grange or Don Pedro Dams, after notice and opportunity for hearing.

Fish Enumeration and Predator Control

Although not required by the current license, the Districts have been operating a seasonal fish counting weir at RM 24.5 since 2009, about 27.7 miles downstream of the La Grange Diversion Dam. The Districts also operated two additional temporary fish counting weirs during their licensing studies. One weir was located approximately 1,000 feet downstream of La Grange Diversion Dam in the main channel, and the other was approximately 140 feet downstream of the La Grange Powerhouse in the tailrace channel. The Districts operated these temporary weirs from September 23, 2015, through April 14, 2016, and from September 20, 2016, through January 2, 2017.

Under any new license issued for the project, the Districts propose to construct and operate a small permanent fish counting/barrier weir (less than 5 feet of head at normal flows) at approximately RM 25.5 (about 26.7 miles downstream of the La Grange Diversion Dam), to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitats. The weir would be a reinforced concrete structure consisting of the following components: (1) a right concrete abutment merging with natural grade, (2) a Denil-type fishway and counting structure with a viewing window and fish sorting capabilities, (3) a bottom drop gate with a maximum hydraulic capacity of 75 cfs providing attraction flow to the fishway entrance, (4) a spillway section, (5) middle abutment, (6) a non-motorized craft (kayak/canoe/raft) bypass structure with flap-gate control and concrete chute; and (7) left concrete abutment merging with natural grade.

To further reduce predation on Chinook salmon by striped and black (largemouth and smallmouth) bass, the Districts also propose to implement a predator control and suppression plan that would include active control and suppression of striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir. Control and suppression measures would include, but would not be limited to, sponsoring and promoting black bass and striped bass derbies and reward-based angling in locations both above and below the fish counting/barrier weir, and removal and/or isolation via electrofishing, seining, fyke netting, and other collection methods. To document compliance with this measure, the Districts propose to file an annual report on black bass and striped bass reduction efforts undertaken during the prior calendar year. The Districts would conduct a survey every five years to identify the number of fish to be targeted to reduce the bass population by 10 percent in succeeding years. Additionally, the Districts would seek and advocate for changes to current fishing regulations for the lower Tuolumne River (e.g., length of season, bag limit, catchable size, requested removal of black bass/striped bass caught, allowing a bounty program) to reduce black and striped bass numbers. The Districts propose to establish a fund to carry out these activities and to educate the public on the adverse effects of introduced predatory species on fall-run Chinook salmon in the Tuolumne River,[163] to encourage participation in the removal program and advocacy of changes to fishing regulations that facilitate such removal. To monitor compliance with this measure, the Districts propose to file an annual report describing the specific educational and advocacy measures undertaken during that year. All of the elements of the predator control and suppression plan described above were included in the draft Voluntary Agreement submitted to the Water Board by California DFW and California DWR on March 1, 2019.

In its letter filed January 29, 2018, NMFS states that the Districts' proposed predator control suppression plan is not beneficial to salmonids and does not address the problem that juvenile salmonids have very little floodplain refugia in the lower Tuolumne River and that predator fields (e.g., SRPs) are maintained by the projects' flows and sediment retention. Furthermore, they state that the proposed fish counting/barrier weir at RM 25.5 can also act as a partial migration barrier to Chinook salmon and steelhead and is likely to result in a predator field becoming established downstream of the weir. NMFS also comments that many of the measures in the Districts' proposed predator control and suppression plan range from having the potential to measurably adversely affect salmonids (e.g., electrofishing during outmigration), to having little to no potential for a measurable benefit to salmonids (e.g., a public sport-fishing derby). While NMFS does not recommend any specific predator control measures, it states that the flow and habitat measures included in its 10(j) recommendations are intended to improve habitat

[163] The Districts suggest that activities could include, but would not be limited to, developing educational materials about the effects of predatory fish, community outreach, or kiosks.

and reduce predation. These recommendations include substantially increasing springtime flows to expedite smolt outmigration, increasing base flows that would make water temperatures less suitable for predatory fish, implementing large-scale gravel augmentation that would help to fill in the SRPs, implementing floodplain activation flows to increase access to floodplain refugia, and augmenting LWM to provide structural habitat partitioning that provides protection from predation.

California DFW recommends (10(j) recommendation M6) the Districts revise their proposed predator control and suppression plan to include: (1) recommendations for shaping spring pulse flows, recession flows, and how to best meet temperature requirements consistent with requirements of CWA § 303(d) that favor native fish and dissuade non-native predatory fish; (2) recommendations, priorities, and conceptual designs that would be used to conduct the annual placement of sediment and LWM (California DFW 10(j) recommendation M4) to minimize predator habitat and to favor cover habitat for salmonids; (3) monitoring activities that can be readily incorporated in other required monitoring activities conducted by the Districts and members of the TREG; and (4) performance measures and monitoring actions to evaluate the outcomes of any recommendations from the revised predator control and suppression plan that are incorporated into ongoing FERC required measures. California DFW further recommends (10(j) recommendation M6) that the Districts should prepare annual predation monitoring reports as well as a predation monitoring synthesis report every five years that would report on the synthesis of all required predation monitoring activities for the last five years, including analysis of trends and results of meeting performance measures that are part of the predator monitoring plan. California DFW also recommends that the Districts revise their proposed predator control and suppression plan to include monitoring activities that may be conducted by any member of the TREG.

The Conservation Groups state that they strongly oppose the installation of a permanent fish counting/barrier weir at RM 25.5, but support installation of a temporary seasonal fish counting weir and a temporary weir to capture striped bass and black bass in critically dry and super critically dry water years only. The Conservation Groups (recommendation 7) recommend the Districts: (1) annually install a temporary fish counting weir at or near RM 24, from September 15 through at least December 31, with the same basic configuration as the facility that the Districts have deployed since 2009; (2) install a temporary weir in critically dry and super critically dry years, from no later than April 15 to September 1, between RM 25.9 and RM 25 for the purpose of capturing and removing striped bass, black bass, and other non-salmonid predatory fish, with no permanent infrastructure related to the weir; and (3) relocate striped bass captured at the temporary weir to San Francisco Bay, and black bass and other warmwater predatory fish to reservoirs where salmonids are not present and are isolated from the Tuolumne River or other salmonid-bearing waters. The Conservation Groups (recommendation 7) also recommend the Districts conduct two snorkel surveys between April 20 and June 30 in any year that the weir is installed, both 300 feet upstream and downstream of the temporary weir and monitor the numbers, species and size of fish captured at the weir.

The Districts would report the initial results of the snorkeling surveys to TRTAC as soon as data are compiled, with a written report on fish captured at the weir and the results of the snorkel surveys provided to TRTAC within six months of the removal of the weir.

Regarding California DFW's recommendation for the Districts to revise their proposed predator control and suppression plan to include monitoring conducted by any member of the TREG, the Districts state in their reply comments that no basis exists for it to be held financially liable for activities by others for a watershed-wide problem not of the Districts' making. They also state that Conservations Groups' statement that installing a temporary weir can be effective at capturing predators during periods of very low flows is not supported by any data but has nevertheless been noted for consideration. The Districts also state that Conservations Groups' recommendation to relocate striped bass to San Francisco Bay should not be adopted because the Bay would still be in the migration corridor of Tuolumne River Chinook juveniles, and instead, any successful predator removal should require relocation to non-anadromous waters.

Some members of the public who offered oral testimony at the evening public draft EIS meeting held in Modesto, California, on March 26, 2019, were local anglers who oppose the removal of predatory fish, especially lethal removal.

Our Analysis

The lower Tuolumne River supports large numbers of non-native largemouth, smallmouth, and striped bass. While these species support a popular recreational fishery, they are highly piscivorous and are known to consume large numbers of juvenile salmonids (FISHBIO, 2013b). Predation of juvenile salmonids by introduced species may be a major source of their mortality under low-flow conditions in the Tuolumne River and SRPs appear to provide ideal habitat for predators.

During the spring of 2012, the Districts conducted a series of investigations to quantify the effects of predation on juvenile Chinook salmon rearing in and migrating through the lower river (FISHBIO, 2013b). Specifically, these studies estimated the abundance of predatory fish species, assessed predation rates on juvenile Chinook salmon, and tracked the movements of predatory fish in relation to juvenile Chinook salmon.

Between March 1 and May 31, 2012, the estimated number of smallmouth bass (>150 mm fork length) in the lower Tuolumne River (from RM 0 to RM 39.4) was 9,092 and 6,764, based on area and shoreline length, respectively. The estimated number of largemouth bass (>150 mm fork length) was 3,796 and 5,843, and the estimated number of striped bass (>150 mm fork length) was 588 and 692, based on similar methodology. Largemouth bass were captured in all reaches sampled between RM 3.7 and RM 32.9 but not upstream of RM 34.8, smallmouth bass were captured throughout the study reach (RM 3.7 to RM 38.4), and striped bass found from RM 3.7 to RM 35.0.

The estimated number of juvenile Chinook salmon potentially consumed annually by these predators was 15,495 for largemouth bass, 20,501 for smallmouth bass, and

6,193 for striped bass. Using the estimated losses of juvenile Chinook salmon observed by RSTs in the Tuolumne River from 2007 through 2011, the Districts estimated the number of juvenile Chinook salmon lost each year ranged from 47,000 to 270,000.[164] Based on these results, the authors hypothesized that the majority of juvenile Chinook salmon mortality in the Tuolumne River during most years may be due to predation (FISHBIO, 2013b).

The Districts' proposed permanent upstream migrant fish counting/barrier weir located at RM 25.5 would include a Denil-type fishway and counting window to facilitate fish counts, fish species separation, and broodstock collection. It would also provide a barrier to exclude striped bass from upstream habitats used for rearing by juvenile fall-run Chinook salmon and prevent black bass movement into sections of river upstream of RM 25.5. Furthermore, the proposed fish counting/barrier weir would be capable of being operated year-round and in river flows up to at least 3,000 cfs.[165] The annual operation of this weir, in combination with the Districts' proposed predator control and suppression plan would also facilitate the removal of bass and other predatory fish in the lower river.

In the draft EIS, we stated that while the above measures would likely reduce predator abundance in the lower Tuolumne River and theoretically decrease the amount of predation on juvenile Chinook salmon, it was not known if they would have a measurable benefit to Chinook salmon or *O. mykiss*, based on the apparent ineffectiveness of a predator removal program conducted at Clifton Court forebay (California DWR, 2017). However, we reevaluated this assessment based on subsequent filings made by the Districts and review of additional studies on the effectiveness of predator removal programs on survival rates of Chinook salmon.

In their response to comments on the draft EIS filed on August 16, 2019, the Districts identified several large-scale management programs that are currently being implemented in North America to remove or suppress predatory fish to benefit native fish species and several studies that examined survival responses of Chinook salmon to non-native fish removal in California. The Districts attached a summary of these programs and studies to their comments, along with links to multiple sources of information on each program. The large-scale programs include: (1) Northern Pikeminnow Predator Control Program on the Columbia and Snake Rivers, which is estimated to have reduced predation of juvenile salmonids by 40 percent through sport fishing, site-specific gill nets, and angling at dams; (2) Upper Colorado River Endangered Fish Recovery Program, which uses measures such as electrofishing, sport fishing tournaments, net capture, and

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[164] It is not clear what proportion of juvenile mortality can be directly attributed to fish predation.

[165] The existing temporary seasonally operated Alaska-type counting weir located at RM 24.5 must be removed when flows reach 1,500 cfs.

exclusion barriers; (3) mechanical removal of non-native fishes in the Colorado River, which has reduced populations of non-native fish through electrofishing; (4) Great Lakes Restoration Initiative Action Plan, which has used pathway blocking, tributary barriers, and traps to create "[o]ne of the longest-running and most effective invasive control technology programs" for sea lamprey; and (5) Yellowstone's Native Fish Conservation Plan, which has significantly reduced lake trout populations through entrapment nets, tagging, gill netting, and catch-and-kill programs. Example experimental studies examining survival responses to non-native fish removal in California include: (1) Mokelumne River at Woodbridge Irrigation District Dam, which involved, in part, predator removal with boat-based electrofishing (Sabal et al., 2016); (2) North Fork Mokelumne River downstream of the Delta Cross Channel (Cavallo et al., 2012), which involved predator removal by electrofishing; and (3) an ongoing collaborative project (Save the Stan, 2019) between FishBio and NMFS on the Stanislaus River, which studies the effect of predation on juvenile salmonid survival and migration to inform the development of a management plan.

In addition to the studies and programs listed above, we also reviewed a recent study entitled "*Limitations of Active Removal to Manage Predatory Fish Populations*" (Michel et al., 2020), which was filed into the record by the Tuolumne River Trust on February 12, 2020. This study was conducted during 2014 and 2015 along a 25-km reach of the San Joaquin River from approximately the highest extent of tidal influence near Mossdale, California, downstream to the Port of Stockton, California. The study involved nine 1-km reaches consisting of three "removal" reaches where predatory fish were removed via electrofishing, three "addition" reaches to which the predatory fish were relocated, and three control reaches where predatory fish were neither removed nor relocated. Largemouth bass and striped bass were treated as potential predators if their lengths were 150 mm or greater, while all other species were considered potential salmonid predators if their lengths were 200 mm or greater. Predation rates at each reach were monitored by two methods: the release and tracking of radio-tagged Chinook salmon smolts, and the use of "predation event recorders" (PERs), consisting of buoys with a live Chinook salmon smolt attached, which were drifted through each reach.[166] Supplemental electrofishing efforts were conducted 2–3 weeks after the removal/relocation efforts to estimate the number of predators that moved back to their original reach based on PIT-tag recoveries.

During the two years of the study, 2,972 predatory fish were relocated, of which 1,930 were PIT-tagged. Most of the removed predators were either largemouth bass (40.7 percent) or striped bass (41.4 percent), followed by white catfish and channel catfish. Based on the results of radio tag and PER monitoring, the authors concluded that

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[166] Each PER included a GPS tracker, a predation-triggered timer that recorded the time and location of the predation event, and a GoPro camera that was intended to identify predatory fish species when there was sufficient light.

the study provided little evidence that reach-specific predator density manipulations affected smolt survival or predation rates, and that further studies are needed to determine the conditions under which physical predator removals could be an effective management tool in the Sacramento–San Joaquin Delta.

However, the results obtained via both methods were affected by factors that may understate the potential benefit of predator fish removal efforts. Of the three groups of radio-tagged smolts that were released, the first two groups passed through the study reaches before the predator fish removals/additions occurred. The third group passed through the study reaches 4 to 13 days after the predator fish removals/additions, which allowed time for predatory fish, especially the highly migratory striped bass, to move into the treatment reaches before the radio-tagged smolts moved through the treatment reaches.[167] In addition, the PER predation monitoring approach was reported to be less effective in shallow-water environments with aquatic vegetation, which is also ideal habitat for smallmouth and largemouth bass.

The results of this study do not suggest that the predator control and suppression program proposed by the Districts would be ineffective for the following reasons: (1) under the Districts' proposal the predatory fish collected would not be released back into the Tuolumne or San Joaquin rivers and would thus be permanently removed from the population; and (2) the permanent barrier weir would prevent all upstream movement of predatory fish into the river upstream of the barrier weir, potentially allowing for the eradication of striped bass and possible eventual eradication of smallmouth and largemouth bass from habitat upstream of the weir. These aspects would substantially limit the ability of predatory fish to repopulate the treatment area, as was observed in the Michel et al. (2020) study.

The Districts also note in their comments filed on November 19, 2019, in response to discussion of predation that occurred at the September 19, 2019, 10(j) meeting and the Commission staff summary of the meeting, that predation on Chinook salmon smolts in the Tuolumne River has been identified as a substantial issue by the agencies represented at the meeting. They note that NMFS's filing of terms and conditions state that one of the primary purposes of its section 10(j) recommendations is to reduce predation, and that California DFW's 10(j) recommendation 6 includes a suite of flow and non-flow measures intended to reduce predation and increase juvenile salmon survival. While FWS does not propose a specific predator control plan in its filing of revised 10(j) recommendations, it acknowledges that the Districts' predation management strategy, including a fish counting/barrier weir and predator control and suppression measures, would be beneficial if the predation rate reductions anticipated by the Districts were

[167] During the follow-up electrofishing conducted 2 to 3 weeks after removal efforts, 83 percent of PIT-tagged fish that were recaptured had returned to the reach from which they had been relocated.

achieved, and FWS committed to "participate with the License applicants to provide technical assistance as they undertake and refine their predation management strategy." In their comments filed on November 19, 2019, the Districts also note that California DFW's and NMFS's leadership have stated in public testimony[168] the importance of addressing predation in the Tuolumne River.

The results of production modeling filed by the Districts in response to staff's September 17, 2019, AIR provide further support for the relative benefits of implementing predator control measures. These results indicated that achieving a 20 percent reduction in predation upstream of the proposed fish counting/barrier weir and a 10 percent reduction in predation downstream of the weir would increase Chinook salmon productivity (measured by the number of smolts produced per spawning female) by 66 percent in a population of 2,000 female spawners and by 63 percent in a population of 10,000 female spawners, over the production that would occur with implementation of the increased flows specified in the draft Voluntary Agreement alone (Districts, 2020c). Modeling results indicated that the relative benefit to *O. mykiss* were more limited, with an increase in young-of-year production of 8 percent under both low and high population densities. Based on the information filed by the Districts on the widespread implementation of predator control programs, the reported effectiveness of predator removal efforts demonstrated in recent studies, and the fish production modeling results summarized above, we agree that measures to control predator populations would benefit juvenile Chinook salmon and *O. mykiss*. Predator control would also complement the provision of spring pulse flows to expedite the emigration of salmon smolts and habitat improvement measures that would reduce habitat for predatory fish, provide escape cover, and habitat partitioning.

In the draft EIS, we noted that the Districts' proposed fish counting/barrier weir would be an impediment to salmonid migration in the Tuolumne River and could serve to increase predation if predatory fish aggregate downstream of the weir. Given the potential magnitude of relative benefits to Chinook salmon and *O. mykiss* from reducing the population of predatory fish, as indicated by the Districts' production modeling

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[168] The Districts note that on December 12, 2018, at a public hearing before the Water Board, Mr. C. Bonham, Executive Director of California DFW, stated unequivocally that predation of salmon by non-native fish is a "limiting factor" in the lower Tuolumne River and voiced California DFW's support for the barrier weir concept and a comprehensive predator control plan. Similarly, the Districts note that NMFS's leadership has consistently identified predator control as a significant issue in California dating back to February 10, 2016, when NMFS's then-director Will Stelle testified before the U.S. House Committee on Natural Resources that NMFS acknowledged and recognized the importance of predator management as a high priority for salmon recovery and survival and stated that predation is "unequivocally" a problem and striped bass predation, in particular, is a "major problem" in the Central Valley.

results, the benefits of the Districts' proposed predator control measures may outweigh any adverse effects associated with the weir, if an increase in predation associated with the potential congregation of predatory fish below the weir can be avoided. The addition of a monitoring and adaptive management component to the Districts' proposed predator control and suppression plan designed to detect any aggregation of predators below the weir, implementation of measures to remove predators that do aggregate below the weir, and monitoring the effectiveness of those measures could address this potential adverse effect. The weir would also enable the monitoring of the upstream migration of adult salmonids, which would help to guide and assess the effectiveness of fall pulse flows for promoting upstream migration. However, the management of predatory species by blocking their upstream movement at the weir, monitoring and controlling their numbers below the weir, are all fishery management actions that are typically the responsibility of state and federal fishery management agencies.

The temporary weir recommended by the Conservation Groups for installation in critically dry and super critically dry years for the purpose of capturing and removing striped bass, black bass, and other non-salmonid predatory fish would only prevent the upstream migration of non-native predatory fish while it is in place, while the permanent weir would provide the potential for their eventual elimination from habitat upstream of the weir. Regarding their recommendation to relocate striped bass captured at the temporary weir to San Francisco Bay, we agree with the Districts that this would provide little benefit because salmon smolts from the Tuolumne River are subject to predation in the bay, and nothing would prevent the translocated striped bass from migrating back into the Tuolumne River.

Anglers who offered oral testimony at the evening public meeting to receive comments on the draft EIS were uniformly opposed to the removal, especially lethal removal, of predatory fish as part of the Districts' proposed predator suppression and control plan. Opposition by anglers may be reduced if fish that were removed from the river could be transferred to local water bodies such as Turlock Lake or Modesto Reservoir to augment the fisheries in those waters, if this is acceptable to California DFW. Anglers may also be more accepting of removal via sponsoring and promoting black bass and striped bass derbies and reward-based angling compared to other means of removal, and these events should help to improve public awareness of the adverse effects of non-native predatory fish on native species. Reward-based angling could be particularly effective at addressing predator aggregations downstream of the fish counting/barrier weir, where their concentration should provide effective angling opportunities and where administration would be easier than a river-wide program, given that the effort would be concentrated on a short reach of the river where participation and harvest could be effectively monitored. Again, these types of activities are related to fisheries management under the jurisdiction of state and federal agencies.

Regarding the Districts' proposal to seek and advocate for changes to current fishing regulations for the lower Tuolumne River (e.g., length of season, bag limit, catchable size), we note that there appears to be significant potential to increase the

harvest of striped bass through changes in regulations. Currently, the Tuolumne and San Joaquin Rivers are managed under the statewide regulation that limits harvest of striped bass to two fish greater than 18 inches in length, while some waters in the state have special regulations that allow harvest of up to 10 fish with no size limit. If California DFW were to apply these more liberal regulations to the San Joaquin and Tuolumne Rivers, this should increase harvest and reduce predation on Chinook salmon smolts during their outmigration. The statewide regulations for black bass in rivers and streams are comparatively liberal (up to five fish with no size limit) and appear to offer less potential for increasing harvest through changes in regulations. But as noted above, these are fishery management activities under the jurisdiction of state and federal agencies.

In addition to the proposed predator control and suppression plan, several other measures proposed by the Districts would help to reduce the level of predation on juvenile Chinook salmon and *O. mykiss*. These include: (1) increased base flows that would provide more escape cover[169]; (2) spring pulse flows that would reduce predation by expediting the outmigration of Chinook salmon smolts; (3) gravel augmentation that would help to gradually fill the SRPs that represent preferred habitat for largemouth and smallmouth bass; and (4) habitat enhancement measures to be implemented through the LTRHIP that would increase the available amount of escape cover. The inclusion of LWM augmentation as part of the LTRHIP would also help reduce predation by further increasing cover and habitat partitioning.

Spawning Habitat Improvement

The availability and composition of river gravel influences suitability of spawning habitat for anadromous and resident fish. Coarse gravel also provides substrate for algae and invertebrates, both of which are important components of the aquatic food web. Mitigating any adverse effects associated with operation of the project through the implementation of gravel augmentation projects could benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Tuolumne River. However, any recommended or proposed mitigation measures must demonstrate a clear nexus to the project and consider the Districts' ongoing role in providing water supply, flood control, hydroelectric generation, and recreation.

To improve spawning conditions for fall-run Chinook and *O. mykiss*, the Districts propose (RPM-1) to implement a coarse sediment management program, which would add coarse (0.125 to 5.0 inches in diameter) sediment from RM 52 to RM 39 over a 10-year period following issuance of a new license. The Districts filed preliminary gravel

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[169] Increased flows would raise water levels and allow greater access to streamside structure (such as vegetation, undercut banks and LWM) and increase the amount of area with turbulence, both of which can provide areas where fry and juvenile salmonids are less visible to predatory fish).

augmentation designs,[170] which would result in placement of a total of 75,000 tons of gravel at six sites (Riffle A2 at RM 51.7, Riffle A3 at RM 51.5, Riffle A5 at RM 51.2, Riffle A6 at RM 41.0, Basso Upper at RM 47.2 and Basso Lower at RM 47.0). Monitoring associated with this measure would include (1) a spawning gravel evaluation in year 12 of the augmentation program using methods comparable to those employed for the Spawning Gravel in the Lower Tuolumne River Study Report (Stillwater Sciences, 2013d), and (2) annual surveys of fall-run Chinook and *O. mykiss* spawning use of new gravel patches for five years following completion of gravel augmentation. The estimated amount of coarse sediment to be augmented would be approximately 75,000 tons, or almost 10 times the amount of coarse sediment lost over the 8-year period as estimated in the Spawning Gravel Study.

In addition, the Districts propose (RPM-2) to provide flows of 6,000 to 7,000 cfs (measured at the La Grange gage) to mobilize gravel and fines. Flows would be provided for at least two days at an estimated average frequency of once every three to four years, i.e., during years when sufficient spill is projected to occur. In years when the La Grange gage spring (March through June) spill is projected to exceed 100,000 acre-feet, the Districts would plan to release a flow of 6,500 cfs for two days within the spill period, with downramping not to exceed 300 cfs/hour. Monitoring associated with this measure would consist of conducting substrate surveys at designated test sites located upstream of RM 43 prior to a high-flow event and then examining the same test sites following the flow event to evaluate whether corresponding changes occur in channel morphology or improvements to the quality of spawning gravel via a reduction in interstitial fines. Flow magnitude and/or duration may be adjusted based on these observations.

The Districts also propose (RPM-4) a five-year experimental gravel cleaning program. Each year of the program would consist of two to three weeks of cleaning select gravel patches using a gravel ripper and pressure wash operated from a backhoe, or equivalent methodology. The Districts would conduct *O. mykiss* spawning and redd surveys in areas planned for gravel cleaning prior to commencing any gravel cleaning, to ensure that the areas have not already been used for spawning that year and contain redds. Subject to the results of these surveys, the gravel cleaning might coincide with May pulse flows to benefit Chinook salmon smolt outmigration by providing increased turbidity to reduce predator sight feeding effectiveness. Monitoring associated with this measure would consist of substrate surveys at designated test sites. Monitoring would be implemented prior to and following gravel cleaning to evaluate changes in substrate composition, particularly reductions in interstitial fines.

To reduce fall-run Chinook salmon redd superimposition, the Districts also propose to develop and install a temporary barrier to encourage spawning on less used, but still suitable, high-quality riffles (RPM-8). The temporary barrier would be installed

[170] Don Pedro amended final license application, Appendix E-1, Attachment A.

each year below the new La Grange Bridge (RM 49.9) after November 15 once the number of Chinook salmon passing the proposed RM 25.5 fish counting/barrier weir exceeds 4,000 total spawners. The temporary barrier would be similar to the Alaska-type counting weir currently used on the Tuolumne River at RM 24.5 or a picket-weir type. Final design and configuration of the temporary barrier would be based on consultation with state and federal resource agencies.

NMFS and California DFW each recommend the Districts develop a gravel augmentation program in the lower Tuolumne River. Specifically, NMFS (10(j) recommendation 2) recommends that for both projects, over the duration of any licenses issued for the projects, the Districts should add a total volume of 752,000 cubic yards of coarse gravel (spawning and non-spawning) within four reaches of the lower Tuolumne River, at a rate of 18,800 cubic yards per year, in consultation with TRTAC, to mitigate for the 18,800 cubic yards per year of sediment/gravels trapped annually by the projects. Under the NMFS measure, the Districts would enhance the following reaches of the lower Tuolumne River:

- Spawning Reach (RM 52.2–RM 47.5) La Grange Diversion Dam to Basso Bridge
- Dredger Reach (RM 47.5–RM 39.5) Basso Bridge to Roberts Ferry
- Mining Reach (RM 39.5–RM 36.3) Roberts Ferry to Santa Fe Bridge
- Lower Tuolumne River (RM 36.3–RM 0.0).

Within the first 15 years of any license issuances, NMFS recommends the Districts place 564,000 cubic yards of the total volume noted above to fill in the bedload traps/special pools and follow the priorities for short and long-term gravel augmentation identified in the coarse sediment management plan prepared under the 1995 Settlement Agreement by McBain and Trush (2004). Additionally, sediment harvest downstream of La Grange Diversion Dam would be completed in a manner that creates new floodplain areas, and in-channel placement would be completed in a manner that increases local floodplain inundation (e.g., raises the channel bed). The Districts would annually use 13,400 cubic yards of coarse gravels to fill in the SRPs (total volume is 564,000 cubic yards). The Districts would annually use 5,400 cubic yards of cleaned spawning-sized gravel to create or restore spawning riffles and restore fluvial geomorphic processes (total volume 188,000 cubic yards). Under the NMFS recommendation, the placement of gravel by the Districts into the respective reaches, configurations (piles or beds), and depth of sediments, cobble/fill material, and its integration with other substrates (LWM and boulders) would be determined based on an assessment of each placement site, guided by the coarse sediment management plan prepared by McBain and Trush (2004), in consultation with TRTAC. Goals useful for monitoring the effectiveness of sediment management in the lower Tuolumne River reaches would include: (1) increase the amount of California Central Valley steelhead and Central Valley Chinook salmon spawning habitats; and (2) increase the number and longitudinal distribution of California

Central Valley steelhead and Central Valley Chinook salmon redds, decrease superimposition, and decrease female egg retention levels. Specific metrics useful for monitoring the effectiveness of sediment management in the lower Tuolumne River reaches would include: (a) the maximum size of substrate movable by salmonids would be approximately 10 percent of fish length; (b) the number of redds per square meter indicates whether the gravel is appropriate for spawning (0.05 redds per square meter is a standard guideline); (c) the level of egg retention in females indicates whether a sufficient number of suitable sites are available for spawning (less than 10 percent retention is a standard guideline); (d) the percentage of salmonids using emplaced gravel indicates whether the action is providing habitat that is suitable (10 percent use is a standard guideline); (e) redd density in the Tuolumne River can be approximated to estimate capacity because spawnable area includes four times the redd area to account for defensible space (however, defensible space need not necessarily be comprised of just spawning gravel, other habitat types are acceptable); and (f) increase annual average of egg-to-emergence survival for Central Valley Chinook salmon and California Central Valley steelhead by 24 percent.

FWS does not recommend a gravel augmentation program in the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 3) implementation of an LTRHIP that would provide funding for planning, designing, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. This would include spawning habitat improvements. Additional discussion of the LTRHIP is included below in the subsection *Floodplain Habitat Restoration.*

California DFW recommends (10(j) recommendation M4) that the Districts update the coarse sediment management plan prepared under the 1995 Settlement Agreement (McBain and Trush (2004) for both projects and develop project designs working with the TREG within two years of license issuances. The updated plan should include the following: (1) description of potential locations of gravel collection for placement into the reaches of the Tuolumne River between La Grange Diversion Dam (RM 52.2) and Geer Road Bridge (RM 24.0); (2) description of any other potential options for providing and placing gravel in the La Grange Diversion Dam to Geer Road Bridge reaches; (3) consultation with the TREG regarding annual gravel augmentation with respect to geomorphic and hydrologic annual variations; (4) plans for annual gravel augmentation with respect to geomorphic and hydrologic factors, access, and suitability for gravel addition; (5) an implementation timeline; (6) report and evaluate any legal constraints on gravel placement, and any federal, state, or local permits that may be needed; and (7) approval by California DFW, NMFS, and FWS.

As part of the updated plan, conceptual designs would be developed for the modifications of SRPs and other reaches that the TREG identifies as desirable restoration sites. These designs would be approved by California DFW, FWS, and NMFS before finalization and used by the Districts to minimize predation habitat via sediment

placement. Project designs should focus on: (1) enhancing Chinook salmon and *O. mykiss* spawning habitat; (2) reducing predator holding and spawning habitat; (3) maintaining or enhancing *O. mykiss* holding habitat above RM 42; and (4) creating floodplain habitat of medium to high quality for juvenile salmon rearing. The updated plan would be used as the guiding document for annual gravel augmentation in the lower Tuolumne River with the goal of mitigating the loss of gravel and sediment (both spawning-sized gravel and fine sediment) due to direct effects of project operations, as well as, mitigating for the abundance of predator habitat created by direct project effects and/or by the loss of proper river functions due to past and current project operations. Starting upon completion of the updated plan, the Districts would place at least 200,000 cubic yards of sediment annually for 10 years to mitigate for project impacts until at least 1,950,824 cubic yards of additional sediment has been placed in the river to fill SRPs. California DFW further recommends that the Districts should apply the bedload transport rating curve developed by McBain and Trush (2004) to any new flow schedule required by the Commission or the Water Board for the Don Pedro or La Grange Projects, to calculate average annual bedload transport rates for sediment > 8 mm. The Districts would annually add this amount of gravel to the lower Tuolumne River to ensure no net loss of spawning habitat occurs. At a minimum, the Districts should annually add 2,500 cubic yards of cleaned spawning-sized gravel. The size of gravel added under this provision would be identified in consultation with the TREG and agreed to by California DFW, FWS and NMFS. California DFW recommends the Districts comply with California DFW Fish and Game Code § 1602, which requires any person, state or local governmental agency, or public utility to notify California DFW before beginning any activity that will substantially modify a river, stream or lake.

California DFW further recommends monitoring and reporting within 60 days of full implementation of gravel placement and augmentation actions. The report should include: (1) the quantity and quality of placed gravel; and (2) the results of monitoring of the placement/augmentation of gravels, and subsequent geomorphic distributions (movement, representative gravel quality, and bedload morphological change) and improvement (additions) of suitable anadromous salmonid spawning and rearing habitat by individual reach. California DFW recommends this report be submitted to the TREG by March 1 each year, and a final report submitted to the Commission each year, following approval by California DFW, BLM, FWS, and NMFS. California DFW's recommendation additionally contains a provision for effectiveness monitoring that would include assessments of floodplain inundation and geomorphic processes at the sites of gravel placement and gravel augmentation. The effectiveness monitoring would begin one year after gravel placement and augmentation and for three years. The Districts would present the results of effectiveness monitoring to the agencies mentioned previously at the annual TREG meeting and provide a summary of effectiveness monitoring in a report provided to the agencies for review and comment within 60 days following completion of monitoring. California DFW also recommends a separate annual report be submitted to the Commission and California DFW, BLM, FWS, NMFS,

and the Water Board by March 15, which describes both implementation and effectiveness monitoring.

The Conservation Groups comment that the Districts' proposed coarse sediment augmentation program (RPM-1) is inadequate, and they propose a more extensive and robust gravel augmentation program which, in combination with other Conservation Groups restoration measures, would mitigate project effects and achieve the Anadromous Fish Restoration Program's Doubling Goal. Conservation Groups recommend (recommendation 6) gravel augmentation and restoration and predatory habitat reduction provisions, for both projects, that are identical to California DFW's 10(j) recommendation 4. The Conservation Groups further recommend identifying the size of gravel added under this provision in consultation with the TRTAC described in Conservation Groups' recommendation 3. The Conservation Groups also state they oppose the Districts' proposed measure RPM-4 (gravel cleaning) and that the Conservation Groups' flow proposal would achieve gravel-cleaning objectives more effectively and in a less damaging manner than the Districts' proposal.

The Water Board (preliminary 401 condition 5) specifies that it will likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to facilitate coarse and fine sediment transport past La Grange Diversion Dam in the Tuolumne River. The goal of this plan is to replace sediment lost downstream of La Grange Diversion Dam in order to improve downstream habitat. The Districts may also be required to monitor implementation and effectiveness of the sediment augmentation and submit associated reports to the Water Board's Deputy Director. BMPs would be developed to minimize the impact to beneficial uses (e.g., turbidity and wildlife) from initial sediment placement.

In response to NMFS's 10(j) recommendation 2, the Districts state in their reply comments filed on March 15, 2018, that mining pits are unrelated to the Don Pedro Project and its operations. The Districts also note that their lower Tuolumne River spawning gravel study (Stillwater Sciences, 2013d) concluded the coarse sediment budget for RM 52.2 to RM 45.5, encompassing the primary salmon spawning reach immediately downstream of La Grange Diversion Dam, indicates that approximately 4,549–6,707 cubic yards (5,913–8,720 tons) of coarse bed material was lost from storage between 2005 and 2012, and the total estimated volume lost from storage in the reach is comparable in magnitude to the quantity of coarse sediment added during any one of the augmentation projects that occurred since 2002 (approximately 7,000–14,000 tons).

The Districts additionally comment that NMFS's citing an estimated 18,800 cubic yards of coarse sediment annually captured by the Don Pedro Project from McBain and Trush (2004) is incorrect; in fact, the estimate of coarse sediment supply used by McBain

and Trush (2004) was taken from a separate study (Brown and Thorp, 1947[171]) and is specifically stated to be the estimated "*unimpaired* coarse sediment supply from the *watershed*." The Districts state that NMFS does not account for the capture of sediment by CCSF's Hetch Hetchy System of dams (O'Shaughnessy, Cherry, Eleanor, and Early Intake) all located upstream of Don Pedro Reservoir. However, in their reply comments, CCSF notes several factors that make it unlikely that the Hetch Hetchy System of dams trap large volumes of coarse sediment: (1) the pre-dam Hetch Hetchy Valley and Poopenaut Valley (downstream of Hetch Hetchy) likely naturally trapped much of the coarse sediment arriving from the river above Hetch Hetchy Valley; (2) sediment originating from the watershed downstream of Poopenaut Valley is allowed to pass through Early Intake Dam; and (3) Lake Eleanor was a natural lake prior to enlargement by Eleanor Dam and would have naturally trapped all coarse sediment under pre-dam conditions. CCSF acknowledges that Cherry Valley Dam, which impounds Cherry Creek above the Eleanor Creek confluence, likely does reduce sediment delivery below CCSF's impoundments.

In response to Conservation Groups' recommendation 6 to develop a coarse sediment and gravel replacement and restoration plan, the Districts state that mining pits are unrelated to the Don Pedro Project and its operations and mitigating the impacts of bedload traps created by SRPs in the mining reaches from RM 46.6 to RM 24 is outside the scope of relicensing. They further note that the Districts' proposed coarse gravel augmentation from RM 52 to RM 39 over a 10-year period following issuance of a new license is consistent with coarse sediment augmentation priorities identified in McBain and Trush (2004) and in their lower Tuolumne River spawning gravel study.

In response to California DFW's recommendation for annual sediment placement to minimize predation habitat hotspots, the Districts state that predation is not a project effect; in fact non-native predators were introduced into the San Joaquin Watershed by California DFW to advance its interest in recreational fishing. It is unreasonable for the agency to now recommend that the Districts use their water supply and spend their customers' money to address an impact caused by California DFW. In response to California DFW's recommended annual gravel augmentation, the Districts state that their proposed gravel augmentation plan (RPM-1), which was developed based on the results of their lower Tuolumne River spawning gravel study and specifically examined the effects of the Don Pedro Project operation on gravel availability, condition, and transport, would include a study in year 12 to again update the condition of coarse sediment in the lower Tuolumne River.

[171] In their reply comments, the Districts erroneously cited this reference as Thorp (1947).

Our Analysis

Prior to widespread European settlement, the channel form in the lower Tuolumne River was a combination of single-thread and split channels that migrated and changed course (McBain and Trush, 2004). Beginning in the mid-1800s, stored riverbed material was excavated for gold and aggregate, which eliminated active floodplains and terraces and created large in-channel and off-channel pits. By the end of the gold mining era, about 12.5 miles of river channel and floodplain from RM 50.5 to RM 38 were dredged and converted to tailings piles, and much of the gravel-bedded zone of the river was converted to long, deep pools, now referred to as SRPs. These SRPs are up to 400 feet wide and 35 feet deep and occupy 32 percent of the channel length in the gravel-bedded reach. Agricultural and urban encroachment, in combination with a reduction in coarse sediment supply and recurring high flows, have also resulted in a relatively static channel within a floodway confined by dikes.

Under existing conditions, La Grange Diversion Dam (constructed in 1893), old Don Pedro Dam (completed in 1923), and new Don Pedro Dam (completed in 1971) trap all coarse sediment (>2 mm [0.08 inch]) and most fine sediment (<2 mm [0.08 inch]) originating from unregulated portions of the upper Tuolumne River Watershed. These projects also alter the frequency, magnitude, and duration of bed-mobilizing flows that influence bedload transport capacity in the lower Tuolumne River.

McBain and Trush (2004) estimated the "unimpaired" annual bedload sediment delivery in the lower Tuolumne River to be an average of 18,800 cubic yards per year. McBain and Trush (2004) also mapped the SRPs in the lower Tuolumne River that resulted from in-channel mining and determined that they trap most of the sediment input from upstream reaches that is able to pass through the projects or is recruited from tributary streams. As a result, the SRPs have the potential to reduce any benefits associated with spawning gravel augmentation. NMFS recommends that these bedload traps (which have an estimated total capacity of 564,000 cubic yards) be filled in with coarse gravels and then overlain with suitable spawning gravels (188,000 cubic yards total volume) to provide adequate spawning habitat for resident and anadromous salmonids. California DFW recommends the Districts place at least 1,950,824 cubic yards of sediment in the river to fill the SRPs.

In their study of spawning gravel in the lower Tuolumne River, the Districts describe indicators that suggest a deficit in coarse sediment supply relative to bedload transport in the Tuolumne downstream of La Grange Diversion Dam, a condition affecting both the capacity and productivity of salmonid spawning habitat (California DWR, 1994; McBain and Trush, 2004):

- Channel cross section surveys indicate that in many reaches the channel is wider than would have occurred prior to large-scale anthropogenic disturbance, lacks bankfull channel confinement, and has cross sectional dimensions that are not adjusted to the contemporary flow regime.

- Field surveys indicate that sediment storage features (e.g., lateral bars and riffles) are depleted of coarse sediment, and riffles throughout the gravel-bedded zone have progressively diminished in size.
- SRPs deprive downstream reaches of sediment by trapping all particles larger than coarse sand (4 mm [0.16 inch]), provide little or no high-quality salmonid habitat, and provide suitable habitat for non-native fish species that prey on juvenile salmonids (McBain and Trush, 2000).

The Districts also determined that:

- The average annual total and coarse (>2 mm [0.08 inch]) sediment yields to Don Pedro Reservoir, calculated over the 1923–2011 period, were approximately 373,966 tons (287,657 cubic yards) per year and 37,397 tons (28,766 cubic yards) per year, respectively.
- The channel in the first 12.4 miles downstream of La Grange Diversion Dam is slowly degrading in response to a reduction in coarse sediment supply by Don Pedro Dam, but past gravel augmentation has helped increase coarse sediment storage in the reach.
- Augmentation material is being mobilized short distances during infrequent high-flow events (e.g., during water year 2006 and water year 2011), but that routing is slow due to low bedload transport capacity.
- The total volume of discrete fine bed material deposits in the reach from La Grange Diversion Dam (RM 52.2) to Roberts Ferry Bridge (RM 39.5) decreased by 48 percent from 2001 to 2012.
- A total of 3,527,200 square feet of riffle mesohabitat was mapped from RM 52.2 to RM 23 in 2012, of which 2,967,500 square feet (84 percent) was occupied by spawning gravel.
- Comparing the results of riffle surveys conducted in 1988 and 2012 suggests riffle area increased by 606,200 square feet (21 percent).

Based on this information, it is apparent that the projects have reduced the amount of coarse sediment entering the lower Tuolumne River, and that without some form of ongoing gravel augmentation over the term of the licenses, the river channel would slowly degrade, and eventually become gravel limited. It is also evident that gravel augmentation efforts associated with the 1995 Settlement Agreement have helped increase coarse sediment storage in the reach, and that most of this coarse sediment has been retained, increasing the amount of available salmonid spawning habitat.

However, because the projects continue to intercept gravel that would otherwise be available as spawning habitat in the lower Tuolumne River, we concluded in the draft EIS that it would be appropriate for the Districts to develop a coarse sediment management plan, in consultation with the NMFS, FWS, California DFW, and Water

Board, that includes a gravel augmentation program that would extend throughout the term of any new licenses issued for the projects. However, river channel impacts associated with gold and aggregate mining are not related to the projects, and the goal of filling the bedload traps/SRPs would have no direct nexus to project operations. We also concluded in the draft EIS that the coarse sediment management plan would best focus on providing high quality spawning habitat for anadromous salmonids in those reaches that have the greatest potential to increase salmon and *O. mykiss* production (i.e., the first 12.4 miles downstream of the La Grange Diversion Dam). We further concluded that periodically monitoring and mapping augmented spawning gravels (i.e., once every 10 years over the term of the licenses), as recommended by NMFS, FWS, California DFW, and the Conservation Groups, would also provide an indication of the performance of the augmentations and inform the need for future augmentation. We noted that the Districts are proposing the LTRHIP (discussed in the following section), which may include in-channel habitat improvements such as gravel placement, and if the LTRHIP is implemented, the coarse sediment management plan could be included under the umbrella of the LTRHIP.

According to the Spawning Gravel in the Lower Tuolumne River Study Report (Stillwater Sciences, 2013d), actions implemented under the 1995 Settlement Agreement from 2002 through 2012 have already resulted in the addition of approximately 44,750 cubic yards of gravel to the river. The Districts' proposed coarse sediment management program would add another 57,650 cubic yards over a 10-year period, an average of 1,441 cubic yards of gravel per year assuming a 40-year license term.

According to McBain and Trush (2004), approximately 1,000 to 2,500 cubic yards of gravel per year would be needed for long-term coarse sediment maintenance in the lower Tuolumne River. Although the 1,000 to 2,500 cubic yards per year estimate is well below the "unimpaired" annual bedload sediment delivery value described in McBain and Trush (2004) (approximately 18,800 cubic yards/year), the coarse sediment budget for RM 52.2 to RM 45.5 (Stillwater Sciences, 2013d), encompassing the primary salmon spawning reach immediately downstream of La Grange Diversion Dam, indicates that approximately 4,549–6,707 cubic yards (5,913–8,720 tons) of coarse bed material was lost from storage between 2005 and 2012, and the total estimated volume lost from storage in the reach is comparable in magnitude to the quantity of coarse sediment added during any one of the augmentation projects that occurred since 2002 (approximately 7,000–14,000 tons). We concluded in the draft EIS that it is reasonable to say that the level of gravel augmentation that has taken place through the 1995 Settlement Agreement is maintaining an adequate amount of spawning habitat in the lower Tuolumne River, and that there is no evidence that gravel availability is limiting *O. mykiss* or fall-run Chinook salmon productivity downstream of La Grange Diversion Dam. However, we noted that the Districts' proposed coarse sediment management program would be limited to only 10 years (following license issuance). Under any new licenses for the projects (which may be issued for a term of up to 50 years), Don Pedro Reservoir would continue to capture gravel that would eventually result the net loss of gravel supply to the lower

Tuolumne River. Consequently, we concluded that developing a coarse sediment management plan that addresses the need for gravel augmentation throughout the term of any new licenses, potentially as part of a future LTRHIP, in consultation with the resource agencies, is needed to mitigate the impacts of the projects on aquatic habitat downstream of La Grange Diversion Dam. We also noted that the annual volume of gravel added to the river should be commensurate with the project's ongoing level of impact, as described in the Spawning Gravel in the Lower Tuolumne River Study Report (Stillwater Sciences, 2013d).

In the draft EIS, we noted that obtaining the gravel to be placed in the lower river reaches from the existing dredger-tailings piles along the river, as recommended by NMFS, California DFW, and the Conservation Groups, could make implementation relatively efficient, as opposed to importing gravels from outside the projects, which could result in off-site environmental effects at the harvest site. Harvesting gravels here could also serve to create a more naturally shaped floodplain and help to improve floodplain connectivity. The Districts' proposed five-year experimental gravel cleaning program, with associated redd and substrate surveys, would also act to improve spawning substrates in the lower river.

We further discussed that while implementing the Districts' proposed spawning surveys would provide data on the annual distribution and abundance of fall-run Chinook and *O. mykiss* entering the Tuolumne River for five years, it is unclear how these data would be used to inform future gravel augmentation measures. It is well known that the annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by ocean and estuary conditions, annual hatchery augmentation, state and federal fishery management, and the operation of other dams and diversions in the watershed. All these factors are outside the Districts' control.

We also noted that the Districts, agencies, and other stakeholders have focused on the effects of gravel retention by the projects on the spawning habitat in the lower river, but BMI may also be affected by gravel retention, where substrates may become less suitable for some species and orders. However, the Districts have conducted BMI monitoring in the lower Tuolumne River since 1987, and this sampling has indicated that although overall invertebrate abundances in riffle samples have declined slightly from 1996 to the present, community composition shifted away from pollution-tolerant organisms and toward those with higher food value for juvenile salmonids and other fish. This indicates a gradual improvement in habitat conditions for BMI under current project operations.

We further concluded in the draft EIS that the Districts' proposed fall-run Chinook spawning superimposition reduction program would not fully address the lack of suitable spawning habitat in the lower Tuolumne River and could also result in the "take" of federally listed species through potential injury from the temporary barrier. We also noted that implementation of a coarse sediment management plan as recommended by staff, potentially as part of a future LTRHIP, would address the lack of suitable spawning

habitat more fully than the proposed superimposition reduction program and without the potential "take" of federally listed species.

In comments on the draft EIS and in discussions that occurred at the September 19, 2019, section 10(j) meeting, the resource agencies disagreed with the volumes of gravel the Districts are proposing and the staff-recommended coarse sediment management plan. NMFS still requested much higher quantities and argued that the Districts should provide mitigation for the full volume of coarse sediment that the project prevents from moving downstream, based on studies by McBain and Trush (2004) and Stillwater (2013d). The Districts also commented and noted that the 18,800 cubic yards/year volume from McBain and Trush (2004) refers to unimpaired sediment delivery, not existing conditions, which have been affected by the development of upstream storage reservoirs and diversions. They also noted that these estimates were calculated based on the difference between volumetric surveys of Don Pedro Reservoir conducted in 1920 and 2011, but the accuracy of the 1920 survey (old Don Pedro reservoir) is disputable. The Districts measured current bedload transport, and the largest estimate was 3,000 tons (2,308 cubic yards) per year, an insufficient amount to fill the SRPs. NMFS commented that the higher estimates from McBain and Trush (2004) and Stillwater (2013d) align with other studies estimating the bedload input to Don Pedro Reservoir. NMFS requested that staff determine a volume for gravel augmentation to include in the license article and that the enhancement reach be extended farther downstream than RM 39 because of documented spawning downstream of that point. The parties to the section 10(j) meeting also discussed the SRPs created by historical instream aggregate mining, with NMFS noting that while these SRPs are not project-related effects, the gravel captured in Don Pedro Reservoir prevents the recovery of these reaches, and the lack of high flows has reduced recruitment of gravel from the floodplain. California DFW also noted that riffles created by past gravel augmentation efforts often are removed by high-flow events and require continued augmentation to compensate for the lack of gravel transported from upstream sources. The Districts commented that the staff alternative is generic in nature and has the same deficiencies that staff identified for the LTRHIP.

Staff suggested in section 10(j) meeting discussions that it would be most cost-effective to focus gravel augmentation on the areas where it is needed, rather than focusing on volumes. Staff noted that in the draft EIS, a recommended volume of gravel augmentation was provided but was not included in the draft license article; however, any final license article would include a volume. Staff was also receptive to modifying the river miles where gravel augmentation is needed and requested additional information about specific sites to best mitigate the limiting factors for Chinook salmon. As a result of these additional discussions and stakeholder comments, we revised the analysis of gravel augmentation for the final EIS. While we still agree that gravel augmentation is needed in the lower Tuolumne River via the Districts' proposed coarse sediment management program, which we believe could be implemented in coordination with the

LTRHIP, we have further analyzed the amount of gravel needed and the locations for augmentation.

NMFS, California DFW, and FWS filed follow-up comments after the section 10(j) meeting discussions to provide additional support for their section 10(j) meeting comments, including the agency slides presented at the meeting. NMFS commented that Don Pedro Reservoir withholds 37,397 tons (23,560 cubic yards)[172] of coarse sediment per year and the amount of gravel that staff recommends for annual gravel augmentation (1,000 cubic yards/year) does not account for the past and ongoing effects of the projects. NMFS further commented that the staff-recommended volume of gravel would not mitigate the loss in spawning habitat or the perpetuation of the SRPs. For these reasons, NMFS recommends that the Commission adopt NMFS 10(j) recommendation for sediment enhancement in the final EIS.[173] California DFW similarly continues to maintain its previous recommendation of 200,000 cubic yards of sediment annually for 10 years to mitigate for project impacts until at least 1,950,824 cubic yards of additional sediment has been placed in the river to fill SRPs. In addition, California DFW recommends the Districts apply the bedload transport rating curve developed by McBain and Trush (2004) to any new flow schedule required by the Commission or the Water Board for the Don Pedro or La Grange Projects to calculate average annual bedload transport rates for sediment > 8 mm (0.31 inch). California DFW recommends the Districts annually add this amount of gravel to the lower Tuolumne River to ensure no net loss of spawning habitat occurs, which at a minimum should be 2,500 cubic yards of cleaned spawning-sized gravel. The follow-up filing from FWS consisted of copies of agency slides presented at the 10(j) meeting, including information on Chinook salmon redd distribution in the lower Tuolumne River from 2014 to 2018, showing that annually from 27 to 42 percent of the redds are constructed downstream of RM 39 to as far downstream as RM 24.5. In the draft EIS, staff recommended gravel placement only as far downstream as RM 39.

The Districts' proposed coarse sediment management program would add coarse (0.125 to 5.0 inches in diameter) sediment from RM 52 to RM 39 over a 10-year period following issuance of a new license, with an estimated 74,945 tons (57,650 cubic yards)[174] of coarse sediment to be augmented, or almost 10 times the amount of coarse

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[172] Using a conversion factor of 1.6 tons per cubic yard; other reports (Stillwater, 2013d) use a conversion factor of 1.3 tons per cubic yard, which we use elsewhere in this final EIS.

[173] NMFS recommends the Districts place 564,000 cubic yards to fill in the bedload traps/special pools and annually use 5,400 cubic yards of cleaned spawning-sized gravel to create or restore spawning riffles and restore fluvial geomorphic processes (total volume of spawning gravel would be 188,000 cubic yards).

[174] Using a conversion factor of 1.3 tons per cubic yard.

sediment lost over the eight-year period (4,549–6,707 cubic yards) in the 6.7-mile-long dominant salmon spawning reach immediately downstream of La Grange Dam, as estimated in the Spawning Gravel in the Lower Tuolumne River Study Report (Stillwater Sciences, 2013d). If the Districts' proposed gravel augmentation were evenly allocated over a 40-year license term, it would result in an allocation of 1,441 cubic yards per year, and if gravel was spread evenly over the proposed 13-mile-long reach (RM 52 to RM 39), this would amount to 111 cubic yards per mile.[175] For comparison, the loss of 4,549–6,707 cubic yards over eight years in the 6.7-mile-long reach would be 85–125 cubic yards per mile, similar to the gravel augmentation rate proposed by the Districts. Stillwater Sciences (2013d) reported, and we noted above, that past gravel augmentation efforts in the river (2001–2012) maintained spawning gravels with the addition of approximately 44,750 cubic yards of gravel to the river. Further, Stillwater Sciences (2013d) reported an overall increase in spawning gravels in the lower Tuolumne River (RM 52 to RM 23) from 2001 to 2012, including spawning gravel in riffles, with an estimated maximum suitable spawning area of 1,370,917 square feet for Chinook salmon and 346,029 square feet for *O. mykiss*. Depending on the flow schedule and the redd size used in the calculation, this amount of spawning habitat could support from 47,882 to 59,795 spawning Chinook salmon and approximately 803,178 to 854,547 *O. mykiss* (Stillwater Sciences, 2013d), which indicates that the current amount of spawning gravel in the lower river could support spawning populations substantially higher than current levels, and that the level of gravel augmentation proposed by the Districts would be sufficient to maintain and enhance spawning gravels in the segment of the lower river where augmentation is proposed.

Both NMFS and California DFW recommend substantially higher levels of gravel augmentation, with a focus on filling in the SRPs resulting from past in-river mining operations unrelated to the projects. NMFS recommends that 564,000 cubic yards be added to the river in the first 15 years of any license, to fill the SRPs, which would be a rate of 37,600 cubic yards per year, and California DFW recommends 200,000 cubic yards per year in the first 10 years of any license to fill the SRPs. NMFS acknowledges that the Districts are not responsible for creation of the SRPs but indicates that the presence of the projects has intercepted gravel that would have otherwise filled the SRPs if the projects had not been built. Once the SRPs are filled in, NMFS further recommends 5,400 cubic yards of cleaned spawning-sized gravel be introduced per year to create or restore spawning riffles, with a total volume of 188,000 cubic yards, which would require about 35 years to complete. Adoption of these agency recommendations by Commission staff would mean that staff agrees the Districts are responsible for

[175] This metric is for comparison purposes only. Gravel would not be spread evenly over the full reach and instead would be placed in specific areas that would have the best potential for habitat enhancement and would measure much less than the full reach.

mitigating in-river effects of mining, which was not a direct effect of the projects. However, a portion of any gravel introduced by the Districts would be transported to and settle in the SRPs during high-flow events, so some refilling of the SRPs would occur under any gravel augmentation program, although at a slower rate than contemplated by NMFS and California DFW (10 to 15 years). The volume of gravel augmentation recommended by NMFS and California DFW may be excessive for the lower Tuolumne River, based on the size and morphology of the river. The agencies are recommending the annual placement of from 48,880 to 260,000 tons (37,600 to 200,000 cubic yards) of coarse sediment, and the logistics of a gravel augmentation program of that magnitude have not been addressed, including potential impacts associated with gravel sources, transportation logistics, and access roads/points to the river for gravel distribution.[176]

Although we are not adopting the level of gravel augmentation recommended by NMFS and California DFW, we agree that some additional gravel augmentation could occur in portions of the river downstream of RM 39. Information provided by the agencies at the section 10(j) meeting, and later filed by FWS, showed that from 2014 to 2018, from 27 to 42 percent (average of about 36 percent) of Chinook salmon redds were constructed downstream of RM 39 to as far as RM 24.5. This lower river reach was shown to be an important reach for Chinook salmon spawning, and it would be appropriate to include it as part of the gravel augmentation program. Because on average about one-third of the spawning occurs from RM 39 to RM 24.5, a reasonable approach would be to increase the Districts' originally proposed 75,000 tons (57,692 cubic yards)[177] of gravel augmentation by one-third or 25,000 tons (19,230 cubic yards), for distribution between RM 39 and RM 24.5. We previously noted that any gravel augmentation program could be made part of the LTRHIP, which would allow the Districts and agencies to consult in the preparation of specific plans for the 100,000 tons (76,923 cubic yards) of gravel to be augmented: 75,000 tons (57,692 cubic yards) from RM 52 to RM 39 and 25,000 tons (19,230 cubic yards) from RM 39 to RM 24.5.[178] The Districts propose to evaluate the need for additional gravel at the initial sites and the need for additional augmentation sites as part of the gravel augmentation study to be filed in year 12 of any license issued; and then file an implementation plan for any new gravel

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[176] For example, although the size of dump trucks may vary, using 15-ton trucks would require from about 3,260 to 17,300 truckloads to annually distribute the tonnage recommended by the agencies.

[177] The Districts proposed 74,945 tons (57,650 cubic yards) of gravel augmentation, but we round this number up to 75,000 tons (or 57,692 cubic yards) for convenience.

[178] If we assume that the 100,000 tons (76,923 cubic yards) would be distributed over a 40-year license term, it would result in about 2,500 tons or 1,923 cubic yards per year.

augmentation sites identified in the year 12 report. This would be a reasonable approach for management of the gravel augmentation program.

Another aspect of spawning habitat enhancement proposed by the Districts is a five-year experimental gravel cleaning program with associated redd and substrate surveys. We concluded in the draft EIS that continuing gravel augmentation for the duration of the license in conjunction with gravel flushing and mobilization flows would more effectively address the long-term project effects on gravel quantity and quality than an experimental gravel cleaning program. However, on December 11, 2019, the Districts filed a response to staff's September 17, 2019, AIR that requested additional modeling simulations to allow staff to adequately assess the effects of proposed non-flow measures, including the effects of implementing the proposed gravel cleaning program on Chinook salmon smolt productivity, *O. mykiss* young-of-year productivity, and *O. mykiss* adult replacement rate. The Districts' June 17, 2020, filing of corrected model results indicates that the gravel cleaning program, implemented in conjunction with the draft Voluntary Agreement flow regime, would increase relative Chinook salmon smolt productivity by 19 to 22 percent, *O. mykiss* young-of-year productivity by 12 to 24 percent, and the *O. mykiss* adult replacement rate by up to 2 percent compared to implementing the draft Voluntary Agreement flow regime alone.[179] This modeling suggests that the gravel cleaning program would have a substantial beneficial effect on salmon and *O. mykiss* populations in the lower Tuolumne River. Therefore, because of these new modeling results, staff now concludes that the proposed gravel cleaning program would be an appropriate condition for any license issued.

Regarding the Districts' proposed fall-run Chinook spawning superimposition reduction program, which we did not adopt in the draft EIS, we continue to believe this program would not substantially improve fish production. The Districts' June 17, 2020, filing with additional modeling results showed no increase in fall-run Chinook smolt productivity for this program with the draft Voluntary Agreement flow regime, supporting our draft EIS conclusions.

Floodplain Habitat Restoration

The storage and diversion of water associated with operation of the projects and irrigation diversions in the lower Tuolumne River restrict fish passage; block the downstream movement of LWM and coarse sediment; alter the timing, magnitude and duration of river flows; and modify the natural thermal regime in the lower Tuolumne River. Mitigating any adverse effects associated with operation of the projects through the implementation of habitat restoration and enhancement projects could benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower

[179] Flows would increase below the infiltration galleries in dry and critical years from 75 to 125 cfs from July 1 to October 15 but would decrease slightly at the La Grange gage from 350 to 300 cfs in wet, above normal and below normal water years.

Tuolumne River. However, any recommended or proposed mitigation measures must demonstrate a clear nexus to the project and consider the Districts' ongoing role in providing water supply, flood control, hydroelectric generation, and recreation. The Districts and other stakeholders to this proceeding have proposed a suite of measures to mitigate project effects, which are discussed in other sections of this final EIS, including flow and non-flow measures to protect and enhance aquatic and terrestrial habitat. Many of these measures are closely intertwined; for example, instream flows to protect aquatic habitat may also provide benefits to riparian habitat and wildlife. Similarly, floodplain habitat restoration would benefit fish, botanical, and wildlife resources, including creating additional salmonid fry and juvenile rearing habitat. Resource agencies and other stakeholders have stated the importance of floodplain rearing habitat for anadromous salmonids, and California DFW, the Tuolumne River Conservancy, and the Conservation Groups recommend development of a floodplain rearing habitat restoration plan. FWS does not recommend specific measures for floodplain habitat restoration in the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 3) implementation of an LTRHIP that would provide funding for planning, design, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. The Districts did not propose floodplain habitat restoration and questioned the recommended floodplain rearing habitat restoration plan but support the adoption of the LTRHIP as recommended by FWS.

In the draft EIS, we included a section entitled *Floodplain Habitat Restoration* beginning on page 3-192, in which we analyzed the California DFW, Tuolumne River Conservancy, and Conservation Groups recommendations for floodplain habitat restoration, and the Districts' reply comments in opposition to a specific plan for this restoration. We used the results of the Districts' hydraulic model (TUFLOW) for the lower Tuolumne River that simulates the interaction between flow within the main channel and the floodplain downstream of the La Grange Diversion Dam to the confluence with the San Joaquin River and applied the model results to estimate floodplain juvenile salmonid rearing habitat (HDR and Stillwater Sciences, 2017). Based on this analysis, we concluded that flows above bankfull discharge are associated with increases in habitat area for fry and juvenile life stages of lower Tuolumne River salmonids. Floodplain inundation along the lower Tuolumne River is initiated at a flow of approximately 1,100 cfs. Based on flows in the 1971 to 2012 period of record, flows at the La Grange gage greater than 1,500 cfs would occur from February through July in 28 years (or more than 60 percent of years) under the Districts' proposed flow regime. Flows exceeding 2,500 cfs would occur in 45 percent of years in that period. Extended periods of springtime floodplain inundation (e.g., 14 to 21 sequential days) regularly occur at a 2- to 4-year recurrence interval in the lower Tuolumne River under the base case (water years 1971–2012) hydrology. In addition, in spill years, as part of their agreement with FWS revised 10(j) recommendation 2 (the spill management plan), the

Districts state that they would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions and benefit salmonid floodplain rearing. Therefore, we concluded that a floodplain rearing habitat restoration plan would not be required.

However, we are cognizant that the Tuolumne River historically supported large numbers of anadromous spring-run Chinook salmon, fall-run Chinook salmon, *O. mykiss*, and unknown numbers of other native fish species, [180] and beginning in the mid-1800s, a combination of gold mining, gravel mining, grazing, and agriculture severely affected floodplain habitat availability for juvenile salmonids. Dredge mine tailings along the lower Tuolumne River are primarily the result of gold mining abandoned in the early 20th century; however, gravel and aggregate mining still continues for a number of miles along the river, particularly upstream of RM 34. Excavation of riverbed material for gold and aggregate to depths well below the river thalweg also formed large in-channel SRPs as well as off-channel ponds. During the construction of Don Pedro Dam, aggregate was reclaimed from floodplain areas formerly occupied by dredger tailings between RM 51.5 and RM 40.3 (McBain and Trush, 2000). These floodplain areas are characterized by floodplains two to three times wider than floodplains in other portions of the lower Tuolumne River corridor. Along the lower Tuolumne River, agricultural and urban encroachment, in combination with in-channel excavation, has resulted in a river channel contained within a narrow floodway confined by dikes and agricultural fields. Extensive levees extend along portions of the riverbank from about RM 25 downstream to the San Joaquin River, limiting potential floodplain access for rearing juvenile salmonids. In addition to these channel modifications, altered flows in the Tuolumne River associated with water storage for consumptive use and project operations have reduced the magnitude and frequency of high-flow events that are part of the natural flow regime, thereby affecting habitat diversity and complexity in the lower river. Attenuation of peak flows reduces the frequency of river connection to the floodplain and its inundation, which is important for juvenile salmonid rearing.

We recognize that there is substantial potential for the enhancement of floodplain habitat to benefit aquatic and terrestrial resources, and the LTRHIP offers an approach that could guide the implementation of these types of enhancement projects in an effective and efficient manner. The LTRHIP, as described in FWS's revised Don Pedro

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[180] The Districts note that historical accounts of large numbers of spring-run Chinook and *O. mykiss* are generally referenced to Yoshiyama et al. (2001), and that no actual fish counts are provided in this reference. Based on the studies conducted as part of the La Grange licensing process, there appears to be little suitable habitat for spring-run Chinook or anadromous *O. mykiss* in the river above Don Pedro Reservoir under natural conditions. Physical barriers identified during field investigations at relatively low elevations in the watershed and high summer temperatures below these barriers may have limited these historic runs to high flow years.

10(j) recommendation 3 filed on October 2, 2018, and also included in the draft Voluntary Agreement, would be developed by the Districts in coordination with FWS, NMFS, California DFW, and CCSF and filed with the Commission for approval. The program would have a total capital fund of $38 million to be funded with four equal distributions of $9.5 million beginning within six months of the Commission's approval of the LTRHIP implementation plan and being fully funded by the 12th anniversary of license issuance. This recommendation replaced FWS's original Don Pedro 10(j) recommendation 3 (Restore and Enhance Juvenile Salmonid Rearing Habitat in the Lower Tuolumne River) and 10(j) recommendation 4 (Coarse Sediment and Gravel Replacement and Restoration Plan). FWS also states that establishment of the LTRHIP would be in lieu of the Districts' proposed hatchery, boulder placement, and hyacinth funding enhancement measures.

On October 17, 2018, the Districts filed a response to the FWS's October 2, 2018, filing. The Districts support the withdrawal of 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects and support the Commission's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS's revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal, and their proposed restoration hatchery, boulder placement, and donations to California Boating and Waterways to aid in hyacinth control are considered withdrawn from their proposal.

Our Analysis

According to FWS, the purpose of the LTRHIP is the development of a long-term habitat restoration strategy to be implemented via an associated capital fund ($38 million) and annual funding ($1 million for operation and maintenance, monitoring, and reporting), for actions that protect and enhance salmonid populations and aquatic habitat in the lower Tuolumne River. The associated fund would support non-flow resource measures that enhance habitat for native salmonid species. The Districts would be responsible for dispersing monies from the LTRHIP account, as recommended by TPAC,[181] and would be responsible for executing and implementing contracts for design, permitting, construction, monitoring, and reporting related to the improvement projects.

Types of enhancement projects may include spawning habitat improvements, floodplain habitat improvements, riparian restoration, improved connectivity between the river channel and adjacent floodplains, slough development, improvements to in-channel structural complexity, and LWM installation and replacement. Habitat improvement

[181] The TPAC, which would be established pursuant to FWS 10(j) recommendation 4, would guide the implementation of measures provided under 10(j) recommendations 2 (Spill Management Plan) and 3 (the LTRHIP). The TPAC would, at a minimum, include the Districts, FWS, and CCSF, but other agencies such as NMFS and California DFW would be invited to participate.

projects would be prioritized and recommended by TPAC, with the primary beneficiaries of the projects being native salmonid species. The project selection process would follow the Spawning Habitat Integrated Rehabilitation Approach (SHIRA),[182] or another technically rigorous approach approved by TPAC. SHIRA has been successfully used on several Central Valley watersheds where overall water availability was limiting.[183] Typically, initial work using SHIRA is focused on instream additions of gravel and contouring of existing gravels. Gravel cleaning, as proposed by the Districts, could be a complementary component of efforts to contour and improve existing gravel.

FWS identifies recently implemented restoration projects on the Mokelumne, Merced, Stanislaus, and Yuba Rivers that used this general approach for floodplain reconnection/restoration that could be applied on the Tuolumne River. FWS also lists areas adjacent to the lower Tuolumne River that may be suitable for restoration efforts, based on GIS databases, totaling approximately 27 miles of shoreline on the lower Tuolumne River that are publicly owned, are designated as open space, and/or have existing conservation easements.

In the draft EIS, we concluded that overall, the recommended LTRHIP overseen by the TPAC appears to be a program that could mitigate project effects on spawning and rearing habitat in the lower Tuolumne River. However, we found that although FWS identifies a range of habitat enhancement projects that could be implemented using the $38 million capital fund and lists potential enhancement sites in the lower 52.5 miles of the river, few specifics were provided as to how the $38 million would be spent, and whether this would mitigate project effects or serve as enhancement. FWS states that the fund could be used for in-channel habitat improvements such as spawning gravel enhancement or addition of LWM, but the focus appears to be on floodplain habitat improvements (see attachment 1, tables 1 and 2, of the FWS October 2, 2018, filing).

In the draft EIS, we concluded that additional measures for floodplain habitat restoration would not be needed because existing project operations include periods of high flows on a regular basis (two- to four-year recurrence interval in the 1971 to 2012 period of record) that would sufficiently inundate the floodplain and provide substantial

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[182] Information on the development and application of SHIRA is available at http://shira.lawr.ucdavis.edu/. The process consists of comprehensive pre-project assessment, planning and design phases followed by construction, post-project assessment, monitoring and adaptive management. Four primary modes (data collection, conceptualization, scientific experimentation, and modeling) are used iteratively to collect and analyze data on which flexible and informed decisions can be based. SHIRA places extra emphasis on the design development stage.

[183] Case studies of application of the SHIRA on the lower Mokelumne, lower Yuba, Feather, Trinity and lower American rivers are available at http://shira.lawr.ucdavis.edu/.

habitat for Chinook salmon and *O. mykiss* fry and juveniles, the two life stages that would benefit the most from additional floodplain habitat. However, in some lower flow years when Don Pedro Reservoir is storing the spring runoff, that operation reduces downstream flows and the extent of floodplain inundation, adversely affecting salmonid rearing habitat.

In the draft EIS, we also estimated the effect of Don Pedro Reservoir storage during spring runoff under proposed operations,[184] using the output from the Districts' operations model, to determine the amount of storage (in acre-feet) retained in the months of March and April[185] by subtracting the storage value at the beginning of each month from the storage value at the end of each month. We then estimated the volume of river flow retained, based on the amount of storage retained, and using the relationship of flow versus floodplain inundation in HDR and Stillwater Sciences (2017), estimated the average amount of inundation area that is reduced due to reservoir storage. We ran this analysis for five water year types for the period of record, and this analysis was summarized in table 3.3.2-45 of the draft EIS, which is reproduced here as table 3.3.2-48.

Table 3.3.2-48. Analysis of the effect of Don Pedro Reservoir storage on floodplain inundation in the lower Tuolumne River (Source: staff).

Water Year Type	Average Difference in Storage (ac-ft)		Average Flow Retained per Day (cfs)		Reduced Inundation Area due to Storage (ac) – Total River		Reduced Inundation Area due to Storage (ac) – Gravel Reach (RM 51.7–40)	
	March	April	March	April	March	April	March	April
Wet	34,096	-5,032	555	0	51	0	26	0
Above normal	18,799	-6,147	306	0	28	0	14	0
Below normal	79,358	2,071	1,291	35	148	3	74	1.5
Dry	31,208	-18,733	508	0	47	0	23	0
Critical	14,711	-13,092	239	0	22	0	11	0
Combined (all water years)	29,586	-9,078	481	0	44	0	22	0

[184] Note that this only estimates the effect of reservoir storage and not for any other consumptive uses.

[185] March and April are important months for fall-run Chinook rearing and are the months when floodplain inundation typically occurs.

Our analysis indicated that the greatest effect of reservoir storage occurs in the month of March, when reservoir storage reduces floodplain inundation by 22 acres to 148 acres, depending on water year type, with an overall reduction of 44 acres for all water year types for the total lower river. The reduction of inundated area in the more upstream gravel-bedded reach is about half of the total river reduction, which indicates that the overall effect of reservoir storage on potential floodplain rearing habitat in the lower river is not substantial. The overall reduction of 44 acres equals 1,916,640 square feet. The extent of project effects would depend on river flow, with a reduction of 1,916,640 square feet (44 acres) representing about 49 percent of the total area of inundation at 1,000 cfs and about 2 percent of the total area of inundation at 9,000 cfs.[186]

In lieu of making changes to reservoir storage to mitigate this project effect, which could have substantial adverse effects on downstream water supply, the Districts could mitigate the ongoing adverse effects of reduced floodplain inundation by implementing floodplain enhancement measures. In order to establish whether the Districts' proposed off-site mitigation would be commensurate with the project operational effect on floodplain habitat, in the draft EIS we calculated that, at an average cost of $146,836 per acre for floodplain reconnection/restoration projects (from FWS October 2, 2018, filing, attachment 1, table 1), restoring 44 acres of floodplain habitat would cost about $6.5 million, compared to the total LTRHIP capital fund of $38 million. Therefore, we concluded that the LTRHIP capital fund would greatly exceed the cost for restoring our overall estimate of an average of 44 acres of floodplain habitat reduced due to reservoir storage. We also stated that it was unclear: (1) which habitat restoration projects would be funded, (2) where those projects would be located in the lower river, (3) how the Districts would obtain the rights to access a property for restoration and maintenance activities for each proposed improvement site, (4) how compliance with the ESA and NHPA would be obtained at each site, and (5) how the Commission would determine whether each habitat improvement site should be included in the project boundary without site-specific details on project design and scope of operation and maintenance activities.

However, since issuance of the draft EIS, additional detailed information on potential projects that could be implemented under the LTRHIP was filed with the Commission. This includes four projects that were described in an August 15, 2019, filing by the Districts; additional comments filed by state and federal agencies and other parties supporting the Districts' proposal; and discussions among these same parties at

[186] We further evaluate the effects of project operations on floodplain inundation in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Wetlands and Riparian Areas.*

the September 19, 2019, section 10(j) meeting in Sacramento, California. These filings and discussions have further clarified the proposed LTRHIP.

Further, on December 11, 2019, the Districts filed a response to staff's AIR dated September 17, 2019, requesting the Districts complete additional modeling simulations to allow Commission staff to adequately address several alternatives included in the draft EIS, including the effects of implementing the LTRHIP on Chinook salmon smolt productivity, *O. mykiss* young-of-year productivity, and *O. mykiss* adult replacement rates, and followed this with corrected model results filed on June 17, 2020. The District's modeling showed that the LTRHIP would increase relative Chinook salmon smolt productivity by 9 to 19 percent and *O. mykiss* young-of-year productivity by 3 percent over the draft Voluntary Agreement flows alone (Districts, 2020c).[187] This modeling indicates that the LTRHIP would have a relative beneficial effect on salmon and *O. mykiss* populations in the lower Tuolumne River, and the relative benefits could be even greater if engineered log jams (ELJs) are incorporated into the LTRHIP projects to further increase habitat diversity, as we discuss below in the following subsection, *Large Woody Material Augmentation*. This type of LWM structure is typically anchored into the streambed with pilings to enable it to withstand flood forces and can be designed to provide complex overhead cover, low-velocity refugia, create pools and spawning habitat, direct flow towards bank-side cover, and re-connect side channels and floodplain habitat (Abbe et al., 2018; U.S. Bureau of Reclamation and U.S. Army Engineer Research and Development Center, 2016).

As we discussed above, potential habitat restoration under the LTRHIP could exceed our estimated average of 44 acres of floodplain habitat reduced due to reservoir storage. Thus, any additional floodplain habitat restored under the LTRHIP would be considered habitat enhancement that could increase fry to smolt survival and complement any flow measures that would increase floodplain inundation.

Large Woody Material Augmentation

LWM provides habitat structure in rivers and streams and can influence sediment storage and channel morphology through its effects on flow, water velocity, and sediment transport. These in-channel features also provide cover and holding habitat for fish, serve as substrate for the growth of algae and invertebrates (which are important components of the aquatic food web), and affect patterns of sediment deposition and scouring. A reduction in the amount of LWM can result in reduced complexity of aquatic habitat and reduced carrying capacity for aquatic biota. Mitigating any adverse effects of the projects

[187] Flows would increase below the infiltration galleries in dry and critical water years from 75 to 125 cfs from July 1 to October 15 but would decrease slightly at the La Grange gage from 350 to 300 cfs in wet, above normal, and below normal water years.

on instream habitat through the implementation of habitat restoration projects could benefit aquatic biota as well as terrestrial vegetation and improve geomorphic processes in the lower Tuolumne River.

NMFS recommends (10(j) recommendation 3) LWM enhancement and management for both projects, that includes provisions for counting and acquiring LWM from the projects' reservoirs and roads as well as during sediment harvesting from nearby dredger tailings, for collecting, storing, and prioritizing LWM for enhancement projects, for placement in the lower Tuolumne River, and for monitoring and reporting on the overall LWM enhancement and management effort. Under the NMFS recommendation, LWM is defined as structurally sound logs, with or without rootwads that are at least 3 feet long and at least 8-inches in diameter at 4 feet from the large end,[188] while key pieces of LWM are logs greater than 25 feet long, with rood wad attached, and 24 inches or greater in diameter (measured 4 feet from the rootwad). Under NMFS's 10(j) recommendation 3, the Districts would survey the upper reaches of Don Pedro Reservoir following any peak flow equal to or greater than a 1.5-year return interval flow and secure all LWM floating in the reservoir or perched on the reservoir margin so that it can be retrieved for removal later that season. The Districts would also annually remove LWM from the projects' reservoirs and store the material at locations that minimize transport time to the restoration reaches and are secure from illegal firewood cutting and other non-designated consumptive uses. Under the NMFS plan, the Districts would enhance the following reaches of the lower Tuolumne River with an initial placement of 80 to 100 pieces of LWM each year:

- Spawning Reach (RM 52.2–RM 47.5), La Grange Diversion Dam to Basso Bridge
- Dredger Reach (RM 47.5–RM 39.5), Basso Bridge to Roberts Ferry
- Mining Reach (RM 39.5–RM 36.3), Roberts Ferry to Santa Fe
- Lower Tuolumne River (RM 36.3–RM 0.0).

Under the NMFS recommendation, the annual wood augmentation would continue until a frequency of 100 LWM pieces per mile of stream channel is reached (about 6 pieces per 100 meters [328 feet] of channel length) on average throughout the four restoration reaches. Wood frequencies within a given reach may be higher or lower than the target average frequency, but a minimum frequency of 70 pieces per mile would need to be met in each of the reaches. Once an average frequency of 100 pieces per mile is met, monitoring (frequency dependent on peak flow occurrence) would determine whether the target frequencies are being maintained throughout the reaches (minimum of 70 pieces per mile within a reach and an average of 100 pieces per mile over the entire

[188] Because NMFS is citing the diameter 4 feet from the large end, we consider the minimum length to be 4 feet and not 3 feet.

length of the 52-mile river reach). Additional LWM augmentation would be necessary if LWM frequencies fall below the targets. LWM would be placed within the active channel, side channels, and on floodplain benches. Specifically, at least 50 percent of LWM would be placed in the active channel, as single pieces, clusters, and jams. Placement of the key pieces would be as follows: (1) 50 percent of the root-wad-free end of the log would be buried in the riverbank (not the stream bed); (2) the rootwad end of the log would be placed in the river at a depth so that 50 percent of the rootwad is inundated at low flows; and (3) placement of the log would be angled so that the rootwad end is at a 45 degree angle directed downstream. NMFS recommends that the composition of LWM augmentation pieces should adhere to the following guidelines: (1) at least 50 percent of all augmentation pieces should be longer than 10 feet and have diameters greater than 12 inches, (2) 20 percent should be longer than 18 feet and have diameters greater than 24 inches, and (3) at least 20 percent of all LWM augmentation pieces should have rootwads attached. NMFS further recommends (10(j) recommendation 3) that the Districts map the LWM in the lower Tuolumne River to inventory all LWM in the four lower Tuolumne restoration reaches. The mapping effort would begin with an initial inventory of existing wood to prioritize the initial LWM augmentation efforts and updated as LWM is augmented each year. In water years with high flow sufficient to mobilize and transport LWM, the augmented reaches would be remapped to verify existing wood locations. The Districts would also prepare an annual report to the Commission on the status of the LWM management program and monitoring, including the amount and types (e.g., size ranges) of LWM collected during the year, amount and location of material transported, and any noted biological use of LWM.

FWS does not specifically recommend LWM augmentation in the lower Tuolumne River, but instead recommends (revised Don Pedro 10(j) recommendation 3) implementation of an LTRHIP that would provide funding for planning, design, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. This would include holding and rearing habitat improvements. Additional discussion of the LTRHIP is included in the preceding subsection entitled *Floodplain Habitat Restoration*.

California DFW (10(j) recommendation M4-5) states that the Districts should place a total of 1,600 pieces of LWM from La Grange Diversion Dam down to the confluence with the San Joaquin River. They further recommend that the LWM be placed at an appropriate distribution, density, and configuration as recommended by a restoration ecologist and in consultation with appropriate agencies; that LWM pieces be placed within or adjacent to floodplain lowering and planting sites where feasible; that a minimum of 160 LWM pieces be secured or embedded in the bank to provide at least partial inundation at 300 cfs upstream of the Districts existing infiltration galleries and 200 cfs in areas downstream of the infiltration galleries; and that all pieces of LWM be a

minimum of 24 inches in diameter and 18 feet in length with a minimum of 50 percent having a crown or rootwad attached.

California DFW further recommends that annual implementation reports be prepared to include: (1) the quantity and quality of placed gravel and LWM; (2) the locations and duration of placed LWM, if dislodged, and placement/augmentation; (3) the results of monitoring of the placement/augmentation of gravels, and subsequent geomorphic distributions (movement, representative gravel quality, and bedload morphological change), and improvement (additions) of suitable anadromous salmonid spawning and rearing habitat by individual reach; and (4) the quantity, timing, and disposal method of LWM removed from Don Pedro Reservoir and La Grange Reservoir.

Additionally, a census would be conducted 3 and 10 years following license issuance and every 10 years thereafter. The census would include procedures for documenting all unrooted wood meeting minimum size requirements of greater than 3 feet in length and 4 inches in diameter that are located within the channel bed up to areas that would be inundated at 5,000 cfs and a map, including a geographic information system (GIS) database, developed after each census with an associated report.

Conservation Groups (recommendation 5) recommend that, within six months of any new licenses issued for the projects, the Districts develop a large woody debris placement and management plan in consultation with the TRTAC. The Conservation Groups recommend that the plan include the following: (1) description of potential collection locations of LWM in Don Pedro Reservoir or other locations in the Tuolumne River Watershed; (2) description of potential options for moving LWM from Don Pedro Reservoir to the Tuolumne River downstream of La Grange Diversion Dam; (3) identification of suitable LWM placement locations in the active channel of the Tuolumne River downstream of La Grange Diversion Dam to the confluence with the San Joaquin River; (4) consultation with state and federal agencies regarding effects of LWM on safety or maintenance of bridges; (5) consultation with qualified recreational boating groups to ensure safety with regard to placement of LWM in the context of channel design; (6) evaluation of the efficacy, costs, and permitting requirements of providing permanent anchorage to the placed LWM; (7) a long-term LWM management plan to re-install LWM annually to ensure no net loss of LWM; (8) a regular LWM effectiveness monitoring and reporting process; and (9) description of necessary permits and a permitting timeline.

Water Board preliminary 401 condition 4 specifies that the Water Board will likely require the Districts, in consultation with relevant resource agencies, to develop a plan to address the reduction of LWM downstream of La Grange Diversion Dam. The goal of this plan would be to increase the amount of LWM below La Grange Diversion Dam in order to improve downstream aquatic habitat. The Districts would consult with representatives from the boating community (e.g., American Whitewater) to ensure LWM placement in the river is not hazardous to boaters. The Districts may also be required to monitor the implementation and effectiveness of LWM augmentation and to

submit associated reports to the Water Board's Deputy Director. BMPs would be developed to minimize the effect on beneficial uses (e.g., turbidity and wildlife) from LWM placement and installation.

In their reply comments, the Districts state it is unlikely the Don Pedro Project affects LWM content in the lower Tuolumne River because the wood captured in Don Pedro Reservoir is too small to be maintained in the lower river for any length of time. In two surveys of the size of wood deposited in the reservoir, an average of only 6.5 percent of the measured logs were greater than 16 inches in diameter and greater than 13 feet long (Stillwater Sciences, 2017a). These surveys occurred in the third and fifth highest wood loading years of the 12-year study of wood raft volume in Don Pedro Reservoir. Moreover, because even logs 18 feet long and 24 inches in diameter are unlikely to be stable in the 120-foot-wide alluvial lower Tuolumne River, wood would likely be highly mobile and unlikely to provide extensive habitat. Nearly every study of wood mobility emphasizes that wood less than half a channel width is unlikely to be stable, particularly if the diameter is less than the mean depth during floods. Ten-foot-long logs are even less likely to be stable and would be difficult to anchor. These logs would likely need to be replaced after even modest flows, particularly given the lack of key pieces (greater than 60 feet long) in the reservoir and riparian zone.

In response to California DFW's recommendation, the Districts state that insufficient large wood from upstream is delivered to Don Pedro Reservoir to justify California DFW's recommendation, and that California DFW offers no justification for the program it recommends as applied to the lower Tuolumne River, nor any assessment of the expected benefits other than hypothesized general habitat improvements. The wood trapped in Don Pedro Reservoir is typically small, with few large logs.

Our Analysis

In the draft EIS, we concluded that the Don Pedro and La Grange Dams intercept most LWM moving downstream from the upper Tuolumne River Basin, and the projects reduce the frequency and magnitude of high flows in the lower river, limit LWM transport, and reduce geomorphic processes that often deliver local sources of wood to the channel. We also concluded that a comprehensive LWM management plan, as recommended by the resource agencies, would likely provide much more complex habitat over a longer period and would have a clear nexus to the project. We also noted that a comprehensive LWM management plan would promote the accumulation of spawning gravels, provide hydraulic refugia for juvenile fish rearing and adult fish holding (Roni and Quinn, 2001; Bisson et al., 1987), create pools by forcing flows to scour channel beds and banks, and afford structural partitioning that provides protection from predation, and visual isolation that lowers interspecies competition (Dolloff, 1983). The LWM would also supply nutrients and substrate for aquatic organisms (Anderson et al., 1978) and aid in the retention of salmonid carcasses, which provide important marine-derived nitrogen to terrestrial ecosystems and organic nutrients to salmon juveniles, macroinvertebrates, terrestrial animals, and birds (Naiman et al., 2002; Merz and Moyle,

2006). But we questioned whether LWM measuring less than 16 inches in diameter (at 4 feet from the large end) and less than 20 feet in length would provide the structural benefits that are currently lacking in the lower Tuolumne River (given its existing bankfull width and occasional high river flows) and even then, pieces of this size may need to be aggregated into log jams to provide the desired benefits. The availability of larger pieces of LWM in Don Pedro Reservoir also appeared to be limited. Figure 3.3.2-38 shows the typical LWM collected in the reservoir to limit the hazards to recreational users. We also noted that although the resource agencies identify placement targets for the lower Tuolumne River, an LWM management plan should be designed to mitigate the ongoing effects of the projects on wood recruitment, and we therefore recommended the Districts develop a comprehensive LWM management plan for the Don Pedro Project, in consultation with state and federal resource agencies. This LWM management plan would increase the amount of LWM downstream of the La Grange Diversion Dam by guiding the placement of LWM collected from Don Pedro Reservoir, monitoring enhanced sites, and revising the plan over time based on monitoring data.

In comments on the draft EIS and in discussions that occurred at the September 19, 2019, section 10(j) meeting, FWS stated that it appears that staff limited its analysis to only using natural wood input into Don Pedro Reservoir and recommended using other sources of salvage wood that would provide easier logistics. FWS requested that any license requirement should allow the collection of wood outside the reservoir because LWM is available from a variety of sources where salvage wood may be available and easier to access. NMFS agreed with the FWS recommendation but continued to recommend specific LWM augmentation amounts of approximately 100 pieces of LWM per mile based on studies of Chinook salmon habitat from 19 other river systems in the region. NMFS also requested that the final EIS should analyze NMFS's specific plan for LWM (NMFS 10(j) condition 3) along with the scientific rationale that supports it and use this analysis to determine the specifics of a plan (including total volume of wood per year) to be implemented in the license order. The Districts continued to question whether LWM enhancement would provide any habitat benefits in a river the size of the lower Tuolumne River, because much of the LWM would likely just pass through the lower river during high flows, noting that habitat formation due to LWM usually decreases with increasing channel width. The Districts also commented that it would be infeasible to recover LWM from Don Pedro Reservoir where it currently is collected and corralled because of the difficult logistics (steep shoreline terrain, lack of roads along the shoreline), so the staff plan to only collect LWM from the reservoir would not be possible.

Figure 3.3.2-38. Woody material on Don Pedro Reservoir in 2017, near Ward's Ferry Bridge (Source: FWS, 2018a).

Also related to aquatic habitat enhancement, as we discussed above in the subsection entitled *Floodplain Habitat Restoration*, based on additional information filed by the Districts, and the continued support for the LTRHIP by FWS and NMFS, we conclude that this program would mitigate project effects on floodplain habitat in the lower Tuolumne River, as well as provide additional enhancement that would increase fry to smolt survival and complement any flow measures that would increase floodplain inundation. Although the initial four projects described by the Districts would primarily involve gravel augmentation, channel manipulations, and riparian plantings, future projects under the LTRHIP could involve LWM installation, and it would be logical and more efficient to include any plans for LWM enhancement and management under the LTRHIP, instead of under a separate and duplicative LWM management plan as we previously recommended. This would allow coordination of LWM enhancement with other habitat enhancement measures under the LTRHIP. However, we have revised our analysis to further assess the volume of LWM that would be appropriate for aquatic habitat enhancement in the lower Tuolumne River, in consideration of previous recommendations made by NMFS and other stakeholders.

The NMFS target (an average frequency of 100 wood pieces per mile) was derived using densities found in other California streams supporting Chinook salmon and in the lower Mokelumne River. NMFS is recommending an ultimate placement of 100 pieces of wood per mile in the four restoration reaches that total 52 river miles, with a minimum of 70 pieces per mile in the restoration reaches. NMFS has indicated that wood pieces should be greater than 3 feet long and 8 inches in diameter at 4 feet from the large end, which appears to indicate that the minimum length for each piece should actually be 4 feet long. Thus, each piece would have a minimum volume of 1.37 cubic feet (assuming a cylinder 4 feet long and 8 inches in diameter). At 100 pieces per mile, this would be a

minimum volume of 137 cubic feet per mile, or a minimum volume of 7,124 cubic feet for the 52 miles of the Tuolumne River restoration reaches. NMFS, however, also recommends that the composition of LWM augmentation pieces should adhere to the following guidelines: (1) at least 50 percent of all augmentation pieces should be longer than 10 feet long and have diameters greater than 12 inches, (2) 20 percent should be longer than 18 feet long and have diameters greater than 24 inches, and (3) at least 20 percent of all LWM augmentation pieces should have rootwads attached. Assuming 100 pieces per mile and the above NMFS guidelines,[189] we estimate that those pieces would total a minimum volume of 1,565 cubic feet per mile, or a minimum volume of 81,380 cubic feet for 52 miles.

NMFS is using other studies in California as the basis for their placement guidelines and cites Albertson et al. (2013)[190] and Senter and Pasternack (2010). We also reviewed those studies to assess the NMFS basis for their placement guidelines. Albertson et al. (2013) reported a median of 130 pieces of wood per mile for 19 California streams, and Senter and Pasternack (2010) observed 112 pieces of wood per mile in the lower nearby Mokelumne River, although both studies used smaller minimum criteria for LWM than the NMFS minimum criteria.[191] Albertson et al. (2013) was a more comprehensive study because it involved measurements in 19 California streams, and reported that the median size of LWM surveyed in the 19 streams was 0.55 cubic foot. Albertson et al. (2013) also reported a median of 8.1 wood pieces per 100 meters (130 pieces per mile) for the 19 streams, which translates to 4.5 cubic feet per 100 meters or 72.4 cubic feet per mile. If this LWM loading is applied to the 52 miles of the lower Tuolumne River, it results in about 3,765 cubic feet, a much lower volume than recommended by NMFS. California DFW recommends the Districts place a total of 1,600 pieces of LWM from La Grange Diversion Dam to the confluence with the San Joaquin River,[192] which would be about 31 pieces or 1,751.5 cubic feet per mile (a minimum of 91,078 cubic feet over 52 miles, not counting rootwads), which is less than

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[189] We assume 50 pieces, 10-feet long and 12 inches in diameter; 20 pieces, 18-feet long and 24 inches in diameter; and 30 pieces, 4-feet long and 8 inches in diameter.

[190] NMFS cites this publication as Albertson et al. (2012), but the publication date in the journal *River Research and Applications* is 2013.

[191] Albertson et al. (2013) counted any piece of wood greater than 6 cm (2.4 inches) in diameter, and Senter and Pasternack (2010) defined LWM as being a minimum of 1 meter (3.28 feet) long and 10 cm (3.9 inches) in diameter.

[192] California DFW recommends all pieces of LWM be a minimum of 24 inches in diameter and 18 feet in length with a minimum of 50 percent having a crown or rootwad attached. Pieces of this dimension, without the rootwad that would have an irregular dimension, would have a volume of 56.5 cubic feet.

the NMFS recommendation but substantially higher than observed by Albertson et al. (2013).

We also reviewed the Tuolumne River-specific LWM study conducted for the Districts (Stillwater Sciences, 2017a), who estimated the volume of LWM currently deposited in the lower river (RM 51.8 to 24) and in Don Pedro Reservoir, and categorized wood pieces by width and length. Stillwater reported three width intervals (in inches): 4–8; 8.1–16; and 16.1–31; and four length intervals (in feet): 3–6.5; 6.6–13; 13.1–26; and 26.1–52. Based on observations in the lower Tuolumne River and as reported in the literature (Bilby and Ward, 1989; Booth et al., 1997), smaller LWM that is deposited in the lower river would likely be washed out by high flows, with only wood deposited at higher elevations on the riverbanks, or larger wood pieces, capable of remaining in place. This is related to the increased capacity of larger streams (with greater streamflow and wider/deeper wetted channels) to move LWM downstream, similar to the lower Tuolumne River. Using Stillwater Sciences (2017a) wood categories, we conservatively defined larger pieces of LWM as those with a diameter of at least 16.1 inches at all lengths. In their sampling, Stillwater Sciences (2017a) found that those larger size categories comprised 9.5 percent of the wood counted in the lower Tuolumne River, and 23.9 percent of the wood counted in Don Pedro Reservoir, indicating more than twice as many larger LWM pieces in reservoir representative samples than in the lower river. Stillwater Sciences also estimated the total volume of the various size categories in the 27.8-mile lower river study reach and estimated 6,535 cubic feet of larger LWM (diameter of 16.1 inches or greater), or about 235 cubic feet per mile. All size classes totaled 11,702 cubic feet or 420.9 cubic feet per mile.

In summary, the LWM loadings that we estimated from the studies discussed above and the recommendations from NMFS and California DFW are listed below:

- Albertson et al. (2013) observed for 19 existing streams – 72.4 cubic feet per mile
- NMFS recommended – minimum of 1,565 cubic feet per mile
- California DFW recommended – minimum of 1,751.5 cubic feet per mile
- Stillwater Sciences (2017a) – observed for all sizes = 420.9 cubic feet per mile
- Stillwater Sciences (2017a) – observed larger sizes only = 235 cubic feet per mile

This indicates that both the NMFS and California DFW recommendations for LWM loading are substantially higher than observed in the 19 streams surveyed by Albertson et al. (2013) and by Stillwater Sciences (2017a) in the lower Tuolumne River. The NMFS and California DFW recommendations represent a much larger volume of wood than was observed by Albertson et al. (2013), which NMFS uses as a basis for its recommended LWM loadings. Both the NMFS and California DFW recommendations specify a majority of large LWM in any LWM to be used for habitat enhancement, with the objective that this LWM remain stable and not be washed out by high flows, yet the

19 streams surveyed by Albertson et al. (2013) appear to maintain a much lower LWM loading in streams that are known to support salmon in California's Central Valley.

Because the NMFS and California DFW recommendations appear to exceed the LWM volume observed in other streams in the region and to the likely magnitude of project effects, we developed alternative LWM loadings for use in habitat enhancement as part of the LTRHIP. As noted above, Stillwater Sciences (2017a) found that the lower Tuolumne River (RM 51.8 to 24) already contains 235 cubic feet per mile (6,535 cubic feet) of larger LWM, although much of it was not in the wetted channel. As we also noted above, the ratio of large wood to smaller wood between the river and the reservoir (9.5 percent versus 23.9 percent) suggests that the effect of the project appears to have reduced the abundance of large wood in the lower river by about half. Thus, if we double the loading of large LWM in the lower river (i.e., introduce 6,535 cubic feet), this would mitigate project effects. However, it would be most effective to only introduce this LWM to the river upstream of RM 24, the reach that has the most suitable habitat and water temperatures for salmonids, and to focus on areas most likely to benefit from additional LWM. In addition, installing the LWM in ELJs would help to ensure that the LWM is not swept downstream during floods, since these structures are typically anchored in place by pilings driven into the riverbed.

Downstream of RM 24, the river is less suitable for salmonids because of modification of the river channel, reducing the potential for LWM to be retained due to construction of levees and the loss of riffles and point bars due to in-river gravel mining, resulting in reaches that are wide and deep and of limited habitat value. We estimate that an ELJ would likely use a volume of 250 to 500 cubic feet of LWM, so addition of 6,535 cubic feet of LWM could contribute enough material for 13 to 26 ELJs, which could be clustered and anchored in target areas with the greatest potential for habitat enhancement. While this level of LWM enhancement is lower than that recommended by NMFS and California DFW, it would be substantially higher than reported by Albertson et al. (2013) for 19 Central Valley streams known to support salmon. We note that NMFS previously recommended that the Districts first map the LWM in the lower Tuolumne River to inventory all LWM in lower Tuolumne restoration reaches in order to prioritize the initial LWM augmentation efforts and update the inventory as LWM is augmented each year. This NMFS recommendation would be a reasonable approach to managing LWM distribution in the lower river. The specific plans for LWM management would be developed as part of the interagency consultations under the LTRHIP.

Comprehensive LWM management, developed as part of the LTRHIP in consultation with the resource agencies, would ensure that any plans are well developed and capable of meeting stated enhancement objectives. Any planning could identify sources of LWM for habitat enhancement and identify suitable LWM size classes, locations for placement, and placement methods (i.e., anchoring and/or incorporation into ELJs) in the lower Tuolumne River. Monitoring and mapping the location of LWM as a component of the LTRHIP monitoring program would also provide an indication of their stability and inform the need for future placement activities.

Fish Stocking

Don Pedro Reservoir offers anglers year-round fishing for cold- and warmwater species and hosts multiple fishing tournaments annually. California DFW stocks trout in Don Pedro Reservoir, while DPRA stocks largemouth bass. Additionally, the Districts estimated recreational use to increase by approximately 67 and 12 percent for Stanislaus and Tuolumne Counties respectively, by 2050 (HDR, 2013d). No known fish stocking has occurred in the reach of the Tuolumne River between the Don Pedro Dam and La Grange Diversion Dam, and no local hatchery supplementation occurs in the reach of river downstream of the La Grange Diversion Dam.

Hatchery-raised fall-run Chinook salmon from other San Joaquin tributary rivers often stray into the Tuolumne River and crossbreed with native Tuolumne River fall-run Chinook salmon. The rate of hatchery-raised fall-run Chinook salmon straying into the Tuolumne River has ranged from 39 to 100 percent in some years, based on otolith samples provided to the Districts by California DFW (Stillwater Sciences, 2016).

To genetically manage the Tuolumne River fisheries, California DFW recommends (10(j) recommendation M7-1) the Districts develop a fisheries genetic management plan for both projects, in consultation with TREG. The plans should include at a minimum: (1) genetic goals and objectives for Chinook salmon, steelhead/rainbow trout, species that would be part of reservoir fish stockings, and other natives fishes of the Tuolumne River including, but not limited to, white sturgeon, Red Hills roach, and Pacific lamprey, and (2) recreation fish stocking plans for project facilities. California DFW further recommends (10(j) recommendation M7-1) that if required by California DFW's 10(j) recommendation M8 (provide for fish protection at project facilities and section 18 authority for fish passage) or by TREG during development of the recommended fisheries genetic management plan, the Districts should develop a conservation hatchery plan to accompany the fisheries genetic management plan. California DFW's recommended conservation hatchery plan would address: (1) native fish restoration, especially Chinook salmon and steelhead/rainbow trout, (2) genetic and ecological criteria, (3) maximizing genetic and phenotypic (e.g., behavioral life history) diversity, (4) enhancement of natural life history strategies, and (5) minimizing negative impacts to the existing native Tuolumne River salmonid population. The plan would be intended as a basis for an adaptive management program and any implementation would be based on an adaptive management framework.

California DFW recommends (10(j) recommendation M7-2) that in order to mitigate for lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities, that the Districts assume full responsibility for providing reservoir-based recreation, including angling opportunities, at all project reservoirs that are currently or have historically been stocked by California DFW. Under this recommendation, the Districts would stock at least 35,000 pounds of hatchery salmonids in the project reservoirs for the first two years of any licenses issued for the projects, or until the fisheries genetic management plan is developed and implemented.

After which, the Districts would annually fund fish stocking in Don Pedro Reservoir and annually consult with California DFW to establish stocking targets, species compositions, discuss acquisition, and verify completion of the previous year's stocking commitment. The Districts may acquire fish directly from a California DFW-approved hatchery, or reimburse the California DFW, to the extent the department has fish available, for the cost of the stocking.

In their reply comments, the Districts state that expanding the goals and objectives of a genetic management plan to species other than fall-run Chinook (i.e., steelhead/rainbow trout, white sturgeon, Red Hills roach, and Pacific lamprey), as recommended by California DFW, is not supported by available information that indicates the reintroduction of spring-run Chinook and steelhead into the upper Tuolumne River above the Don Pedro Project is not feasible.

Our Analysis

Don Pedro Project—California DFW and DPRA have stocked hatchery fish into Don Pedro Reservoir since 1953 and manage the reservoir as a put-and-take fishery for coldwater species and as a year-round fishery for black bass. DPRA has been stocking black bass in the reservoir on an annual basis since the early 1980s, and the reservoir is home to frequent bass fishing tournaments. Specifically, in 2010, 30 different organizations held 45 tournaments in Don Pedro Reservoir. According to DPRA's website, 31 fishing tournaments are scheduled for 2018 in Don Pedro Reservoir, and black bass weighing up to 18.5 pounds have been caught in the reservoir in recent years (DPRA, 2018). California DFW's (10(j) recommendation M7-2) recommendation is intended to mitigate for lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities. However, the fishery in Don Pedro Reservoir offers substantial recreation opportunities, and a need to improve it is unclear, or why the Districts should become responsible for stocking the reservoir.

California DFW's recommended fisheries genetic management plan and conservation hatchery plan does not contain specific details regarding the contents of the plans and its nexus to the Don Pedro Project. Instead, these details would be developed in consultation with resource agencies, after issuance of any license. Consequently, we cannot evaluate how California DFW's recommendations would specifically address impacts of the Don Pedro Project. As written, California DFW's recommendations appear to be a general research project for the fisheries of the Tuolumne River Basin. Our analysis must focus on potential project-related measures that could benefit Central Valley fall-run Chinook salmon populations and other species by enhancing natural in-river production, such as an improved flow regime, reduced water temperatures to the extent controllable by the project, and salmonid habitat enhancements.

La Grange Project—California DFW states that goal of its 10(j) recommendation M7 is to identify and maintain a diverse and locally adapted fish population in the Tuolumne River, Don Pedro Reservoir and La Grange Reservoir, while the objective of

its recommended fisheries genetic management plan is to identify genetic goals for fishes stocked in the Tuolumne River, Don Pedro Reservoir and La Grange Reservoir to ensure that the genetic portfolio of each species is not detrimentally altered by any river or reservoir stocking program. As with the Don Pedro Project, because of the lack of specific details, there appears to be little nexus to the La Grange Project.

Salmonid Monitoring

Any new license for the project would likely include several measures that would alter aquatic and riparian habitat conditions in the Tuolumne River downstream of La Grange Diversion Dam. These altered habitat conditions could affect the distribution and abundance of resident and anadromous salmonids and other aquatic organisms in the Tuolumne River.

NMFS recommends (10(j) recommendation 4) the Districts develop a salmonid monitoring plan within the first year of any licenses issued for the projects. The plan would cover resident and anadromous salmonids with the option to add green sturgeon to the plan once NMFS has determined their presence in the lower Tuolumne River. Under NMFS's plan, monitoring would include: (1) annual snorkeling, pre-spawning mortality, and carcass surveys in the following reaches (a) downstream of La Grange Diversion Dam to Basso Bridge (RMs 52.0 to 47.5), (b) from Basso Bridge downstream to Roberts Ferry (RMs 47.5 to 39.5), (c) from Roberts Ferry downstream to Santa Fe Bridge (RMs 39.5 to 36.3), and (d) from Santa Fe Bridge to the Tuolumne River's confluence with the San Joaquin River (RMs 36.3 to 0); (2) annual juvenile emergence and outmigration monitoring from at least mid-January through the end of May, using a paired RST at RM 5.3 (Grayson RST) and one at RM 29.8 (Waterford RST); (3) seasonal counting weir at RM 24.5 to estimate Central Valley Chinook salmon and California Central Valley steelhead escapement and provide data on the percentage of females and migration timing; (4) annual otolith analysis to estimate the contribution of naturally produced fry-, parr-, and smolt-sized migrants to the adult population; and (5) supervision of all work by California DFW and NMFS field staff in consultation with TRTAC.

FWS recommends (Don Pedro 10(j) recommendation 5) the Districts develop a salmonid monitoring plan in consultation with the Water Board, FWS, NMFS, and California DFW, and, within the first three years of any new licenses issued for the projects. Under FWS's plan, salmonid monitoring would include at a minimum: (1) measurement of fall-run Chinook salmon escapement by conducting annual carcass surveys, from October 1 through December 31; (2) morphometric measurements of 100 percent of the Chinook salmon carcasses downstream of the existing seasonal fish counting weir at RM 24.5; (3) morphometric measurements of the first 500 Chinook salmon carcasses found upstream of the fish counting weir, plus morphometric measurements of 5 percent of the next 500 to 1,000 Chinook salmon carcasses found upstream of the fish counting weir; (4) annual paired RST surveys from February 1 through June 15 at RM 5.3 (Grayson RST) and at RM 29.8 (Waterford RST); (5) the operation and maintenance of the existing seasonal counting weir at RM 24.5; (6) snorkel

surveys prior to each LWM placement action, within the area of the LWM placement and 10 meters upstream and downstream of the placement; two snorkel surveys should occur in the placement area following LWM placement (the first during the second week following placement and the second prior to spring flows returning to minimum instream flows in the calendar year following LWM placement); and (7) annual reporting of the results of salmonid monitoring to FWS, NMFS, and California DFW.

California DFW recommends (10(j) recommendation M11) a similar plan as FWS however, with the provision that if STM Work Group is established by the Water Board, as part of the update to the 2006 Bay-Delta Plan, then TREG would work with the STM Work Group, to further the goals and objectives of the California DFW's recommended salmonid monitoring plan.

In their reply comments, the Districts state that they already perform many aspects of the NMFS's recommended program (including snorkeling surveys, RST monitoring, and weir monitoring), propose to continue these measures, and each monitoring measure in the Districts' program has a specific purpose and use for the data obtained, while NMFS does not explain what is to be done with the large amount of data collected and what purpose each measure serves. The Districts also state that NMFS and FWS's recommended annual carcass surveys to estimate spawning and escapement should not be adopted because of the high level of uncertainty in abundance estimates.[193] Regarding NMFS's recommendation for annual pre-spawning mortality surveys, the Districts state that based on California DFW carcass survey data, pre-spawn mortality has not been an issue of concern on the Tuolumne River; however, evaluation of pre-spawn mortality could be incorporated into reduced carcass surveys and should be focused on expanded collection of scales, otoliths, and coded-wire-tags. In response to FWS's Don Pedro 10(j) recommendation 5, the Districts state that continued operation of the Tuolumne River weir would provide morphometric measurements of all Chinook salmon passages.

Our Analysis

Fish population monitoring, if conducted, is typically based on the presence, absence, and relative abundance of target species, or on community parameters (such as productivity, density, and diversity), and is usually conducted over multiple years. Once analyzed, monitoring data can be used to verify compliance with specific license requirements or to evaluate ongoing project effects on a resource. However, these data must be robust enough to separate any project effects from non-project effects on the monitored resource.

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[193] The Districts state that comparison of weir counts with Jolly-Seber escapement estimates showed that California DFW underestimated annual abundance by 47 to 69 percent; however, they did not provide a reference to support their statement.

While the agency-recommended salmonid monitoring measures would provide valuable information on annual anadromous salmonid escapement, pre-spawning mortality, spawning success, juvenile outmigration and abundance, and other parameters, we do not see how this information would specifically relate to project operations or how these data could be used to inform any future changes in these operations. In addition, the resource agencies do not explain what would be done with these data or how it would be used to better manage the resource. Resource management, however, is an agency responsibility and not the Districts'.

It is well known that the annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by ocean and estuary conditions, annual hatchery augmentation, state and federal fishery management, and the operation of other dams and diversions in the watershed. All of these factors are outside of the Districts' control and they should not be held responsible for any impacts to the fishery that may occur outside of the Tuolumne River. Furthermore, the Districts already perform snorkeling surveys, RST monitoring, and weir monitoring (as a component of the 1995 Settlement Agreement) and propose to continue these measures under any new licenses issued for the projects.

Aquatic Invasive Species Management

New Zealand mudsnails, quagga mussels, and zebra mussels are invasive aquatic mollusk species that compete for habitat and food resources and have the potential to affect aquatic communities. While these species have not been reported in the Don Pedro Reservoir or the Tuolumne River by the Districts or resource agencies, the New Zealand mudsnail has been documented in the lower Merced River between Crocker-Huffman Diversion Dam (RM 52.0) and the Highway 59 Bridge (RM 42.0). If New Zealand mudsnails became established in the Tuolumne River Watershed, they would pose similar threats as other aquatic invasive species in other areas, including clogging facility pipes and out competing other aquatic macroinvertebrates for food, thereby disrupting ecosystem balances across the food web.

Water hyacinth is an invasive aquatic plant species that spreads rapidly and can displace native aquatic plants. During relicensing studies, the Districts documented water hyacinth throughout the lower Tuolumne River between RM 24.5 and the confluence with the San Joaquin River. Through rapid proliferation, water hyacinths can obstruct navigable waterways, impede drainage, foul hydroelectric generators and pumps, block irrigation canals and impair water quality (California Invasive Plant Council, 2018).

The Districts propose to implement an Aquatic Invasive Species Management Plan (filed on October 11, 2017) that includes: (1) providing information to recreational users on ways to reduce the spread of invasive species; (2) continuing the boater self-inspection permit program for invasive mollusks; and (3) implementing routine operation and management activities, using the following BMPs: (a) identifying aquatic invasive species that may be introduced by a given activity, (b) implementing preventive

measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs.

In its letter filed January 29, 2018, the Water Board (preliminary 401 condition 8) specifies the Districts develop, in consultation with resource agencies, a plan to manage aquatic invasive species, through establishing a framework with specific activities to minimize the spread and impact of aquatic invasive species on native fauna and habitats, and identifying and describing aquatic invasive species currently established within the projects' area, and aquatic invasive species with high potential to become established within the projects' area. The plan specified by the Water Board could include, but is not limited to, the following measures: (1) implement actions to minimize and prevent the introduction and spread of aquatic invasive species into and throughout projects' affected waters; (2) provide education and outreach to ensure public awareness of aquatic invasive species effects and management throughout the projects' affected waters; (3) implement monitoring programs for early detection of aquatic invasive species; (4) ensure all the projects' aquatic invasive species management activities comply with federal and State of California laws, regulations, policies, and management plans, and with Forest Service directives and orders regarding aquatic invasive species; and (5) monitor and minimize the spread of established aquatic invasive species.

California DFW recommends (10(j) recommendation M10) the Districts implement the revised Aquatic Invasive Species Management Plan filed with their recommendation. California DFW's revised plan would address the same species as the Districts' plan, but would also address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil. Many of California DFW's recommended provisions are either similar to or slightly modified from provisions in the Districts' plan, and include: (1) educating the public with respect to aquatic invasive species with the potential to invade project waters, (2) meeting or exceeding the requirements of the California Fish and Game Code § 2302[194] with respect to dreissenid mussels, (3) incorporating aquatic invasive species prevention in all project activities,

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[194] Section 2302 of the California Fish and Game Code requires any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir, as defined in section 6004.5 of the Water Code, where recreational, boating, or fishing activities are permitted, except a privately owned reservoir that is not open to the public, to assess the vulnerability of the reservoir for the introduction of non-native dreissenid mussel species and develop and implement a program designed to prevent the introduction of non-native dreissenid mussel species. If recreational, boating, or fishing activities are not permitted, the managing entity shall, based on its available resources and staffing, include visual monitoring for the presence of mussels as part of its routine field activities.

(4) continuing to collaborate with other regional and statewide efforts, (5) reporting incidental observations, (6) implementing the North Central Valley Consortium's Quagga and Zebra Mussel Prevention Plan, and (7) developing BMPs for individual project activities that have the potential to introduce aquatic invasive species into a project reservoir. California DFW's revised plan also includes provisions for annual consultation between the Districts, California DFW, and BLM to ensure that the goals and objectives of the plan are met, the proposed measures are implemented, and for review, update, and/or revisions to the plan as needed, when changes to the existing conditions regarding aquatic invasive species have occurred.

BLM Don Pedro revised 4(e) condition 6 specifies that, following consultation with BLM, the Districts should file a BLM-approved aquatic invasive species management plan within one year of any new license issued for the project. BLM provided an approved plan with its preliminary condition. The plan provided by BLM contains the same provision as listed previously in California DFW's plan and addresses the same invasive species. However, in BLM's plan, all invasive plant species would be addressed in the TRMP specified by BLM's Don Pedro revised 4(e) condition 7. Park Service 10(a) recommendation 3 recommends conducting any measures to remove water hyacinth that would render the river non-navigable well before the summer recreational flow season. In their reply comments, the Districts state that in response to California DFW's recommendation to educate the public with respect to aquatic invasive species, they agree to draft a modified Aquatic Invasive Species Plan to include information provided by California DFW.

Our Analysis

Don Pedro Project—Don Pedro Reservoir provides many angling opportunities (40 to 80 fishing derbies annually), and consequently, provides frequent opportunities for boats and trailers to transfer aquatic invasive species into the reservoir. Educating the public on ways to reduce the spread of invasive species, by providing signage and information pamphlets at boat launches as well as relevant information and boater self-inspection forms on project recreational facility websites, as proposed by the Districts and recommended by the Water Board, BLM, and California DFW would help minimize the risk of transporting invasive species from infected waterbodies.

The Districts propose and resource agencies recommend similar BMPs for individual project activities, including maintenance activities performed by the Districts or their contractors. The BMPs proposed by the Districts and recommended by the resource agencies would help minimize the introduction and potential spread of invasive species, particularly during project activities at the Don Pedro Project where aquatic invasive species management may not be the primary objective. Including annual employee training to identify aquatic invasive species, as recommended by California DFW, would increase the potential for incidental observations of non-native species.

Early detection is a critical component in effectively managing the spread of invasive species and routine monitoring as recommended by California DFW and specified by the Water Board and BLM, would provide a means for early detection. As mentioned previously, invasive mollusks have not been reported by the Districts or resource agencies in Don Pedro or La Grange Reservoirs or the Tuolumne River, and the nearest occurrence of invasive mollusks are New Zealand mudsnails documented in the lower Merced River. Recording incidental observations of non-native species during project activities in Don Pedro Reservoir and in stream reaches regulated by the Don Pedro Project, and immediately (within 24 hours) reporting any observations to California DFW, and if observed on federal lands, to BLM, would help to provide a means for effectively managing invasive mollusks.

The Districts consider the overall vulnerability of Don Pedro Reservoir to the introduction of dreissenid mussels to be low, based on Cohen's (2008) ranking of sites on the Tuolumne River upstream of Don Pedro Dam and downstream of La Grange Diversion Dam as "not vulnerable to colonization" by zebra mussel and quagga mussel due to low calcium concentrations. The Districts' proposed plan includes a provision to reassess the vulnerability of Don Pedro Reservoir and to develop appropriate additional program modifications, if significant new information becomes available that changes current understandings on the water chemistry thresholds that support non-native dreissenid mussel species. Because calcium samples analyzed in Cohen (2008) from the Tuolumne River at Modesto (13 mg/L) were considered to have low vulnerability to colonization by zebra and quagga mussels and even lower vulnerability in Don Pedro Reservoir, its inflow, its outflow (Districts, 2011a; HDR, 2013a), and the Tuolumne River at the La Grange Bridge (Cohen, 2008).[195] Both California DFW's and BLM's recommended plans are intended to address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil, in addition to the dreissenid mussels and New Zealand mudsnail addressed by the Districts' proposed plan. Asian clam, like the New Zealand mudsnail have not been documented in the Tuolumne River, but have been observed in the lower Merced River. Re-assessing project waters vulnerability when warranted, early detection, applying BMPs, and public educational information on Asian clams would provide appropriate management of aquatic invasive species for the Don Pedro Project.[196]

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[195] The maximum reported calcium concentration for 173 samples from Don Pedro Reservoir, its inflow, and outflow was 7.4 mg/L, which suggests low vulnerability because it is well below the 12–15 mg/L range used to identify vulnerability to colonization (Cohen, 2008).

[196] We expect that such a vulnerability assessment would be conducted after data collected by a state or federal fish and wildlife agency indicates that such a reassessment is warranted, and that any new measure(s) would be implemented via the Commission's standard fish and wildlife reopener, which allows the opportunity for public comment.

La Grange Project—No existing recreational facilities are located along the reach of the Tuolumne River between Don Pedro Dam and the La Grange Diversion Dam that would act to draw recreationists that could spread invasive species, but the Districts propose to construct a footpath to improve access to La Grange Reservoir. Boating above La Grange Diversion Dam is made difficult by the lack of access sites, infeasibility of portage at the spillway because the dam's abutments are vertical canyon walls, and the design of the spillway spanning directly between the two Districts' canal intakes, which creates hazardous conditions for boating. Similar to managing aquatic invasive species at the Don Pedro Project, educating the public on ways to reduce the spread of invasive species, by providing relevant information and boater self-inspection forms on project recreational facility websites, as proposed by the Districts for the Don Pedro Project, and as specified by the Water Board and recommended by California DFW for the La Grange Project, would help minimize the risk of transporting invasive species from infected waterbodies.

Applying similar BMPs as discussed previously for the Don Pedro Project, to individual La Grange Project activities, including annual employee training to identify aquatic invasive species, would increase the potential for incidental observations of non-native species. Similar to the Don Pedro Project, recording incidental observations of non-native species during La Grange Project activities and immediately (within 24 hours) reporting any observations to California DFW, and if observed on federal lands, to BLM, would help to provide a means for effectively managing invasive mollusks. California DFW's recommended plan is intended to address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil, in addition to the dreissenid mussels and New Zealand mudsnail. Asian clam, like the New Zealand mudsnail have not been documented in the Tuolumne River, but have been observed in the lower Merced River. Early detection, applying BMPs, and public educational information on Asian clams would provide appropriate management of aquatic invasive species for the La Grange Project.

Although the Districts proposed in their amended final license application to provide funding to California DFW to support water hyacinth removal, this measure was withdrawn when the Districts agreed to fund the LTRHIP, and no other parties have recommended that water hyacinth removal be required as a license condition. Although this invasive plant species can adversely affect navigability of the river, it has proven difficult to control and its occurrence and abundance is not attributable to the operation of the hydroelectric projects.

3.3.2.3 Cumulative Effects

Water Quantity

Hydroelectric project operation and diversions for consumptive uses have historically affected streamflows and water levels in the Tuolumne River Basin. Upstream of the Don Pedro Project, non-project inter-basin water transfers from the Tuolumne River to the San Francisco Bay Area reduce the volume of water that enters

Don Pedro Reservoir and is subsequently available for release to the portions of the Tuolumne River below the Don Pedro Project. The largest inter-basin water diversions occur from CCSF's O'Shaughnessy Dam which impounds the 360,400-acre-foot Hetch Hetchy Reservoir. The Hetch Hetchy System delivers an average of 250,000 acre-feet of water each year, providing 85 percent of CCSF's Bay Area municipal and industrial water supply. CCSF also owns and operates the lower Cherry Creek Diversion Dam and Early Intake Diversion Dam, which are used to divert water supplied by CCSF's Cherry Creek facilities during emergency and extreme drought conditions.

The Districts divert flows from the Tuolumne River, at the La Grange Project, for irrigation and municipal and industrial water supply purposes. The Districts' proposed changes in minimum flows and the continued intrabasin water transfers from the Tuolumne River associated with project operation would influence the timing and volume of the water that enters the La Grange Reservoir and is subsequently available for release to the lower Tuolumne River downstream of La Grange Diversion Dam. The Corps also affects the timing of flow releases from the Don Pedro Project through its flood control regulations. Storage provided by project and non-project storage reservoirs buffers the flow regime in the Tuolumne River by storing runoff during high flow periods and releasing the stored water over longer periods.

One of the Districts' primary purposes is to provide a reliable water supply to its members. During the irrigation season, which typically extends from March through October, diversions from the Tuolumne River into water supply canals typically average 920,000 acre-feet per year. The Districts' proposal to shift the supply of up to 225 cfs normally diverted at La Grange Diversion Dam to the infiltration galleries at RM 25.9 between June 1 and October 15 would result in higher flows in the 26-mile-long reach between the La Grange Powerhouse and the infiltration galleries. Although environmental flow measures and power operations are likely to remain similar over the duration of the project license, non-project consumptive water demand (agriculture, municipal, and industrial) is projected to increase during this same period. Increases in water demand and the exercise of water rights to meet that demand could contribute to lower minimum flows being implemented when the proposed drought management plan is triggered, particularly in sequential warm, dry water years.

The magnitude and timing of flows in the southern Delta are determined by the factors discussed above; withdrawals and storage of water from the San Joaquin River and its tributaries; and operation of the State Water Project (SWP) and the federal Central Valley Project. Historically and currently, these facilities withdraw up to about 15,000 cfs from the south Delta near Tracy, which results in water flowing upstream,

referred to as reverse flows, in the south Delta.[197] California DWR is currently pursuing the Delta Conveyance Project (California DWR, 2020) for facilities to withdraw water from the Sacramento River instead of obtaining the entire water supply solely from the south Delta pumps.[198] Shifting water supply from the south Delta pumps to the Sacramento River would reduce reverse flows in the south Delta.

Water Quality

Results of the Districts' water temperature modeling indicate that CCSF's operation of the Hetch Hetchy Project reduces Tuolumne River average 7DADM temperature in the summer by as much as 7ºC resulting in less frequent exceedance of 20ºC, and increases average 7DADMs by up to about 3ºC in mid-fall to early summer (Districts, 2017a).[199] In addition, CCSF's peaking operation of the Dion Holm Powerhouse located at RM 0.6 on Cherry Creek results in daily temperature fluctuations of up to about 10ºC in lower Cherry Creek and the Tuolumne River just below the confluence with Cherry Creek at about RM 103.7 (Watercourse Engineering, 2017). These fluctuations become smaller as water flows down to Don Pedro Reservoir. These effects in combination with the Districts' operation of the projects generally reduces 7DADMs just below Don Pedro Dam by more than 5ºC in mid-June through late October, increases 7DADMs just below Don Pedro Dam by about 5ºC in early January, and shifts the timing of maximum 7DADMs between RM 46 and the confluence with the San Joaquin River from early September to mid-July (Districts, 2017a). These cooling and warming effects diminish with distance downstream of the projects primarily because of the non-project effects, including ambient meteorology, non-project diversions, and inflows from agricultural returns, Dry Creek, and groundwater. Regardless of which of the proposed or recommended operations occur, these general patterns would continue to occur in the lower Tuolumne River because thermal stratification of Don Pedro Reservoir would remain nearly the same. Temperature in the lower San Joaquin River and south Delta is primarily determined by the magnitude and temperature of inflows from the upper San Joaquin River and its primary tributaries and flow patterns in the south Delta. The higher flows that the Water Board included in the 2016 supplemental environmental document (Water Board, 2018c) for the lower San Joaquin River's primary tributaries,

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[197] The Central Valley Project's Jones Pumping Plant includes six pumps with a total capacity of 4,600 cfs, and the SWP's Banks Pumping Plant includes 11 pumps with a total nominal capacity of 10,300 cfs.

[198] In addition, the U.S. Bureau of Reclamation is considering including the Central Valley Project in the Delta Conveyance Project (California DWR, 2020).

[199] For example, simulated average 7DADMs below Indian Creek (at about RM 88) without CCSF's dams exceed 20ºC from early July through September and reach a high of about 25ºC, but with the dams only exceed 20ºC for a total of about one month in the summer and reach a high of about 21ºC (Districts, 2017a).

including the Tuolumne River, would result in cooler spring temperatures that would benefit Chinook salmon, steelhead, and other native fish species.

The projects do not measurably contribute to the salinity in the Tuolumne River, but agricultural returns and groundwater inflows increase salinity as water flows downstream, particularly during low instream flows (Water Board, 2018c).[200] Nonetheless, Tuolumne River near the confluence with the San Joaquin River generally has lower salinity than the upper San Joaquin River. Therefore, inflow from the Tuolumne River, as well as inflow from the Merced and Stanislaus Rivers, tends to lower salinity in the San Joaquin River. When flows in the San Joaquin River at Vernalis are lower than the 1995 Bay-Delta Plan requires, the U.S. Bureau of Reclamation supplements flows up to the minimum with releases from New Melones Reservoir on the Stanislaus River, which further reduces salinity. However, high-salinity inflows from agricultural returns, groundwater, and wastewater increase salinity. Tides also influence salinity in the Delta. The Water Board is currently considering changing the required approach to meeting required minimum flows at Vernalis and reducing salinity in the south Delta by requiring that hydroelectric projects on the Tuolumne, Merced, and Stanislaus Rivers provide February–June instream flows based on unaltered flows (Water Board, 2018c). Any increase in inflows from the Tuolumne, Merced, and Stanislaus Rivers would result in lower salinity in the San Joaquin River. Evaluation of all model scenarios considered in this EIS indicates that the change in February–June average flows in the Tuolumne River at RM 25.5 would range from virtually unchanged for the Districts' two proposals to an increase of 60 percent for ECHO's recommended operations (based on District model simulations in Districts, 2018b,d; 2020). The draft Voluntary Agreement would increase February–June average flows at RM 25.5 by 3 percent. Therefore, the Districts' proposed operations would not measurably affect salinity at Vernalis, ECHO's recommended operations would reduce salinity the most of any of the simulated operations, and the draft Voluntary Agreement would provide little reduction in salinity at Vernalis. In addition, the Delta Conveyance Project, if implemented, would reduce salinity in the south Delta by reducing reverse flows, as discussed above.

Fisheries Resources

Tuolumne River Basin

Mining-related effects on aquatic habitat in and along the mainstem of the Tuolumne River began with the California Gold Rush in 1848. The major mining camps of Sonora, Columbia, and Jacksonville were founded in 1848 and 1849. A historical timeline of mining activities in the San Joaquin River's tributaries, including the

[200] This discussion is primarily based on using electrical conductivity as a surrogate for salinity.

Tuolumne River, includes placer mining (1848–1880), hydraulic mining in the La Grange vicinity (1871 to about 1900), dredge mining (1908–1942 and 1945–1951), and gravel and aggregate mining (1940s to present). Decades of dredge mining in the main channel of the Tuolumne River resulted in the excavation of channel and floodplain sediments, which has left a legacy of significant Tuolumne River channel modifications and shoreline dredger tailing deposits between RM 50.5 and 38.0.

After the Gold Rush, crop production and ranching substantially increased in the Central Valley. During this period, woody vegetation along the Tuolumne River was cleared to allow for crop production in the alluvial soils of the bottomlands. Engineers constructed levees to protect the new farmlands from flooding in spring and built irrigation canals to provide water during the growing season. Of the estimated 4 million acres of wetland that occurred historically in the Central Valley, only about 300,000 acres remained in 1990. The conversion of wetlands to agricultural uses accounts for much of the reduction in wetland area. Primary existing agricultural land uses along the gravel-bedded reach include orchards, row crops, and livestock grazing.

Timber harvest operations existed throughout the Sierra Nevada since the mid-1800s. However, the subsequent Gold Rush of 1849 fueled a human migration into California that resulted in dramatic increases in the demand for timber. The indirect effects of gold mining included steamship transportation along the major rivers of the Central Valley, fueled by cordwood harvested from adjacent lands, and likely resulted in the first wave of riparian forest clearing in some areas of the Tuolumne River Basin. More recently, timber harvest in the Tuolumne River Watershed has typically been limited to lands in the upper basin. Large forest fires in 1987 and 2013 also consumed a substantial amount of timber in the upper Tuolumne River Basin.

Privately owned land in the lower Tuolumne River Watershed is also used for rural residential purposes or for denser residential, municipal, and industrial purposes in communities such as Waterford and Modesto. Many miles of riverbank have been leveed and stabilized with riprap by agencies or landowners. Levees and bank revetment extend along portions of the riverbank from near Modesto (RM 16) downstream to the San Joaquin River. Following the 1997 flood, some subdivisions that had been inundated in the Modesto area were found to have been constructed within the Federal Emergency Management Agency floodplain area designated prior to 1997.

The first dam built on the Tuolumne River—Wheaton Dam—was constructed in 1871 near the current location of La Grange Diversion Dam at approximately RM 52.2. Since the late-1800s, several additional dams have been constructed on the main stem of the Tuolumne River and its tributaries; some of them are used for water storage and others are primarily diversion dams.

Completed in 1893, the La Grange Project receives flow from the Tuolumne River and passes flows to the lower Tuolumne River downstream of La Grange Diversion Dam. The Districts divert flows from the Tuolumne River, at the La Grange Project, for irrigation and municipal and industrial water supply purposes.

In 1923, Turlock and Modesto Irrigation Districts joined forces to build the first Don Pedro Dam. The dam held just enough water to accommodate growers' irrigation needs for a single growing season. To get through consecutive dry years, which happens often in TID territory, the Districts needed a dam large enough to store enough water for the demands of multiple irrigation seasons. When the original Don Pedro Dam was finished, the 284-foot-high arched dam was the highest in the world and had a maximum storage of 289,000 acre-feet, which expanded the Districts' irrigation season beyond just the spring runoff season.

Construction of the new Don Pedro Dam began in 1967 and was completed in 1971. By constructing the new Don Pedro Dam, power plant, and related facilities, the Districts firmed up water supplies for their districts, increased capacity to generate hydroelectric power, and provided recreation opportunities and flood control in the Tuolumne River Basin.

CCSF's Hetch Hetchy Water and Power Division maintains and operates several reservoirs in the middle-elevation band of the Tuolumne River Watershed upstream of the Don Pedro Project, including CCSF's Cherry Lake (elevation 4,700 feet), Lake Eleanor (elevation 4,660 feet), and Hetch Hetchy Reservoir (elevation 3,800 feet). These projects provide storage for water supply and generate hydroelectric energy. CCSF stores and diverts water from the upper Tuolumne River for use outside the Tuolumne River Basin. The Don Pedro Project also contributes substantially to the water supplies of the City of Modesto (population: 210,000) and 2.6 million people in the San Francisco Bay Area. CCSF contributed financially to the construction of the Don Pedro Project in exchange for water banking privileges that benefit CCSF's Bay Area water customers. The Hetch Hetchy System includes the San Joaquin Pipeline, which transports about 85 percent of CCSF's total water supply.

In addition to these dams and diversions, four wastewater treatment plants contribute a little over 19 percent of the total phosphorus to the Don Pedro Reservoir. Urban runoff to the lower Tuolumne River from the Modesto area has been shown to contain pesticides.

Fish hatchery practices and non-native fish introductions have altered the fish assemblage in the Tuolumne River Basin. Currently, California DFW manages the Don Pedro Reservoir salmonid fishery as a put-and-grow resource with substantial stocking of kokanee and rainbow trout. Don Pedro Reservoir is also managed as a year-round fishery for black bass. Starting in 2014, triploid (sterile) Chinook salmon from the Iron Gate Hatchery/Silverado Fisheries Base have been stocked in Don Pedro Reservoir. The reaches of the main stem of the Tuolumne River below Yosemite National Park are stocked by California DFW with triploid (sterile) rainbow trout and triploid brown trout raised at the Moccasin Creek Hatchery. California DFW stocks rainbow trout and Eagle Lake trout in the North Fork, Middle Fork, and South Fork of the Tuolumne River. Largemouth, smallmouth, and spotted bass were all introduced into California waters by California DFW and are now actively managed by California DFW in many locations.

All three species of bass can be highly piscivorous and prey heavily on salmonids and other fish species.

San Joaquin River and Sacramento-San Joaquin Delta

Downstream of the Tuolumne River Basin, the San Joaquin River flows northward and enters the legally defined Delta near the USGS Vernalis gaging station (RM 73). The three main tributaries to the San Joaquin River upstream from the USGS Vernalis gaging station are the Merced, Tuolumne, and Stanislaus Rivers. Under historical conditions, the south Delta and lower San Joaquin River were composed of tidal wetlands merging southward into floodplain wetlands interspersed with complex side-channel habitats, lakes, and ponds with seasonal wetlands bordering upland habitats.

Beginning in the 1850s, the construction of levees around the San Joaquin River and Delta facilitated the conversion of lands to agricultural and other human uses. Combined with the straightening, widening, and dredging of channels, levee construction increased shipping access to the Central Valley and increased the ability to control water conveyance and prevent flooding. Currently, the Delta is a highly engineered environment, composed of 57 leveed island tracts and 700 miles of sloughs and winding channels. More than 1,100 miles of levees protect 738,000 acres of Delta islands, tracts, and population centers from flooding and safeguard a large portion of California's water supply.

Agriculture is the primary land use along the lower San Joaquin River from its confluence with the Tuolumne River to the USGS Vernalis gaging station; uses include fruit and nut orchards, field crops, crops of vegetables, seed and other row crops, vineyards, and pastures. The Delta's combination of highly productive soils, a climate conducive to agriculture, and readily available high-quality irrigation water support a broad range of agriculture, including high-value crops. Delta agricultural production relies heavily on irrigation because low rainfall occurs during most of the growing season. Generally, irrigation water is diverted directly from Delta waterways and transported to agricultural lands via canals. In some cases, water is pumped directly into field furrows. Irrigation and drainage canals are operated and maintained in the Delta by reclamation districts, irrigation districts, and water agencies. Some of the agricultural surface water diversions are screened to protect fish, but many are not.

No incorporated cities are located along the lower San Joaquin River from its confluence with the Merced River to Vernalis. Rural residential use is typically the only type of development, and much of the population resides in surrounding cities. There is little infrastructure along the lower San Joaquin River aside from that which supports agriculture and rural residential development. The Delta, on the other hand, contains much infrastructure of statewide importance, including transportation and power transmission facilities.

Currently, more than 80 dams are located on the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers, and these dams have a total storage capacity of greater than

7.7 million acre-feet. Combined, these facilities have the capacity to capture and control the entire average annual yield of the rivers they dam for the primary purposes of water supply, flood control, and hydroelectric power generation. The relatively large flows from the eastside tributaries (i.e., the Merced, Tuolumne, and Stanislaus Rivers), emanating from the Sierra Nevada Mountains, strongly influence flow and water quality in the mainstem San Joaquin River. The low-elevation west side tributaries are ephemeral, so water entering the San Joaquin River from the west side of the basin consists largely of agricultural return flows, which strongly influences the quality of water in the river.

The Central Valley Project, a complex, multi-purpose network of federal dams, reservoirs, canals, hydroelectric power plants and other facilities, is the largest water supply project in the United States. It includes 18 reservoirs with a combined storage capacity of more than 11 million acre-feet, 11 hydroelectric power plants, and more than 500 miles of major canals and aqueducts. Five Central Valley Project divisions/units are located south of the Delta in the San Joaquin River Basin—the Friant Division, the Hidden and Buchanan Units, the New Melones Unit, the San Luis Unit, and the San Felipe Division. Section 4.1.3.2 of the Districts' amended final license application for the Don Pedro Project describes these divisions/units and their effects on water resources in detail.

The State Water Project is a complex system composed of pumping plants, hydroelectric power plants, water storage facilities with a combined capacity of approximately 5.8 million acre-feet, and approximately 700 miles of pipelines and canals. It is the largest state-built water storage and conveyance project in the United States. California DWR operates and maintains the State Water Project, which delivers water to 29 agricultural and municipal and industrial contractors in northern California, the San Joaquin Valley, the Bay Area, the Central Coast, and southern California. The State Water Project facilities south of the Delta in the San Joaquin River Basin include the following: (1) the San Luis Area, which includes the Gianelli Pumping-Generating Plant and the Dos Amigos Pumping Plant; (2) the Coastal Branch Area, which consists of the Devil's Den, Bluestone, and Polonio Pass pumping plants and the Las Perillas and Badger Hill pumping plants; (3) the South San Joaquin Area, which includes the Buena Vista, Teerink and Chrisman, and Edmonston pumping plants; (4) the West Branch Area, which includes the Oso and Alamo pumping plants and the Warne and Castaic power plants; and (5) the East Branch Area, which includes Lake Perris, the Pearblossom Pumping Plants, and the Mojave and Devil Canyon power plants. Section 4.1.3.2 of the Districts' amended final license application for the Don Pedro Project presents a detailed description of these facilities.

Near the city of Stockton, the lower San Joaquin River flows into the 78-mile-long Deep Water Ship Channel that extends from the Port of Stockton to the Golden Gate Bridge. The Deep Water Ship Channel, which was first dredged in the 1930s, terminates at the Deep Water Turning Basin adjacent to the Stockton Port. The channel serves as a shipping corridor for cargo ships traveling through San Francisco Bay and up to the

Stockton Port. Periods of low DO concentrations have historically been observed in the Deep Water Ship Channel; the majority of these low DO periods have occurred during summer and fall upstream of Turner Cut. In January 1998, the Water Board adopted the CWA Section 303(d) list that identified this DO impairment, and the Central Valley Regional Water Quality Control Board initiated development of a TMDL to identify factors contributing to the DO impairment and assign responsibility for correcting the low DO problem. Since the approval of the San Joaquin River DO TMDL Basin Plan Amendment in 2005, two actions have been implemented to alleviate low DO conditions in the Deep Water Ship Channel: (1) the City of Stockton added engineered wetlands and two nitrifying bio-towers to the Stockton Regional Wastewater Control Facility to reduce ammonia discharges to the San Joaquin River, and (2) the California DWR constructed the Demonstration Dissolved Oxygen Aeration Facility (Aeration Facility) at Rough and Ready Island to evaluate its applicability for improving DO conditions in the Deep Water Ship Channel.

Recreational use is a critical asset to the San Joaquin River Watershed and Delta region. Along the San Joaquin River and Delta waterways and on Delta islands, activities include picnicking, swimming, fishing, boating, waterskiing, nature study, sightseeing, horseback riding, tent and RV camping, biking, hunting, and hiking. The 7,000-acre San Joaquin River National Wildlife Refuge supports a mix of habitats that provide excellent conditions for wildlife and plant diversity. Visitor activities at the refuge include wildlife viewing, interpretation and environmental education, and photography. Formal fishing access and hunting opportunities are generally available in publicly owned parks or wildlife areas. Along some waterways, particularly along the Deep Water Ship Channel, there are sandy beaches that are heavily used by boaters.

During the twentieth century, fish hatcheries were constructed throughout California to supplement declining native anadromous fish populations. Fish are reared and released for recreational fishing, commercial harvest, conservation and restoration of native fish species, mitigation for habitat losses caused by development, and mitigation for fish lost at pumping facilities in the Delta. Annual production of salmon and steelhead in California hatcheries approaches 50 million juveniles. During most years, over 32 million fall-run Chinook salmon are produced at five hatcheries in the Central Valley, and nearly 9 million are produced at two hatcheries in the Klamath-Trinity River basin. California DFW currently stocks trout in high mountain lakes, low elevation reservoirs, and various streams and creeks. Salmon and steelhead have been stocked primarily in rivers, including direct tributaries to the Pacific Ocean. California DFW operates four hatcheries in the San Joaquin River basin: (1) the San Joaquin Hatchery in the town of Friant, (2) the Merced River Hatchery in the town of Snelling, (3) the Mokelumne River Hatchery in the town of Clements, and (4) the Moccasin Creek Hatchery on Moccasin Creek. Currently, only steelhead and Chinook salmon are released by California DFW into the lower San Joaquin, lower Merced, lower Mokelumne, and lower Tuolumne Rivers. The San Joaquin River Restoration Program

released juvenile Central Valley spring-run Chinook salmon into the San Joaquin River annually during 2014–2016.

Introduction of non-native species has resulted in large changes in the fish community structure of the Central Valley. Current fish communities in the lower reaches of the San Joaquin River tributaries and Delta are dominated by non-native taxa. Over 200 non-native species have been introduced in the Delta and become naturalized, including many fish (e.g., smallmouth bass, largemouth bass, and striped bass) that prey on juvenile salmonids. According to Grossman et al. (2013), juvenile salmon are clearly consumed by fish predators in the San Joaquin River system and several studies indicate that the population of predators is large enough to effectively consume all juvenile salmon production. However, given extensive flow modification, altered habitat conditions, native and non-native fish and avian predators, temperature and DO limitations, and overall reduction in historical salmon population size, it is not clear what proportion of juvenile mortality can be directly attributed to fish predation. Fish predation may serve as the proximate mechanism of mortality in a large proportion of the population but the ultimate causes of mortality and declines in productivity are less clear. California DFW continues to manage some non-native fish species for recreational angling, such as black bass, striped bass, sunfish and crappie, and catfish and bullhead.

Aquatic Resources Management and Recovery Activities in the Central Valley

There are numerous programs and efforts in the San Joaquin River Basin and Delta that have been completed, are currently underway, or are planned for the foreseeable future. These programs are likely to result in the establishment of new environmental mandates such as streamflow requirements, aquatic habitat restoration measures, and fish protection and recovery objectives. Cumulatively, these requirements could have effects on aquatic resources and threatened and endangered species in the Tuolumne River, lower San Joaquin River, and the Delta.

Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead—In 2014, NMFS issued a final Recovery Plan for the endangered Sacramento River winter-run Chinook salmon Evolutionarily Significant Unit (ESU), threatened Central Valley spring-run Chinook salmon ESU, and threatened California Central Valley steelhead DPS. Implementation of the recovery plan is intended to improve the viability of these species so they can be removed from federal protection under the ESA. The recovery plan describes the steps, strategies, and actions projected to return the three species to viable status in the Central Valley, thereby ensuring their long-term (i.e., greater than 100 years) persistence and evolutionary potential. Watershed-specific actions address threats occurring in each of the rivers or creeks that support spawning populations of the ESUs and/or DPS.

San Joaquin River Restoration Program—The San Joaquin River Restoration Program is a direct result of a settlement reached in September 2006 to provide sufficient

fish habitat in the San Joaquin River below Friant Dam. Parties to the settlement include the U.S. Departments of the Interior and Commerce, the Natural Resources Defense Council, and the Friant Water Users Authority. Federal legislation was passed in March 2009 authorizing Federal agencies to implement the settlement.

The settlement is based on two goals: (1) to restore and maintain fish populations in "good condition" in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish, and (2) to reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that could result from the interim flows and restoration flows provided for in the settlement. The San Joaquin River Restoration Program outlines a comprehensive long-term effort to provide flows in the San Joaquin River from Friant Dam to the confluence of the Merced River to restore a self-sustaining spring-run Chinook salmon fishery while reducing or avoiding adverse water supply impacts.

Delta Water Quality Control Planning—On August 16, 1978, the Water Board adopted the 1978 Delta Plan and Decision 1485 (D-1485). The 1978 Delta Plan included water quality objectives intended to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses in the Delta, and fish and wildlife beneficial uses in Suisun Marsh. The 1978 Delta Plan and D-1485 standards were based on the principle that Delta water quality should be at least as good as it would have been had the state and federal water projects not been constructed. The fish and wildlife standards in the 1978 Delta Plan and D-1485 were based on an agreement developed by California DWR, California DFW (then California Department of Fish and Game), the U.S. Bureau of Reclamation, and FWS. It was acknowledged that these standards did not afford a "without-project" level of protection for salmon, but the level of protection was believed to be reasonable until determinations regarding Delta mitigation measures were finalized.

In 1985, some D-1485 standards were amended to modify or omit some monitoring stations in Suisun Marsh and to revise the schedule for implementation of salinity objectives. In May 1991, the Water Board adopted the 1991 Bay-Delta Plan, which superseded water quality objectives in the 1978 Delta Plan and the San Francisco Bay and the Sacramento-San Joaquin Delta regional water quality control plans in instances where the existing plans conflicted with the 1991 Bay-Delta Plan. The 1991 Bay-Delta Plan contained a range of water quality objectives aimed at protecting beneficial uses. These objectives addressed: (1) salinity levels for municipal and industrial intakes, Delta agriculture, water export agriculture, and estuarine fish and wildlife resources, (2) an expanded period of protection for striped bass spawning, and (3) temperature and DO levels for Delta fisheries. The 1991 Bay-Delta Plan did not include Delta outflow objectives and operational constraints.

In May 1995, the Water Board adopted the 1995 Bay-Delta Plan, which was superseded by the 2006 Bay-Delta Plan, in instances where the 1995 plan conflicted with the 2006 plan. The 2006 Bay-Delta Plan included updates to address what it noted were

emerging issues that, because of changing circumstances or increases in scientific understanding, it determined were either unregulated or not fully regulated by preceding plans. The issues noted by the plan included pelagic organism decline (pelagic fishes in the Delta Estuary and Suisun Bay), climate change, Delta and Central Valley salinity, and San Joaquin River flows. The 2006 Bay-Delta Plan included specific objectives related to the following variables: Delta outflow, flows in the Sacramento River at Rio Vista, flows in the San Joaquin River at Vernalis, export limits, Delta cross channel gates operation, and salinity. The plan also identified what it determined to be beneficial uses of the Bay-Delta, water quality objectives for the reasonable protection of those beneficial uses, and a program of implementation for achieving the water quality objectives.

The Water Board has been reviewing and amending the 2006 Bay-Delta Plan for several years. In 2012, it proposed amendments to the plan and released for public comment a draft substitute environmental document that described the proposed amendments and the Water Board's analysis of their potential effects. The Water Board subsequently modified its proposed amendments and released a revised draft substitute environmental document on September 15, 2016. On July 6, 2018, the Water Board released a final proposal to amend the Bay-Delta Plan (Water Board, 2018a) and released a final substitute environmental document (Water Board, 2018c) and received oral public comments on the topic on August 21 and 22, 2018.[201] This amendment would require: (1) increased flows in the San Joaquin River and its three major tributaries—the Stanislaus, Tuolumne, and Merced Rivers, and (2) establish flow-related compliance locations. On December 12, 2018, the Water Board adopted the plan amendments and final substitute environmental document establishing the lower San Joaquin River flow objectives and revised southern Delta salinity objective. The Water Board acknowledges benefits from non-flow measures and encourages voluntary agreements that will assist in implementing the lower San Joaquin River flow objectives (Water Board, 2018a). In addition, the Water Board states that non-flow measures recommended in the Bay-Delta Plan or by California DFW may support a change in the required percent of unimpaired flow within the range prescribed by the flow objectives or other adaptive adjustments otherwise allowed for implementation (Water Board, 2018a).

San Joaquin River TMDL Plans—Adoption of TMDLs required under the CWA § 303(d) has the potential to affect stream flows in the San Joaquin River basin. The Water Board has initiated a comprehensive effort to address salinity and nitrate problems in the Central Valley and to adopt long-term solutions that will lead to enhanced water quality and economic sustainability. The Central Valley Salinity Alternatives for Long-Term Sustainability effort is a collaborative basin planning effort aimed at

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[201] These documents are available on the Water Board web page, available at: https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/bay_delta_plan/water_quality_control_planning/2018_sed/.

developing a comprehensive salinity and nitrate management program. Additional San Joaquin River flows are being targeted to help dilute saline agricultural return waters and naturally occurring saline waters, pesticides, and other potentially toxic compounds and to reduce temperatures throughout the watershed.

Bay-Delta Conservation Plan—The Bay-Delta Conservation Plan was developed to provide for water supply reliability and recovery of listed species through a Habitat Conservation Plan under federal law, and a Natural Community Conservation Plan under state law.[202] The Bay-Delta Conservation Plan included a wide range of actions related to habitat restoration, protection, and enhancement; water conveyance facilities; water operations and management; monitoring, assessment, and adaptive management; costs and funding; and governance structure and decision-making.

The Bay-Delta Conservation Plan was developed to address ecological needs of at-risk Delta species, primarily fish, while improving and securing a reliable water supply. The Bay-Delta Conservation Plan was structured to be a comprehensive restoration program, consisting of conservation measures designed to improve the state of natural communities and in so doing improve the overall health of the Delta ecosystem. The Bay-Delta Conservation Plan attempted to balance species conservation with a variety of other important uses in the Delta. A draft of the Bay-Delta Conservation Plan was issued in December 2013 but was withdrawn and replaced by the California WaterFix and EcoRestore programs (see below).

Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project—On June 4, 2009, NMFS released the Biological and Conference Opinion on the Long-Term Operation of the Central Valley Project and State Water Project. The opinion included a series of alternatives to avoid jeopardy of the continued existence of California Central Valley steelhead, among other species, and adverse modification of its designated critical habitat. Among the alternatives identified are significantly higher instream flows in the Stanislaus River, San Joaquin River minimum flow requirements at Vernalis, and Delta export limitations to protect out-migrating anadromous salmonids.

Although the opinion addressed only the combined Central Valley Project and State Water Project operations, it concluded that "the long-term viability of this diversity group [steelhead] will depend not only on implementation of this reasonable and prudent alternative, but also on actions outside this consultation, most significantly increasing flows in the Tuolumne and Merced Rivers."

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[202] Bay Delta Conservation Plan-covered fish species consist of delta smelt, longfin smelt, Sacramento River winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley fall and late fall-run Chinook salmon, Central Valley steelhead, Sacramento splittail, green sturgeon, white sturgeon, Pacific lamprey, and river lamprey.

Delta Conveyance—The goal of the California WaterFix, the subsequent smaller single tunnel, and actions to strengthen existing levee protections is to help protect California's water supply from the effects of earthquakes, flooding, and rising sea levels; reduce waste of fresh water; and improve habitat for fish and wildlife. The California WaterFix was a proposal with the following primary elements: (1) construction and operation of new water conveyance facilities in the Delta, including three intakes, two tunnels, appurtenant structures, a permanent head of Old River gate, and expansion of the Clifton Court forebay, (2) coordinated operation and maintenance of existing and new State Water Project and Central Valley Project Delta facilities, (3) resource conservation measures, and (4) a monitoring and adaptive management program. On July 21, 2017, California DWR approved the proposed California WaterFix evaluated in the Bay Delta Conservation Plan/California WaterFix Final EIR/EIS. California DWR withdrew permits for the WaterFix project on May 2, 2019, and replaced it with the Delta Conveyance Project for a single tunnel to modernize and rehabilitate the water distribution system.[203] The planning process is underway, and the associated environmental review process began with a notice preparation under the California Environmental Quality Act on January 15, 2020 (California DWR, 2020).

California EcoRestore—The California Natural Resources Agency is implementing EcoRestore in coordination with other state and federal agencies to contribute to the restoration of at least 30,000 acres of Delta habitat by 2020. The objectives will be guided by an adaptive management program to pursue habitat restoration projects with well-defined goals and objectives and the financing needed to successfully implement the projects. Habitat types identified for restoration include tidal wetlands, floodplains, riparian areas, and uplands. Fish passage improvements and other projects are also elements of the program.

California DFW's Ecosystem Restoration Program—California DFW's Ecosystem Restoration Program is designed to improve the ecological health of the Bay-Delta Watershed through restoring and protecting habitats, ecosystem functions, and native species. The Watershed Program Element specifically works in tandem with the Ecosystem Restoration Program Element to ensure that the ecological health of the Delta is restored, and that water management is improved by working with communities at the watershed level.

California Advisory Committee on Salmon and Steelhead Trout—The California Advisory Committee on Salmon and Steelhead Trout was established by California legislation in 1983 to develop a strategy for the conservation and restoration of salmon and steelhead in California. The Central Valley Salmon and Steelhead Restoration and

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[203] California DWR provides information and updates for the Delta Conveyance Project at: https://water.ca.gov/deltaconveyance.

Enhancement Plan was intended to outline California DFW's restoration and enhancement goals for salmon and steelhead resources of the Sacramento River and San Joaquin River systems and to provide direction for various California DFW programs and activities.

The Restoring Central Valley Streams Plan identifies the following goals to benefit anadromous fish: restore and protect California's aquatic ecosystems that support fish and wildlife, protect threatened and endangered species, and incorporate the state legislature's mandate and policy to double the size of populations of anadromous fish in California. The plan encompasses only Central Valley waters accessible to anadromous fish, excluding the Delta. The Steelhead Restoration and Management Plan for California focuses on restoration of native and naturally produced (wild) fish stocks because they have the greatest value for maintaining genetic and biological diversity. Goals for steelhead restoration and management are: (1) increase natural production, as mandated by The Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988, so that steelhead populations are self-sustaining and maintained in good condition, and (2) enhance angling opportunities and non-consumptive uses.

Final Restoration Plan for Anadromous Fish Restoration Program—In addition, the Final Restoration Plan for Anadromous Fish Restoration Program (Yoshiyama et al., 2001) identifies restoration actions that may increase natural production of anadromous fish in the Central Valley of California. This plan is divided to address different watersheds within the Central Valley, and restoration actions are identified for each watershed. It also includes the involved parties, tools, priority rating, and evaluation of each restoration action. The plan addresses only Central Valley waters accessible to anadromous fish.

Tuolumne Wild and Scenic River Management Plan—The Forest Service Tuolumne Wild and Scenic River Management Plan, which was approved in 1986 and revised in 1988, provides "direction for managing the federal lands within the boundaries of the designated corridor." The plan addresses portions of the Tuolumne Wild and Scenic River (29 miles) outside of Yosemite National Park.

1995 Settlement Agreement—As directed under the 1995 Settlement Agreement, TRTAC developed a suite of priority habitat restoration projects aimed at improving geomorphic and biological elements of the lower Tuolumne River corridor. These include channel and riparian restoration projects (RM 34.3–RM 40.3), predator isolation projects (RM 25.5–RM 25.9), and sediment management projects (RM 47.5–RM 51.8).

Fish and Aquatic Resources Cumulative Effects Assessment

As described above, the fish and aquatic resources of the Tuolumne River and San Joaquin River downstream to the San Francisco Bay Area are affected by numerous past, present, and potential future anthropogenic actions and background environmental conditions, both within and outside the San Joaquin River Watershed. For example, prior to widespread European settlement, the channel form of the lower Tuolumne River

consisted of a combination of single-thread and split channels that migrated and avulsed. The riparian corridor was miles wide in places where the river lacked confinement. More than a century of cumulative impacts have transformed the lower Tuolumne River from a dynamic, alluvial system capable of forming its own bed and bank morphology to a river highly constrained between either man-made dikes or agricultural fields, or constrained by riparian vegetation that has encroached into the low water channel.

Over the past 120 years, dams and diversions have also modified the lower Tuolumne River's flow regime. Analyses of streamflow records from the USGS gaging station at La Grange reveal the following alterations of hydrologic conditions: (1) the magnitude and variability of summer and winter base flows, fall and winter storms, and spring snowmelt runoff have been reduced, and (2) the magnitude, duration, and frequency of winter floods have been reduced. Following completion of the new Don Pedro Dam in 1971, compliance with Corps flood control and other flow requirements reduced the estimated average annual flood from 18,400 to 6,400 cfs.

Gravel and gold mining, as well as other land uses, adversely affected aquatic habitat prior to the construction of dams on the Tuolumne River. The presence of dams, aggregate extraction, agricultural and urban encroachment, and other land uses, including hydraulic mining practices near La Grange, have resulted in imbalances of sediment supply and transport in the lower Tuolumne River channel. Don Pedro Dam and La Grange Diversion Dam, combined with other dams upstream of the project boundary, trap all coarse sediment and LWM that would otherwise pass downstream. In the lower river, in-channel excavation of bed material to depths well below the river thalweg for gold and aggregate has significantly reduced available spawning habitat, eliminated active floodplains and terraces, and created large in- and off-channel pits that provide favorable habitat for non-native predator fish species.

Historical clearing of riparian forests in the Tuolumne River Basin modified vegetation and associated habitat, halting many attendant ecosystem processes. Urban and agricultural encroachment and mining have resulted in the direct removal of large tracts of riparian vegetation in the lower Tuolumne River corridor. Livestock selectively graze younger vegetation, which limits the establishment of riparian plants. Clearing woody plant cover has also created openings in the riparian corridor where non-native plant species have become established and proliferated. Flow regulation and sediment trapping associated with upstream dams have also indirectly affected riparian vegetation by modifying the hydrologic and fluvial processes that influence survival and mortality of riparian vegetation.

Furthermore, anadromous fish abundance in the Tuolumne River has been reduced by habitat degradation and extensive instream and floodplain mining beginning in the mid-1800s. Dams and water diversions associated with mining have affected fish migration as early as 1852. Access to historic spawning and rearing habitat was significantly restricted beginning in the 1870s, when a number of dams and irrigation diversion projects were constructed. Wheaton Dam, built in 1871 near the site of the

present-day La Grange Diversion Dam, was a barrier to salmon migration. In 1884, three years before either District was created, the California Fish and Game Commission reported that the Tuolumne River was "dammed in such a way to prevent the fish from ascending."

During their upstream migration, Tuolumne River flows may affect homing of Tuolumne River origin Chinook salmon and could affect straying of salmonids from other rivers into the Tuolumne River. A lack of spawning gravel and curtailed sediment recruitment, due to in-river and floodplain mining, trapping by upstream dams, and other land uses, also results in density-dependent competition and exclusion from suitable spawning sites.

In addition, because of higher channel gradient, overbank habitats in this reach do not provide the same relative benefits as other river floodplain habitats studied in lowland portions of the Central Valley. Remnant dredger pits and multiple connected backwaters along the lower Tuolumne River have been identified as areas of potential juvenile Chinook stranding and may create favorable habitat for predator species. Because current Don Pedro Project operations do not include power peaking, potential risk of juvenile Chinook salmon and *O. mykiss* stranding and entrapment are low.

Although returning the flow regime in the lower Tuolumne River to a condition that more closely mimics the magnitude, duration, and timing of the unimpaired hydrograph (as recommended by the resource agencies) would contribute to the restoration of more normative ecological processes in the basin, the Districts' proposed flow regime would also improve aquatic habitat conditions downstream of La Grange Diversion Dam compared to existing conditions and continue to meet existing and projected water demands in the region. The Districts' proposed and the draft Voluntary Agreement base flows would slightly improve the frequency of meeting optimal water temperatures for Chinook salmon and *O. mykiss*. Implementing the recommended spring recession flows would further benefit juvenile salmonids through the reestablishment of riparian vegetation and its associated increase in prey availability. Furthermore, providing continuous minimum flows of at least 5 to 10 cfs from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam would ensure consistent and adequate flow to support aquatic resources. Implementing the proposed spring pulse flows would improve outmigration survival of juvenile Chinook salmon, and the staff-recommended fall pulse flows would aid the upstream migration of adult Chinook salmon into the Tuolumne River.

In addition to these flow-related measures, implementing a year-round downramping rate not to exceed 2 inches per hour would protect juvenile salmonids in the lower Tuolumne River. Decreasing flows at night (when possible), when Chinook salmon are less vulnerable to stranding, would likewise reduce the possibility of fish being isolated and/or dewatered along the channel margins and gravel bars.

Implementing the proposed coarse sediment management program, as modified by staff, and the proposed experimental gravel cleaning program would enhance the quality

and quantity of fall-run Chinook and *O. mykiss* spawning habitat in the lower Tuolumne River. Adding coarse sediment to the river channel would also be expected to increase the salmonid egg-to-emergence survival ratio, reduce superimposition of salmonid redds, increase BMI production, and potentially improve hyporheic flow and coldwater habitat downstream of La Grange Diversion Dam. Implementing the LTRHIP would increase habitat complexity and reduce predation by increasing escape cover and partitioning habitat.

NMFS's request for reservation of authority to prescribe fishways under section 18 of the FPA would help maintain the flexibility necessary to respond to new information during the license term (e.g., fish passage needs, project modifications, management goals, environmental conditions, and technological innovations), and allow for potential future installation of fishways, if feasible and needed. Installing a fish exclusion barrier near the TID sluice gate would also prevent fish from entering the sluice channel during powerhouse outages.

Furthermore, implementation of the recommended revised Aquatic Invasive Species Management Plan would help minimize the introduction and potential spread of invasive species, particularly during project activities.

As noted above, the existing fisheries in the lower San Joaquin and Sacramento rivers and the southern Delta have experienced cumulative adverse impacts related to changes in the distribution, abundance, and species composition of native fish assemblages. These impacts have been caused primarily by human-caused factors, including introduction of non-native fish species, highly altered flow regimes and substantial flow reductions, isolation of floodplains from the river channel by channelization and levee construction, substantial reductions in the frequency, magnitude, and duration of floodplain inundation, creation of false migration pathways by flow diversions, and poor water quality. Species in decline as a result of these ongoing activities include delta smelt, longfin smelt, green sturgeon, Sacramento splittail, Central Valley fall-run Chinook salmon, Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and Central Valley steelhead.

Downstream from the Tuolumne River's confluence with the San Joaquin River, the cumulative effects of the Don Pedro Project are attenuated with increasing distance downstream, and the number and complexity of non-project contributing factors affecting the aquatic environment grow considerably. Consequently, it becomes increasingly difficult to isolate the specific effects of any individual action from all the contributing factors affecting individual life stages of these fish, particularly migratory species that are affected by multiple factors during their migrations to and from the Tuolumne River. However, those measures included in the staff alternative, in combination with the ongoing management and recovery activities described above, are expected to improve instream flows, water temperatures, and habitat diversity in the lower San Joaquin River, and contribute to the recovery of native fish species in the San Joaquin and Sacramento rivers and in the southern Delta.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

General Vegetation

The Don Pedro Project is located in the foothills of the west slope of California's Sierra Nevada. The project boundary encompasses over 7,600 acres and is dominated by blue oak woodlands (44 percent), annual grasslands (30 percent), and substantial components of shrub-dominated chaparral (11 percent), gray pine woodlands (6 percent).

Blue oak woodlands occur on well-drained, gentle slopes and sometimes include other hardwood species such as interior live oak, valley oak and/or California buckeye. Shrubs such as wedgeleaf ceanothus, manzanita, coffeeberry, birchleaf mountain mahogany, and poison oak can occur in the understory. Annual grasslands are composed of grasses such as ripgut brome, Italian ryegrass, soft chess, wild oats, cheatgrass, and silver hairgrass. Chaparral communities consist of shrubs such as whiteleaf manzanita, wedgeleaf ceanothus, chamise, birchleaf mountain mahogany and other drought-tolerant species.

Vegetation within the La Grange Project is similar to that described above for the Don Pedro Project, dominated by blue oak (33 percent) and annual grasslands (63 percent), with scattered patches of chaparral plant communities (2 percent).

Wetlands and Riparian Areas

The Districts reviewed FWS's National Wetlands Inventory maps to identify a total of 82.4 acres of potential riparian and wetlands areas within the Don Pedro Project boundary, excluding the Don Pedro Reservoir. Most identified wetlands occurred along the narrow margins of steep ephemeral streams that drain into Don Pedro Reservoir.

For their study of wetland habitats in 2012 (HDR, 2013e), the Districts examined 10 drainages in the field for the presence of wetlands. Nine of the ten drainages supported wetlands, which consisted of mostly patches of riparian vegetation alongside tributary creeks. Wetland conditions typically began at or above the Don Pedro Reservoir's normal maximum surface elevation and extended upstream, usually beyond the project boundary. Most wetlands were dominated by bedrock or cobble and boulder substrates, which do not support hydric soils but provide for hydrophytic vegetation. In addition, other indicators of ground saturation during the growing season, such as watermarks, were often evident. One drainage, Big Creek, is not hydrologically associated with Don Pedro Reservoir; instead, it is supported by subsurface drainage from the swimming lagoon located upslope at Fleming Meadows Recreation Area. Big Creek had no defined channel but supported hydrophytic vegetation and had hydric soils throughout. The drainage not supporting any wetlands was Three Springs Gulch.

Don Pedro Reservoir is characterized by perennial, deep, slow-moving, open water and steep poorly vegetated banks. Its steep shoreline supports upland plant

communities adjacent to the reservoir margin. Areas below the normal maximum surface elevation, which are periodically exposed during low water, are sparsely vegetated or bare. Wetland and riparian habitats are uncommon along its shoreline and shallow areas or areas with emergent vegetation are primarily associated with tributary mouths.

Wetlands at the La Grange Project are primarily confined to narrow bands or small isolated wetlands adjacent to the Tuolumne River. The Districts evaluated wetlands within the La Grange Project by reviewing FWS's National Wetlands Inventory maps to identify potential wetlands within a 1-mile buffer around the project boundary. Excluding the La Grange Reservoir, there were only 0.09 acre of palustrine wetlands within the La Grange Project boundary.

Riparian areas on the Tuolumne River below Don Pedro Dam and La Grange Diversion Dam have been reduced due to a confined channel and a restricted floodplain. Although the project has contributed to this situation, several contributing factors include riparian forest cutting and hydraulic mining during the Gold Rush era, historic levee construction, floodplain encroachment for agriculture and developed land uses, and channelization for flood control. The participants to the 1995 Settlement Agreement agreed that improving the downstream riparian habitat would not only benefit the federally listed Chinook salmon, but also the multipurpose uses of the Tuolumne River. FWS, in its 10(j) comments, states that the lower Tuolumne River is notably lacking in both riparian floodplain and riparian overstory.

The Districts evaluated the extent of riparian vegetation in their Lower Tuolumne River Riparian Information and Synthesis Study (Stillwater Sciences, 2013e), and found that native riparian vegetation occupies approximately 2,700 acres as a nearly continuous but variable-width corridor along the lower Tuolumne River. Native cottonwood forest comprises 21 percent of the riparian plant communities, or 580 acres. The most common woody riparian plants are valley oak, narrow-leaf willow, Fremont cottonwood, and Goodding's black willow. Several riparian restoration projects have been implemented along the lower river during the past decade, and the overall extent of riparian vegetation has increased by approximately 400 acres since a previous riparian vegetation mapping in 1996, over half of which occurs in the lowermost 10 miles near the San Joaquin Wildlife Refuge. Only one 6-mile stretch of the Tuolumne River (Dredger Tailing Reach 6) has multiple age classes of Fremont cottonwood trees, suggesting that natural recruitment of cottonwood is not occurring along the remaining length of the lower Tuolumne River (McBain and Trush, 2000).

Noxious Weeds

To document the current distribution of noxious weeds[204] within the Don Pedro and La Grange Project boundaries, the Districts prepared a Noxious Weeds Study Report that summarized historical occurrences and field surveys (HDR, 2013f). The Districts identified 27 noxious weeds that have a reasonable potential to occur within the project vicinity. The Districts performed noxious weed surveys within the Don Pedro Project boundary in 2012, including all project facilities, recreational areas, and high-use dispersed recreational areas, as identified during study plan consultation. The survey area extended out to 300 feet beyond the project boundary within high-use recreational areas and the BLM's Red Hills ACEC. The Districts identified and mapped the distribution of 12 noxious weeds, divided among 623 geographically distinct occurrences. Table 3.3.3-1 lists the species encountered and their classification and occurrence by land ownership type. One species, Italian thistle, was considered ubiquitous and individual occurrences were not mapped. No California Department of Food and Agriculture (California DFA) A-listed noxious weeds, which are of greatest concern, were documented at the Don Pedro Project. Of the 22 occurrences of California DFA B-listed weeds, 11 of them occurred on BLM lands and 11 were on the Districts' lands. The most widespread noxious weed identified was Italian thistle, which was ubiquitous throughout the Don Pedro Project. Bermudagrass was also common, occurring in a band around Don Pedro Reservoir, just below high-water mark, plus an additional 76 occurrences. Other common noxious weeds included medusahead grass with 317 occurrences, and klamathweed with 158 occurrences (HDR, 2013f).

The Districts did not perform field surveys for noxious weeds within the La Grange Project. Four of the 12 noxious weed species that the Districts observed and mapped within the Don Pedro Project occurred downstream of the dam, extending into the La Grange Project boundary, including: (1) a giant reed population on BLM land, at a turn along the Don Pedro Powerhouse access road, where there were more than 500 plants growing in an area of approximately 0.1 acre; (2) three small infestations of tree-of-heaven, on BLM land just downstream of the Don Pedro Dam spillway; (3) several patches of bermudagrass along the Tuolumne River near the La Grange Project at the Twin Gulch channel; and (4) numerous large, diffuse patches of medusahead within annual grasslands below the Don Pedro Dam.

[204] The Districts defined noxious weeds as those species meeting one or more of the following criteria: (1) listed as "noxious" under the Federal Plant Protection Act; (2) listed as "noxious" and with a rating of A, B, or C by the California Department of Food and Agriculture; or (3) listed as a target species in the Districts' Noxious Weed Survey study plan.

Table 3.3.3-1. Noxious weeds observed within 300 feet of the Don Pedro Project boundary (Source: HDR, 2013f).

Common Name	Scientific Name	California DFA Rating[a]	Number of Occurrences on BLM Land	Number of Occurrences on MID and TID Land
Barbed goat grass	*Aegilops triuncialis*	B	4	1
Tree of heaven	*Ailanthus altissima*	C	3	4
Giant reed	*Arundo donax*	B	1	--
Italian thistle	*Carduus pycnocephalus*	C	n/a	n/a
Smooth distaff thistle	*Carthamus creticus*	B	6	9
Yellow star-thistle	*Centaurea solstitialis*	C	17	21
Bermudagrass	*Cynodon dactylon*	C	19	57
Medusahead grass	*Elymus caput-medusae*	C	24	293
Klamathweed	*Hypericum perforatum*	C	11	147
Russian thistle	*Salsola tragus*	C	--	2
Tamarisk	*Tamarix sp.*	B	--	1
Puncturevine	*Tribulus terrestris*	C	--	3
Total Occurrences			**85**	**538**

[a] California DFA Rating: A—Eradication, containment, rejection, or other holding action at the state-county level. Quarantine interceptions to be rejected or treated at any point in the state; B—Eradication, containment, control, or other holding action at the discretion of the commissioner. State endorsed holding action and eradication only when found in a nursery; C—Action to retard spread outside nurseries at the discretion of the commissioner; reject only when found in a crop seed for planting or at the discretion of the commissioner

Special-status Plants

Plant species considered special-status are those meeting one or more of the following criteria: (1) listed by BLM as Sensitive; (2) listed under California Endangered Species Act (CESA), including species proposed for listing; (3) listed on the California DFW list of California Rare species under the Native Species Plant Protection Act of 1977; or (4) listed on the California Native Plant Society (CNPS) Inventory of Rare Plants and formally listed as a CNPS 1, 2, or 3 plants (CNPS 1, CNPS 2, CNPS 3). Plants listed under the federal ESA are considered separately, in section 3.3.4, *Threatened and Endangered Species.* The Districts identified 31 special-status plant

species that could potentially occur at the Don Pedro Project by reviewing the CNPS database and California DFW's California Natural Diversity Database (CNDDB).

In 2012, the Districts performed botanical surveys within the Don Pedro Project boundary, targeting special-status plants that are subject to project operation and maintenance, or recreational activities (HDR, 2013g). The Districts surveyed portions of the Don Pedro Project with potential for project effects, including all project facilities, recreational areas, and high-use dispersed recreational areas as identified during study plan consultation. The study area extended out to 300 feet beyond the project boundary within high-use recreational areas and BLM's Red Hills ACEC. The Districts documented the full extent of each special-status plant occurrence up to 0.25 mile outside the project boundary. The Districts' study identified 8 special-status plants with 86 occurrences (table 3.3.3-2), with 58 on public land administered by BLM and 28 on private land owned by the Districts. The most abundant special-status plants were Mariposa clarkia (25 occurrences), Red Hills soaproot (20 occurrences), and Mariposa cryptantha (10 occurrences). Most sensitive species are found on serpentine soils within the Red Hills ACEC, which occurs on both sides of Don Pedro Reservoir.

Commission staff's SD2 for the La Grange Project identified the potential for occurrence of seven special-status plants, which included spiny-sepaled button celery, Hoover's calycadenia, Hartweg's golden sunburst, Mariposa cryptantha, dwarf downingia, Merced monardella, and knotted rush. The Districts did not perform project-specific studies of special-status plants within the La Grange Project boundary but reviewed existing information that revealed no known occurrences. The survey area for the Don Pedro Project study extended 1 mile downstream of Don Pedro Dam and included habitats that are similar to the Don Pedro Project. The Districts did not document any special-status plants along this reach of the Tuolumne River below Don Pedro Dam. There were no additional records of special-status plants within the La Grange Project boundary. During the scoping and study development process for the La Grange Project, no additional special-status plant surveys were requested by FWS, California DFW, or other entities.

Table 3.3.3-2. Special-status plants observed within 300 feet of the Don Pedro Project boundary (Source: Districts, 2017a, as modified by staff).

Common Name	Scientific Name	Status	Number of Occurrences by Land Ownership	Occurrence Locations/Habitat
Red Hills onion	*Allium tuolumnense*	BLM-S, CNPS 1B	BLM–10 Districts–0	Prefers south-facing slopes with shallow, serpentine soils in the Red Hills ACEC. Six occurrences were documented at Sixbit Gulch, two at Kanaka Point, one near Moccasin Point Recreation Area and one at Poor Man's Gulch for a total of over 700 individuals over a combined area of approximately 0.3 acre. Known from approximately 20 occurrences.
Red Hills soaproot	*Chlorogalum grandiflorum*	BLM-S, CNPS 1B	BLM–20 Districts–0	Occurs on rocky, serpentine soils within open areas in chaparral plant communities, mostly in the Red Hills ACEC and several other locations. Twelve occurrences were at Sixbit Gulch and eight at Poor Man's Gulch for a total of over 1,600 individuals combined over 0.4 acre.
Mariposa clarkia	*Clarkia biloba ssp. australis*	BLM-S, CNPS 1B	BLM–2 Districts–23	Most often found on north-, northeast-, and northwest-facing, disturbed sites. Many populations are large (> 0.1 acre). Occurrences were found at the Moccasin Point Recreation Area, at Rogers Creek Arm, near the Moccasin transmission line, and along Shawmut Road for a total of over 35,000 individuals. Additionally, one occurrence was in an area associated with a burn pile from debris removal activities, and some occurrences extended below the Don Pedro Reservoir normal maximum surface elevation.

Common Name	Scientific Name	Status	Number of Occurrences by Land Ownership	Occurrence Locations/Habitat
Mariposa cryptantha	*Cryptantha mariposae*	BLM-S, CNPS 1B	BLM–9 Districts–1	Occurs on serpentine soils in the understory of chaparral communities. Many populations are large (> 0.1 acre). Ten occurrences were found in proximity to Kanaka Point, at Moccasin Point Recreation Area, Railroad Canyon, and Sixbit Gulch for about 2,300 individuals over a combined area of approximately 1.24 acres.
Tripod buckwheat	*Eriogonum tripodum*	BLM-S	BLM–4 Districts–0	Occurs on serpentine soils. Four occurrences were documented, at Sixbit Gulch. Approximately 277 individuals were observed over a combined area of approximately 0.07 acre.
Congdon's lomatium	*Lomatium congdonii*	BLM-S, CNPS 1B	BLM–7 Districts–0	Occurs on serpentine soils. Seven occurrences were documented. Five occurrences were at Sixbit Gulch and two at Poor Man's Gulch.
Shaggyhair lupine	*Lupinus spectabilis*	BLM-S, CNPS 1B	BLM–4 Districts–3	Occurs on serpentine soils. Seven occurrences were documented. Two were at Poor Man's Gulch and five at Railroad Canyon. Occurrences ranged from one to 2,000 plants, totaling approximately 0.25 acre.
Red Hills ragwort	*Packera clevelandii*	BLM-S, CNPS 1B	BLM–1 Districts–1	Occurs on serpentine soils. Two occurrences were documented, one on BLM land and another on the Districts' land at Recreation Bay and Sixbit Gulch. A total number of 268 individuals were observed over a combined area of approximately 0.02 acre.

Notes: BLM-S—Bureau of Land Management Sensitive Species; CNPS 1B—California Native Plant Society listed as rare or endangered in California and elsewhere.

General Wildlife

The Districts evaluated wildlife for both Don Pedro and La Grange Projects by compiling historic records and performing field surveys for rare and protected species within the Don Pedro Project boundary. The Districts' analysis of the California Wildlife Habitat Relationship System identified a total of 339 terrestrial vertebrate wildlife species that are predicted to occur in the Don Pedro Project. The Districts provided a partial list of wildlife potentially occurring in the La Grange Project vicinity, which included 35 mammals, and 120 birds. Common mammals at the Don Pedro and La Grange Projects are mule deer, raccoon, and coyote. Birds likely to occur within both project boundaries are species that prefer oak woodland, oak-pine woodland, chaparral, and grassland habitats. Common birds in oak woodlands include the acorn woodpecker, oak titmouse, house wren, European starling, bushtit, and lesser and American goldfinches (Garrison, 2005). In annual grasslands, the western meadowlark, lark sparrow, western bluebird, and dark-eyed (Oregon) junco are most common, in addition to several dozen other species (PRBO Conservation Science, 2008). Water birds likely to occur at the projects include wading birds and waterfowl, such as great blue herons, common mergansers, and mallard ducks, as well as fish-eating raptors such as bald eagles and osprey. Common amphibians and reptiles at the projects could include California toad, American bullfrog, western yellow-bellied racer, Pacific gopher snake, and valley gartersnake.

The CNDDB revealed records of occurrence for five special-status vertebrates within the USGS 7.5-minute quadrangle maps corresponding to the Don Pedro Project boundary: (1) bald eagle; (2) foothill yellow-legged frog; (3) western pond turtle; (4) Sierra Nevada yellow-legged frog; and (5) coast horned lizard (i.e., Blainville's horned lizard). These and other special-status species likely to occur in the projects are discussed further below. Sierra Nevada yellow-legged frog is not considered further because it is restricted to elevations above 6,000 feet, well above the project elevations.

Special-status Wildlife

Special-status wildlife include those species that are listed as: (1) bird of conservation concern by FWS; (2) sensitive species by BLM; (3) protected under the Bald and Golden Eagle Protection Act; (4) threatened, endangered, or candidate species under CESA; (5) fully protected under California Fish and Game Code; or (6) nesting birds and birds-of-prey protected under California Fish and Game Code, Sections 3503 and 3503.5. In its SD2 for the Don Pedro Project, Commission staff indicated that its environmental review would evaluate the effects on special-status wildlife that include the following species: western pond turtle, foothill yellow-legged frog, Swainson's hawk, bald eagle, and osprey. For the La Grange Project, SD2 identified 10 additional special-status wildlife species for which project effects should be evaluated, excluding federally listed species (see section 3.3.4, *Threatened and Endangered Species, Terrestrial Species*). In addition to the bald eagle, this included one mammal (American badger) and two birds (tricolored blackbird and golden eagle).

The Districts reviewed existing information on wildlife resources to determine the presence and distribution of special-status wildlife. The review included a query of federal and state databases; past District surveys; and consultation with FWS, BLM, and California DFW staff. The Districts reported five special-status vertebrates with historic records within the Don Pedro Project boundary, including the western pond turtle, foothill yellow-legged frog, bald eagle, Sierra Nevada yellow-legged frog, and coast horned lizard. Based on the SD2, the Districts performed studies to understand potential project effects to 3 of these species (western pond turtle, foothill yellow-legged frog, and bald eagle), as well as 1 additional bird (osprey) and 9 special-status bats, totaling 13 species. The Districts conducted a study of bats at the Don Pedro Project in 2012 because the project potentially supports nine special-status bat species (HDR, 2013h). The Districts studied bald eagles and osprey on Don Pedro Reservoir in 2012 and 2013 (HDR, 2013i). In 2013, the Districts conducted studies for the western pond turtle and foothill yellow-legged frog—two semi-aquatic special-status species that are under review for ESA listing and potentially found in the projects (HDR, 2013j). Further detail on these surveys is provided below.

Because agency comments addressed potential project effects to other special-status species (i.e., western burrowing owl and golden eagle), we developed an updated list of 35 special-status wildlife species that have suitable habitat or the potential to occur within the Don Pedro Project, including 11 mammals, 21 birds, one amphibian, and two reptiles. Table 3.3.3-3 lists these species, along with their status and known occurrences within the projects.

The Districts did not perform any project-specific studies of special-status wildlife within the proposed La Grange Project boundary because they had conducted surveys for special-status wildlife in 2012 for the Don Pedro Project. These studies extended 1 mile below the Don Pedro Dam and included habitats that are similar to the Don Pedro Project. There were no additional records of special-status species within the proposed La Grange Project boundary. Due to similar habitat, the special-status terrestrial wildlife species listed in table 3.3.3-3 could also occur within the La Grange Project.

Bats

The Districts reviewed the CNDDB for historical occurrences of bat species in the Don Pedro Project vicinity. They performed focused surveys using mist nets and acoustic monitoring at four sites (Fleming Meadows Recreation Area, Don Pedro Dam spillway, Blue Oaks Recreation Area, and Moccasin Point Recreation Area). In addition, the Districts surveyed two long-term acoustic monitoring sites for eight months at the Don Pedro Dam and its spillway. During field surveys, the Districts inspected all project facilities (e.g., powerhouses, storage buildings, public restrooms at campgrounds and boat launches, kiosks, etc.) for active bat roosts and/or signs of past use, including guano and urine staining (HDR, 2013h).

Table 3.3.3-3. Special-status wildlife species with potential to occur within the Don Pedro and La Grange Projects (Source: Districts, 2017a,b as modified by staff; Audubon, 2018; California DFW, 2018b).

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Mammals				
Pacific fisher	*Pekania pennanti*	BLM-S, SSC, ST	Occurs in late succession forest near streams and meadows.	Not detected by surveys. Very low potential for occurrence due to lack of suitable habitat.
American badger	*Taxidea taxus*	SSC	Prefers open areas and may also frequent brushlands with little groundcover. When inactive, occupies underground burrow.	Not detected by surveys. Potentially occurs within suitable habitat.
Western red bat	*Lasiurus blossevillii*	SSC	Ranges from sea level up through high-elevation mixed conifer forests; roosts in foliage, forages in open areas.	One CNDDB occurrence in project vicinity. Detected by acoustic monitoring at Fleming Meadows Recreation Area, Don Pedro Dam, and at its spillway.
Spotted bat	*Euderma maculatum*	BLM-S, SSC	Ranges from sea level up to 9,800 feet in arid deserts, grasslands and mixed conifer forests.	One CNDDB occurrence in project vicinity. Detected by acoustic monitoring at Don Pedro Dam.
Townsend's big-eared bat	*Corynorhinus townsendii*	BLM-S, SSC	Ranges from sea level up to 10,300 feet; roosts in buildings, mines, tunnels, and caves; feeds along habitat edges.	One CNDDB occurrence in project vicinity. Detected by acoustic monitoring at Don Pedro Dam and at its spillway.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Pallid bat	*Antrozous pallidus*	BLM-S, SSC	Ranges from sea level up to 8,000 feet; roosts in caves, crevices and buildings, and forages in a variety of open habitats.	Five CNDDB occurrences in project vicinity. Five individuals captured in mist nets during focused surveys at Blue Oaks Recreation Area (campground). Also detected by acoustic monitoring at Fleming Meadows Recreation Area, and the vicinity of Don Pedro Powerhouse and spillway.
Fringed myotis	*Myotis thysanodes*	BLM-S	Occur primarily at middle elevations in desert, riparian, grassland, and woodland habitats. Roosts in caves, mines, cliff faces, rock crevices, old buildings, bridges, snags, and other sheltered sites. Foraging often occurs close to vegetative canopy.	No CDDNB occurrences in project vicinity. Not detected by surveys. Potentially occurs within suitable habitat.
Western mastiff bat	*Eumops perotis*	BLM-S, SSC	Ranges from sea level up to 8,700 feet; roosts in rock crevices, outcroppings and buildings.	Six CNDDB occurrences in project vicinity. Detected by acoustic monitoring at Don Pedro Dam, and its spillway.
Long-eared myotis	*Myotis evotis*	BLM-S	Roosts in buildings, crevices, and snags; feeds along habitat edges, in open habitats, and over water (0 to 8,800 feet at least).	No CNDDB occurrences within the projects. Detected by acoustic monitoring at Moccasin Creek Recreation Area, Don Pedro Dam, and its spillway.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Yuma myotis	*Myotis yumanensis*	BLM-S	Roosts in buildings, mines, caves, and crevices; feeds over water (0 to 10,800 feet), but uncommon to rare above 8,400 feet.	Two CNDDB occurrences in project vicinity. One individual captured during mist nest sampling at the Don Pedro Dam spillway. Also detected by acoustic monitoring at the Don Pedro Dam spillway.
Western small-footed myotis	*Myotis ciliolabrum*	BLM-S	Roosts in caves, buildings, mines, crevices, and under bridges; feeds over streams, ponds, and springs (0 to 8,800 feet).	No CNDDB occurrences within the projects. Possibly detected by acoustic monitoring at Don Pedro Dam and at its spillway, but not certain because of similarities in call structure to several other myotis species.
Birds				
Bald eagle	*Haliaeetus leucocephalus*	CE, CFP, BLM-S, BCC, BGEPA	See text below.	See text below.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Golden eagle	*Aquila chrysaetos*	CFP, BCC, BGEPA	Generally inhabit open and semi-open country such as prairies, sagebrush, savannah or sparse woodland, and barren areas, especially in hilly or mountainous regions, in areas with sufficient mammalian prey base and near suitable nesting sites. Nests are most often on rock ledges of cliffs but sometimes in large trees.	Only one observation of an adult perched on a pine tree near the top of southwest rim of Railroad Canyon. Previous observations during the BLM and Central Sierra Audubon Society mid-winter eagle surveys on Don Pedro Reservoir in 1997 and each year between 1999 and 2009.
Osprey	*Pandion haliaetus*	FGC	Occur primarily along rivers, lakes, reservoirs, and seacoasts. They often cross land between bodies of water. They typically build large stick nests on living or dead trees and man-made structures. Forage almost exclusively on fish.	Frequently observed on Don Pedro Reservoir, where there are 8 documented nests, with concentrations in the areas of the Upper and Middle Bays (three nests and two nests, respectively). Additionally, one nest was recorded near the Highway 49 bridge, one nest in the West Bay area, and one adjacent to Jacksonville Road close to Jacksonville Road Bridge.
Swainson's hawk	*Buteo swainsoni*	ST, BLM-S	In California, occurs in open blue oak savannahs, annual grasslands, gray pine-oak woodlands, and riparian areas. Foraging typically occurs in native grassland communities.	Unknown. Potentially occurs within suitable habitat.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Rufous Hummingbird	*Selasphorus rufus*	BCC	Migrate through California, but don't nest. Uses a variety of habitats that provide nectar-producing flowers, such as forest edges, streamsides, and mountain meadows.	Unknown. Potentially occurs within suitable habitat.
Oak titmouse	*Baeolophus inornatus*	BCC	Prefers relatively open woodlands of oak and pine and oak trees and can also be found in forests as long as adequate oak trees are present, as well as woody riparian habitats.	Unknown. Potentially occurs within suitable habitat.
Tricolored blackbird	*Agelaius tricolor*	ST, SSC, BLM-S, BCC	Occurs in fresh-water marshes with herbaceous cover such as cattails and bulrushes. Nests in vegetation of marshes or thickets, sometimes nests on the ground. Historically strongly tied to emergent marshes; in recent decades much nesting has shifted to non-native vegetation.	Unknown. Potentially occurs within suitable habitat.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Long-billed Curlew	*Numenius americanus*	BCC	Prefers open habitats of upland shortgrass prairies, wet meadows, grasslands, and, in winter, agricultural fields, saltwater marshes with tidal channels, intertidal mudflats, and coastal estuaries. Breeding habitat is mostly dry grassland and shrublands prairie, often with wetland areas nearby to provide better feeding area for the young.	Unknown. Potentially occurs within suitable habitat.
California thrasher	*Toxostoma redivivum*	BCC	Most common in chaparral, but also in dense oak woodlands, streamside thickets, and in suburban neighborhoods that have enough vegetation.	Unknown. Potentially occurs within suitable habitat.
Lewis woodpecker	*Melanerpes lewis*	BCC	Uncommon, local winter resident occurring in open oak savannahs, broken deciduous, and coniferous forests.	Unknown. Potentially occurs within suitable habitat.
Nuttall's Woodpecker	*Picoides nuttallii*	BCC	Resident of oak and pine-oak woodlands.	Unknown. Potentially occurs within suitable habitat.
Clark’s grebe	*Aechmophorus clarkii*	BCC	Colonial-nesting waterbirds that uses freshwater lakes or marshes with extensive open water, where they feed primarily on fish.	Unknown. Potentially occurs within suitable habitat.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Yellow-billed magpie	*Pica nuttalli*	BCC	Resident of open oak woodlands, riparian areas, and other open and semi-open habitats.	Unknown. Potentially occurs within suitable habitat.
Wrentit	*Chamaea fasciata*	BCC	Inhabits dense shrub thickets within chaparral, oak woodlands, mixed evergreen forests, and other shrubby areas.	Unknown. Potentially occurs within suitable habitat.
White-headed woodpecker	*Picoides albolarvatus*	BCC	Resident of mountain pine forests, preferring stands with large cones or prolific seed production, such as Coulter, ponderosa, Jeffrey, and sugar pines.	Unknown. Potentially occurs within suitable habitat.
Black swift	*Spizella atrogularis*	SSC, BCC	Nests in moist crevices or caves or on cliffs near waterfalls in deep canyons. Forages widely over many habitats.	Unknown. Potentially occurs within suitable habitat.
Black-chinned sparrow	*Chlidonias niger*	BCC	Occurs in marshes, along sloughs, rivers, lakeshores, and reservoirs, or in wet meadows.	Unknown. Potentially occurs within suitable habitat.
Burrowing owl	*Athene cunicularia hypugaea*	SSC, BLM-S, BCC	See text below.	See text below.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Spotted towhee	*Pipilo maculatus clementae*	BCC	Found in chaparral, oak woodlands, or other shrub habitats and in open stands of riparian and forested habitats. Prefers relatively tall, dense stands of shrubs and riparian thickets.	Unknown. Potentially occurs within suitable habitat.
Song sparrow	*Melospiza melodia*	BCC	Found in a wide variety of habitats, including brushy fields, woody riparian habitats, shrubby marsh edges, woodland and forest edges, agricultural fields, and even suburban areas.	Unknown. Potentially occurs within suitable habitat.
Lawrence's goldfinch	*Carduelis lawrencei*	BCC	Uses a variety of habitats including riparian forest, oak woodland, open pine woodland, pinyon-juniper woods, and chaparral. Restricted nesting habitat is limited to California, in open oak woodlands or other arid woodland and chaparral, near water sources.	Unknown. Potentially occurs within suitable habitat.
Amphibians				
Foothill yellow-legged frog	*Rana boylii*	FSS, SSC, SC	See text below.	See text below.

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Reptiles				
Blainville's horned lizard	*Phrynosoma blainvillii*	FSS, SSC	Occurs in a variety of habitats, including shrubland, grassland, coniferous woods, and broadleaf woodlands.	Unknown. Potentially occurs within suitable habitat.
Western pond turtle	*Actinemys marmorata*	FSS, SSC	See text below.	See text below.

[a] BCC—Federal bird of conservation concern; BGEPA—protected by the Bald and Golden Eagle Protection Act; BLM-S—BLM Sensitive Species; FSS—Forest Service sensitive species; CE—CESA-listed as endangered; ST—CESA-listed as threatened; SC—CESA candidate species; CFP—California fully protected; SSC—California species of special concern; FGC—protected by California Fish and Game Code sections 3503 and 3503.5.

Focused surveys and acoustic recordings documented the presence of nine special-status bats species at the Don Pedro Project, which included the pallid bat, Townsend's big-eared bat, spotted bat, western mastiff bat, western red bat, western small-footed myotis, long-eared myotis, fringed myotis, and Yuma myotis. Western red bat and canyon bat were the most often recorded species at all monitoring sites. Pallid bat and Townsend's big-eared bat were the second most often recorded species at both sites and were absent only during the month of March. Of the nine identified species, seven are considered special-status by BLM or California DFW (table 3.3.3-3).

The Districts' study reported evidence of bat use at several project facilities, including the Don Pedro Powerhouse; the visitor center building; and the Fleming Meadows, Moccasin Point, and Blue Oaks Recreation Areas. These observations indicated that project facilities were mostly used by bats as night roosts, where human presence is generally infrequent and intermittent at night and typically associated with recreation use rather than project operation and maintenance. However, at Don Pedro Dam, two bats (*Myotis* spp.) were observed day roosting in the fixed wheel gate building, which provides emergency closure for the power tunnel but is not otherwise used (HDR, 2013h).

The Districts have not performed bat surveys within the proposed La Grange Project boundary.

Bald Eagle

The Don Pedro and La Grange Projects provide year-round habitat for bald eagles. Bald eagle breeding habitat most commonly includes areas close to rivers, lakes, reservoirs, or other bodies of water that provide their primary food sources of fish and waterfowl. Wintering areas are commonly associated with ice-free water and bald eagles communally roost in conifers or other sheltered sites in winter. In California, bald eagle courtship and nest building begins in January, egg laying occurs in February through March, incubation is from late February through May, eggs hatch from March through May, the nestling period occurs from late March through late July, eaglets fledge from early June through late July, the post-fledging period when juvenile eagles learn to hunt and fly extends from early June through August, and migration occurs in mid-July through August.

The study area for the Districts' 2012 and 2013 bald eagle surveys encompassed a 1,000-foot buffer around Don Pedro Reservoir and project facilities. The Districts also documented observations of osprey and other raptors. A review of historical records from BLM and occurrence records in the CNDDB revealed seven previously documented bald eagle nests on Don Pedro Reservoir. Field surveys located nine bald eagle nests, of which five had been previously documented by BLM, and four are considered to be new or previously undocumented by BLM. Three of the nine nests were active during 2012. Two nests successfully hatched one eaglet, located near the upper reach of the Woods Creek Arm and on the northeast corner of Mine Island, but subsequent surveys were not

performed to determine if the eaglets later fledged from either nest. The third active nest that failed was located on the northern flank of Blank Peak, near the entrance to the Rodgers Creek Arm. During May 2013, the Districts observed two occupied and eight unoccupied bald eagle nests. The occupied nests were the same two that hatched eaglets in 2012, located in the Woods Creek Arm and on Mine Island. Some of the unoccupied nests may serve as alternate nests to the three occupied nests located in 2012, although data is insufficient to make that determination. The Districts did not report any historic or recent bald eagle nests within the La Grange Project boundary (HDR, 2013i).

No bald eagle winter surveys were performed by the Districts, although incidental sightings of bald eagles have been recorded on Don Pedro Reservoir during winter. BLM, in coordination with Central Sierra Audubon, have conducted annual wintering counts from 1994–2012 during one day each year in mid-January. The number of eagles per year has varied from 5 to 34 with an average of 20 bald eagles per year (BLM, 2018). No bald eagle winter surveys have been conducted on the La Grange Reservoir.

Burrowing Owl

The western burrowing owl has been included on the list of California species of special concern since 1978 (Gervais et al., 2008) and is listed as a BLM sensitive species. Nest sites of western burrowing owls are protected in California under Fish and Game Code Section 3503.5. In 2003, a petition to list the burrowing owl as threatened or endangered under the CESA was rejected (California Fish and Game Commission, 2004). Another petition could be submitted, however, that could potentially change the burrowing owl's status under the ESA or CESA during the duration of any project license.

The range of western burrowing owl extends throughout the lowlands of the Central and Imperial Valleys, and other open, relatively flat regions of California. Its distribution and abundance vary considerably throughout its range (DeSante et al., 2007). Throughout their range, the western burrowing owl requires habitats with three basic attributes: open, well-drained terrain; short, sparse vegetation generally lacking trees; and underground burrows or burrow-like structures (e.g., culverts). These habitats include grasslands, deserts, shrublands, agricultural areas, and a variety of other open habitat types such as the margins of airports, golf courses, residential developments, and roads (Gervais et al., 2008).

Available information on the status of the western burrowing owl in California suggests that the subspecies has been extirpated in many areas by increasing development and that the distribution of remaining populations reflects the degree to which land conversion and development has reduced available habitat, offset by the bird's ability to adapt to agricultural landscapes. The subspecies has disappeared or greatly declined as a breeding bird in many areas that were once occupied. The population trend for the subspecies in California is reportedly declining, and surveys from 1986 and 1991 show breeding population decreases of 23 to 52 percent. Nearly 60 percent of 22 western

burrowing owl colonies that existed in the 1980s reportedly disappeared by the early 1990s (DeSante and Ruhlen, 1995). In its determination that the subspecies was not warranted for listing under the CESA, the California Fish and Game Commission (2004) found that that expansion of western burrowing owl numbers in some areas, particularly arid lands that are now used for irrigated agriculture, may be offsetting declines elsewhere. It found insufficient evidence to establish an overall statewide increase or decline in western burrowing owl abundance.

Populations of western burrowing owls in California are threatened by the loss of farmland, changes in agricultural practices, eradication of ground squirrels, pesticide use, traffic and wind turbine-related mortality, and possibly West Nile virus. Other hazards of agricultural areas in California include automobiles, barbed-wire fences, and electric fences (Gervais et al., 2008). During the non-breeding season, burrowing owls remain closely associated with burrows, as they continue to use them as refuge from predators, shelter from weather and roost sites (California DFW, 2012). Thus, the decline of burrowing rodents such as California ground squirrels is of considerable concern the subspecies' conservation (DeSante et al., 2007; California DFW, 2008). Conserving and restoring populations of ground squirrels and other host burrowers by reducing or prohibiting lethal rodent control measures is a priority conservation measure for burrowing owls (California DFW, 2012).

The Districts have not conducted surveys for western burrowing owls within either of the project boundaries.

Foothill Yellow-legged Frog

The foothill yellow-legged frog is a candidate for listing under the CESA. It occurs in small to large streams and rivers with pools and low-gradient riffles (small streams are probably nonbreeding habitat). Breeding sites are usually in shallow, slow-flowing areas near the shore with coarse substrates (cobbles and boulders). Foothill yellow-legged frogs are infrequent in habitats where introduced fish and American bullfrogs are present.

Foothill yellow-legged frogs are reported to occur within tributary creeks to Don Pedro Reservoir. The nearest known extant populations occur at the confluence of Moccasin Creek and Big Jackass Creek, approximately 3.7 miles upstream of Don Pedro Reservoir. Additionally, the species is known to occur in Mountain Pass Creek, a tributary to Tulloch Reservoir on the Stanislaus River approximately 4.5 miles from the Don Pedro Project (HDR, 2013j). In 1970, the foothill yellow-legged frog was observed in Hatch Creek, about 4 miles upstream of Don Pedro Reservoir.

The Districts performed a desktop evaluation of foothill yellow-legged frog habitat at 20 locations along perennial streams within 0.5 mile of the Don Pedro Reservoir, including the Tuolumne River up to RM 79, and tributaries up to 1 mile upstream of the reservoir. Based on potential habitat identified during the desktop evaluation and property access, the Districts assessed 17 locations in the field for evidence of foothill

yellow-legged frog habitat suitability. They also performed visual encounter surveys along five tributaries to Don Pedro Reservoir: Six-Bit Gulch, Poor Man's Gulch, Woods Creek, Moccasin Creek, and Drainage #8 (an unnamed tributary of Don Pedro Reservoir at Gardiner Falls). No foothill yellow-legged frogs were observed at any sites during surveys, or incidentally observed during the course of other relicensing studies. Suitable foothill yellow-legged frog breeding habitat was reportedly scarce. In addition, invasive predatory American bullfrogs were observed throughout the Don Pedro Project vicinity, including at three of the visual encounter survey sites (Six-Bit Gulch, Poor Man's Gulch, and Woods Creek). Crayfish were also found throughout the vicinity and predatory fish species are known to occur in the tributaries surveyed (HDR, 2013j).

The Districts did not conduct surveys for foothill yellow-legged frogs within the La Grange Project boundary.

Western Pond Turtle

The western pond turtle is a Forest Service sensitive species and California species of special concern. It is California's only native aquatic turtle, occurring in permanent ponds, lakes, channels, backwaters, and pools of streams. Western pond turtles require habitats with sufficient cover, such as emergent vegetation, to protect hatchlings, and basking substrates such as rocks, logs, banks, and root masses. In river environments, western pond turtles prefer slow flowing areas and backwater environments with basking sites and underwater refuges. They use rivers primarily in the summertime and avoid high flow periods. Western pond turtles spend considerable amounts of time in upland areas surrounding aquatic habitats and may use uplands during any month of the year, particularly for nesting, aestivating, dispersal and overwintering. Females travel into upland environments to nest in mid-summer and may produce more than one clutch of approx. 4-8 eggs each. Nesting usually occurs within 328 feet of water at sites with southern exposure, short vegetation with little or no tree or shrub overstory, and well-drained compact soils with significant clay/silt content (Hallock et al., 2017). The relatively low reproductive effort and longevity of western pond turtles (~ 40 years) means that this species' population recovery time (after disturbances or local extinctions) is relatively slow compared to other species.

Fourteen live western pond turtles were observed by the Districts during their 2012 study (HDR, 2013j). Six individuals were detected at five basking survey sites and 10 individuals (8 live, 2 dead) were observed incidentally at 10 locations. Of the 10 incidentally observed turtles, five were within Don Pedro Reservoir, one was seen in the Don Pedro spillway channel, and two were in Woods Creek upstream of the project (one of these western pond turtles was a juvenile). Two incidental observations of dead western pond turtles occurred, one on the bank of the reservoir, and one in Woods Creek upstream of Don Pedro Reservoir. Some observations could represent repeat observations of the same individuals. This suggests that western pond turtles occur in relatively small numbers concentrated in backwater inlets, particularly those associated with seasonal or perennial tributary streams (HDR, 2013j).

The Districts did not conduct surveys for western pond turtles within the La Grange Project boundary, but they observed an adult below the Don Pedro spillway, and suitable habitat was identified within the Don Pedro Dam emergency spillway. Therefore, we conclude that western pond turtles are present in La Grange Reservoir.

3.3.3.2 Environmental Effects

To minimize potential adverse effects on terrestrial resources at the Don Pedro Project, the Districts propose to implement their TRMP for the duration of a new license. The Districts did not propose a management plan for terrestrial resources with their La Grange Project application. The Don Pedro plan covers the following components: (1) special-status plant species protection and monitoring; (2) noxious weed prevention and management measures; (3) valley elderberry longhorn beetle host plant guidelines; (4) bi-annual employee and contractor training; and (5) procedures for revegetation following ground-disturbing activities. The plan includes specific guidelines for protecting and managing special-status bats, bald eagles, western pond turtles, and the federally threatened valley elderberry longhorn beetle.

BLM, FWS, and California DFW comment that the Districts' proposed Don Pedro TRMP would not provide adequate protections for several special-status plants and animals, and species listed under the ESA or CESA. Their suggested modifications are included in several of BLM's revised 4(e) conditions, FWS's 10(j) recommendations, and California DFW's 10(j) recommendations. The resource agencies also recommend a similar plan for guiding the management of terrestrial resources at the La Grange Project. Specifically, FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 suggest that the Districts include protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, and California tiger salamander. FWS also included Layne's butterweed and Red Hills vervain in this recommendation for the Don Pedro Project and included the western pond turtle in its recommendation for the La Grange Project. For guidance, BLM and FWS provided the Districts with a revised Don Pedro TRMP and a template version for of a La Grange TRMP, the latter being an edited version of the Districts' Don Pedro plan. Also, BLM specifies and FWS recommends that the bald eagle section of the Don Pedro TRMP be revised as a stand-alone bald eagle management plan, and they provided the Districts with recommended stand-alone drafts for both projects. The Districts replied that they would draft revised plans, if necessary, and would review the plans submitted by BLM.

Our Analysis

Our analysis supports the benefits of revising the Don Pedro TRMP to address potential effects that would not be covered by the Districts' proposed plan. The Districts' development of a new, similar TRMP for the La Grange Project would also be beneficial. The specific project effects or resources that would benefit from being addressed by the plans for both projects include: (1) vegetation management; (2) ground disturbance

related to new project construction; (3) wetlands and riparian areas; (4) noxious weeds; (5) special-status plants; (6) burrowing owls; (7) other special-status birds; (8) special-status bats; (9) special-status amphibians and reptiles; (10) San Joaquin kit fox; (11) California red-legged frog; (12) California tiger salamander; and (13) valley elderberry longhorn beetle. We discuss these elements in subsequent sections, although items 10, 11, 12 and 13 are addressed in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*. Developing plans for both projects would guide the Districts' management of terrestrial resources for the duration of the project licenses. Therefore, the TRMPs are the appropriate documents within which the Districts could specify additional environmental measures for the protection and enhancement of terrestrial resources. The only terrestrial wildlife for which a separate stand-alone management plan seems warranted is the bald eagle, as recommended by both FWS and BLM, and supported by California DFW.

Vegetation Management

Under a new license, the Districts could disturb vegetation resources through excavation, grading, topsoil stripping, or vegetation management during the operation and maintenance of the Don Pedro Dam and La Grange Diversion Dam, project facility maintenance, and road maintenance (e.g., grading). Vegetation would also be affected during improvements to recreational resources (e.g., trail maintenance) and treatment of noxious weeds.

The Districts maintain project facilities and associated roads, including three developed recreational areas at Don Pedro Reservoir, using a combination of mowing and periodic use of pre-emergent herbicides, applied by licensed applicators, to manage vegetation growth. The Districts typically manage these areas in proportion to their use, in order to minimize the spread of unwanted vegetation (e.g., noxious weeds) and the risk of fire. High-use sections of each recreational area are mowed, and shrubs and trees are trimmed on a frequent basis around structures and buildings to remove ladder fuels that could increase fire risk, and to eliminate low branches that could injure passing humans. The Districts use herbicides to maintain bare ground around project powerhouses and switchyards, and on Don Pedro Dam. They also spray herbicides on an annual basis in parking areas, campsite pads, road edges, paths along irrigation canals, firebreaks, and the immediate area around restrooms and other recreational facilities.

The Districts propose BMPs for minimizing noxious weeds and ground disturbance during routine operations and maintenance activities in the Don Pedro TRMP, discussed further below under *Noxious Weeds*. The Districts' Don Pedro TRMP also includes provisions to protect special-status plants, discussed below under *Special-status Plants.*

As detailed in section 3.3.1, *Geologic and Soil Resources,* BLM 4(e) condition 3 for both projects specifies that the Districts develop a soil erosion and sediment control plan for erosion and/or restoration actions on or affecting BLM lands that are within or

adjacent to the project. The Water Board provides support with its preliminary 401 condition 9, which specifies that the Districts develop a plan to minimize undesirable erosion or reduce sediment for ground-disturbing activities that include, but are not limited to, routine operation, maintenance, any new construction, and recreational improvement. Such a plan would specify the techniques that would be used to stabilize sites once ground-disturbing activities are completed, in order to support subsequent reclamation or vegetation restoration. According to BLM, an effective soil erosion and sediment control plan would include the following: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Also, BLM Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 specify that the Districts consult with BLM regarding any additional ground-disturbing activities that are not specifically addressed in this license application. The Districts responded that they would work with BLM to identify any necessary site-specific BMPs for ground-disturbing activities on BLM land within both projects.

Our Analysis

The Districts' proposed Don Pedro TRMP does not provide a comprehensive list of BMPs that would be implemented to avoid adverse impacts to plant communities and wildlife habitat from ground-disturbing activities. BLM's 4(e) condition 3 for both projects to develop a soil erosion and sediment control plan, in consultation with the other resource agencies, would serve to limit potential effects on plant communities. Our analysis of the recommended soil erosion and sediment control plan is provided above in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*. Such a plan would provide overarching guidance for project construction, ensuring that affected lands would be revegetated, that noxious weeds would be prevented from establishment, and that erosion would not adversely affect adjacent plant communities. Expanding the plan to apply to all construction activities authorized by the license, rather than just on BLM lands, would provide additional protection during the Districts' ground-disturbing activities.

New Project Construction

The Districts propose several capital improvement projects that could have both short-term and long-term, direct and indirect effects on vegetation (i.e., habitat) and wildlife. Future construction of new project facilities would produce various levels of ground disturbance that would directly affect plant community composition and/or structure or increase the potential for invasive weed colonization. These effects would influence wildlife habitat quality. The Districts propose the following measures that

involve new construction: (1) extending the existing riprap protection on the upstream face of Don Pedro Dam from the current elevation of 585 feet down to elevation 535 feet; (2) construction of a fish counting/barrier weir in the lower Tuolumne River at RM 25.5; (3) construction of a new boat launch facility located just upstream of old Don Pedro Dam; (4) construction of a foot path trail along the river-right shoreline of the La Grange Reservoir; and (5) enhancements at existing recreation facilities. The affected areas for these projects would also include haul roads and staging areas.

California DFW 10(j) recommendation M9 requests that the Districts consider the potential effects on terrestrial species from operating and maintaining the infiltration galleries downstream of the Geer Road Bridge, at approximately RM 25.9. FWS made the same comment about the Districts' proposed Don Pedro TRMP but did not include it as a 10(j) recommendation. The Districts replied that if additional lands are added to the project boundary under the new license, they will be incorporated into the plan.

Our Analysis

The construction of several projects proposed by the Districts would require ground disturbance or the use of equipment to excavate portions of the Tuolumne River channel and bank areas. This disturbance could affect plants and animals through mortality, injury, or displacement as a result of habitat destruction, modification, or fragmentation. Indirect effects could result from changes to wildlife habitat use, reduced animal fitness, and altered natural food webs, or changes to predator-prey abundance. These effects would occur during the duration of construction activities but would mostly cease following the completion of the construction.

The resource agencies did not have specific recommendations to minimize or mitigate effects on terrestrial resources for each potential construction project that the Districts could undertake during the duration of new licenses for the Don Pedro and La Grange Projects. BLM's 4(e) condition 3 for both projects specifies that the Districts would develop a soil erosion and sediment control plan with BLM approval for actions affecting BLM lands. Such a plan would prescribe site-specific erosion control measures, which would serve to avoid the spread of noxious weeds and protect and restore wildlife habitat after ground-disturbing activities are completed. BMPs could include actions to avoid habitat loss or compensate for any temporary or permanent loss of habitat due to construction activities. Conducting pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any ground disturbance in areas with suitable habitat would provide further assurances that project effects would be minimized.

Wetlands and Riparian Areas

Continued operation and maintenance of the Don Pedro Project could affect the distribution, extent, composition, and structure of riparian vegetation along the lower Tuolumne River because the Don Pedro and La Grange Projects control flows and trap sediment. Under pre-dam hydrology, spring flows would have deposited sediment and

created sandbars at elevations above the normal low-flow elevation. Conditions for cottonwood and willow recruitment on these sediments would have been provided by the slow recession of snow-melt flows. Controlled flows below both project dams reduce spring pulse flows and impede sediment transport, which disrupts the regeneration of riparian forest because dominant woody species like cottonwood and willow require freshly deposited and wetted mineral soils for germination. Altered spring recession flows can decrease the duration of floodplain inundation and affect the establishment, growth, and survival of riparian vegetation. Along the lower Tuolumne River, limited natural recruitment of Fremont cottonwood, Goodding's black willow, and other willow species (excluding narrow-leaf, red, and shining willow) outside of actively replanted restoration areas is demonstrated by lack of young cohorts of these species during both field surveys in 1996 and 2012 (Stillwater Sciences, 2013e). Cottonwoods and willows provide important ecological structure and function to riparian ecosystems by stabilizing stream banks, fixing carbon, generating LWM, and providing critical wildlife habitat.

The Districts propose to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph of the Tuolumne River, which would promote seed dispersal and germination of cottonwoods and willows. The Districts propose a significant increase in spring pulse flows over the current flows during high flow, which they modeled as occurring in 60 percent of all years (i.e., spill years, in which flows at La Grange gage exceed 1,500 cfs in the February through July period). The Districts developed a draft plan to systematically optimize the benefit of the higher pulse flows, although it is specifically intended to benefit fall-run Chinook salmon outmigration. They did not identify specific recession rates, but if spill conditions allow, they would manage recession rates during the cottonwood seed dispersal period to provide soil moisture conditions that allow seeds to take up water, germinate, and form roots. The Districts contend that their flow hydrograph shaping is consistent with the intent of the agency and the Conservation Groups' flow proposals (i.e., spring pulse and recession rates) to support riparian vegetation maintenance in the lower Tuolumne River.

A stated goal of FWS is the restoration of riparian forest and floodplain along the Tuolumne River to support juvenile salmonid rearing, which would have substantial positive benefit to a wide diversity of native terrestrial biota. As discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Floodplain Habitat Restoration*, FWS does not recommend specific measures for habitat restoration within floodplains affected by the Don Pedro and La Grange Projects. Instead, FWS recommends (revised 10(j) recommendation 3 for the Don Pedro Project) implementing the LTRHIP, which would provide funding for planning, design, and constructing specific in-channel, riparian and floodplain improvements in the lower Tuolumne River. Additional discussion of the LTRHIP is included in the subsection *Floodplain Habitat Restoration* noted above. California DFW recommends (10(j) recommendation M5-1) the Districts prepare a spawning and floodplain habitat restoration plan for the lower Tuolumne River that would include no fewer than six project sites along the lower river, below the La Grange Diversion Dam, for the purpose of restoring native riparian vegetation. For the specific

details of FWS's and California DFW's recommendations, see the subsection *Floodplain Habitat Restoration*. NMFS recommends (10(j) recommendation 2) that the Districts recreate floodplains and side channels by recontouring piles of dredger tailings, including lowering the higher mounds of tailings piles, creating side channels, and raising the existing riverbed level, and that any in-channel placement of cobble/fill material be performed in a manner that increases local floodplain inundation. The Conservation Groups also recommend (recommendation 4) that the Districts design and implement the lowering of sufficient floodplain surfaces to achieve inundation for the same number of acre-days, as specified above during flow levels greater than 5,000 cfs, between February 1 and June 15. The Districts do not propose any measures specifically relating to floodplain habitat restoration along the lower Tuolumne River.

To further promote restoration of woody riparian vegetation in the lower Tuolumne River floodplain, NMFS recommends (10(j) recommendation 1.7) that the Districts base daily flow recession rates, between April 1 and July 31, on the percentage of the previous 24-hour average flow, depending on water year. In wet, above normal, and below normal water years, flows would not be reduced by more than 7 percent of the previous 24-hour average flow. In dry years, daily flow recession rates would not exceed 10 percent of the previous 24-hour average flow. Further details about this recommendation and the Districts' response to agency recommendations about recession rates are discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Ramping Rates and Fish Stranding.* California DFW recommends (10(j) recommendation M1-6) that the Districts follow the spring recession rates, presented above in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Minimum Flows and Pulse Flows*, and shown in tables 3.3.2-34 and 3.3.2-35 for the Tuolumne River at the La Grange gage and downstream of the infiltration galleries, respectively. The Conservation Groups recommend specific recession flows that would apply in above normal, below normal, and dry years, which are also presented above in the same *Minimum Flows and Pulse Flows* subsection.

In comments on the draft EIS, FWS, NMFS, and the Districts provided additional support for the LTRHIP, noting that the recommended funding would be used for projects to directly mitigate for project effects on salmonid habitat, including restoration of floodplain restoration. In their reply to comments on the draft EIS, the Districts also identify four restoration projects they propose to fund through the LTRHIP. The Districts provide information about specific locations, land ownership, details about project design and monitoring plans, and permitting information. The projects include modifying topography to increase floodplain connectivity at project flows at Riffle 1c and Buck Flat Riffle 3a/3b. The Bobcat Flat Phase III Project would include 76.8 acres of riparian and upland vegetation restoration. In year 5 of any new license, and every five years thereafter, the Districts would prepare a report covering the status of all work conducted and underway associated with the LTRHIP and, after review and comment by TPAC members, file a final report with the Commission. The five-year status reports would

also include information on the performance, monitoring, maintenance, and condition of each project undertaken as part of the LTRHIP.

The Bay Area Institute suggests that results of laboratory tests comparing seedling survivorship under varying recession rates (Stillwater Sciences, 2006) indicate that flow recessions could be up to 9 cm/day for the first 10 days without accelerating seedling mortality above slower rates. Thus, the Bay Area Institute recommends short-term, high recession rates followed by slower recession rates to balance water retention with riparian restoration. The Bay Institute notes that the Stillwater Sciences study did not include mixed flow reduction scenarios and recommends incorporating monitoring to evaluate its recommended approach.

Our Analysis

Wetlands and riparian areas support the greatest biodiversity of any ecosystem within the Don Pedro and La Grange Projects and are critically important to numerous rare and protected species. Nine of the ten drainages that the Districts evaluated within the Don Pedro Project were found to support wetlands and were assessed using the California Rapid Assessment Methodology.[205] Most wetlands evaluated had scores between 70 and 100, indicating that they experience few stressors and provide a multitude of wetland services, but two wetlands had lower scores, suggesting that their function was reduced due to stressors. These systems are influenced primarily by the channel gradient, substrate, and flow duration, rather than project operation and maintenance activities. Adverse effects from cattle grazing was apparent at many wetlands evaluated, as evident by hoof action, grazed vegetation, cow manure, or direct observation of cattle. However, the wetlands examined supported few noxious weed infestations. Those that were present were generally upland species adjacent to wetlands. No project facilities, access roads, recreational use, or other operation and maintenance activities occur in any wetlands surveyed; therefore, there are little to no project effects on wetland habitat conditions.

The bulk of Don Pedro Reservoir is steep-sided, with upland grass or shrub habitats directly adjacent to the reservoir margin. Periodically, exposed areas below the normal maximum surface elevation are sparsely vegetated or bare. No wetland conditions below the reservoir's normal maximum surface elevation were observed during study efforts, and no water backs up into wetlands as a result of the Don Pedro Project operation. As a result, water level fluctuations do not affect wetland systems in proximity to the reservoir.

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[205] This standardized approach evaluates riparian wetlands in California with a standardized methodology. The highest score possible for an overall AA attribute score is 100, indicating that every possible wetland service is provided, and the wetland has reached its maximum potential for riparian wetlands.

The Districts' study of riparian vegetation along lower Tuolumne River demonstrated that riparian areas are recovering from historical disturbances, based on the vigor and variety of age classes of the plants present. Cottonwood is one of the most abundant riparian trees in the river floodplain, second only to willows, and has increased from approximately 465 to 580 acres from 1996 to 2012. Overall, there has been a 419-acre (18 percent) increase in the extent of native riparian vegetation along the lower Tuolumne River over this time period (Stillwater Sciences, 2013e). This increase in native vegetation is largely associated with active restoration projects. Several restoration projects recommended for the Districts to undertake do not have a nexus to the Don Pedro and La Grange Projects. For example, recontouring the Tuolumne River floodplain in places affected by aggregate mining and dredger tailings would not address a direct project effect, even though the hydropower projects may prohibit the natural recovery of former instream extraction areas (e.g., SRPs). The Districts' study of the lower Tuolumne River floodplain demonstrates that several historical and existing human activities have contributed to the current degraded condition of riparian vegetation, including gold dredging, floodplain gravel mining, levee construction, channelization, grazing, row crops, and urban development. Any potential floodplain restoration efforts along the banks of the Tuolumne River would require work under challenging conditions and require solutions to working with private landowners, obtaining access (temporary and/or permanent) through active mining operations or agricultural land, acquisition of aggregate or mineral rights, and reclamation of tailings ponds. The cost of such efforts could likely be very high. However, our analysis reveals that some ecological functions could be restored to reaches that have been degraded by historical floodplain alteration, mining and dredger tailing deposits.

Since 1996, FWS and other stakeholders have successfully increased the amount of riparian vegetation along the lower Tuolumne River through active restoration activities. These efforts have also increased the distribution and quality of riparian habitat (Stillwater Sciences, 2013e). Large-scale river restoration projects are increasingly common in the lower San Joaquin Basin, and numerous studies have been conducted to understand the key physical and ecological processes needed to restore riparian cottonwood and willow ecosystems on large western rivers. With the application of this knowledge to future riparian restoration projects on the lower Tuolumne River, floodplain restoration projects would likely be successful and cost-effective. As described in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Floodplain Habitat Restoration,* the LTRHIP would provide a sustained funding source to perform active floodplain restoration, which would provide substantial, long-term benefits to the majority of terrestrial wildlife species in the region.

A major effect of the Don Pedro and La Grange Projects is the reduced magnitude, duration, and frequency of spring floods in the lower Tuolumne River. The resource agencies and Conservation Groups have presented evidence demonstrating the benefits of high spring flows and resulting floodplain inundation (e.g., Cienciala and Pasternack, 2017; Opperman et al., 2010; Poff and Zimmerman, 2010; Richter and Richter, 2000;

Rood et al., 2003). Floodplain inundation along the lower Tuolumne River is initiated at flows of approximately 1,100 to 3,100 cfs (FWS, 2008). The Districts' proposed flow regime would increase spring pulse flows downstream of La Grange Diversion Dam, achieving floodplain inundation. For further detail regarding the association between floodplain inundation and fisheries, please see section 3.3.2.2, *Aquatic Resources, Environmental Effects, Floodplain Habitat Restoration*.

The Districts designed their flow proposal to provide spring flows to benefit the recruitment and growth of native riparian vegetation that depends on seed deposition during high-flow periods (e.g., cottonwoods). Based on historic hydrologic conditions, the Districts state that their proposed schedule for water releases would provide for spring flows exceeding 1,500 cfs in February through July during 60 percent of years, and flows exceeding 2,500 cfs during 45 percent of years. We evaluated the Districts' flow proposal against other stakeholders' flow recommendations for providing simulated average daily flows greater than 1,100 cfs from April 1 to July 15 below the La Grange Diversion Dam, which is the rate at which floodplain inundation is initiated.

Table 3.3.3-4 summarizes the percentage of days when the simulated daily average flows below La Grange Diversion Dam (RM 51.5) would provide floodplain inundation under the flow proposals by the Districts and other stakeholders. Across all water years, each simulated flow proposal would provide an improvement over existing conditions (i.e., base case), which on average provides flows exceeding 1,100 cfs during approximately 40 percent of days. Both of the Districts' proposed flow regimes would maintain the frequency of floodplain-inundating flows at approximately 55 percent in April and increase the frequency to nearly 70 percent in May, but such high flows would occur less frequently during June and early July (less than 30 percent of days). The simulated flows under the draft Voluntary Agreement provide a similar frequency of days with floodplain inundation flows. On average, the FWS, NMFS, California DFW, and the Conservation Groups' flow scenarios would provide around an additional 5 percent more days with high spring flows in comparison to the Districts' proposal, with greater frequency during either April or May and with flows similarly declining towards baseflow levels into late June and early July. The flow regimes prescribed by the Water Board and recommended by ECHO and The Bay Institute provided the greatest number of days with flows exceeding 1,100 cfs, or between 68 percent and 73 percent of all simulated days. Overall, The Bay Institute flow proposal would maximize the number of simulated days at which floodplain inundation would occur on the lower Tuolumne River.

Table 3.3.3-4. Percentage of days with potential floodplain inundation under flow proposals by the Districts and other stakeholders, from April 1 to July 15 (Source: Districts, 2018b,f; 2020a,b as modified by staff).

Time Period	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWB REA	CG REA 10%	TBI REA-NoIG	ECHO REA-NoIG
April 01–April 30	54.5%	56.0%	56.3%	52.0%	69.7%	74.4%	45.2%	80.9%	70.0%	86.1%	86.5%
May 01–May 31	41.5%	69.9%	68.5%	65.8%	65.8%	63.8%	99.2%	93.2%	66.0%	91.7%	98.1%
June 01–June 30	34.8%	28.6%	28.7%	27.9%	51.0%	39.2%	34.4%	71.8%	51.0%	75.9%	81.7%
July 01–July 15	24.8%	21.4%	20.8%	21.7%	11.4%	13.7%	18.3%	29.0%	12.2%	35.2%	6.8%
Average	38.9%	44.0%	43.6%	41.8 %	49.5%	47.8%	49.3%	68.7%	49.8%	73.1%	68.3%

Notes: See table 3.3.2-17 for a description of each flow proposal.

Quantified as the percentage of days with simulated average daily flows ≥ 1,100 cfs below the La Grange Diversion Dam (RM 51.5).

In unregulated rivers in the Sierra Nevada, native riparian tree species are adapted to recession flows following spring snowmelt. The timing of seed production and environmental cues for seed germination are correlated with high spring flood flows and flood recession. Cottonwood trees, for example, release their seeds after high spring flows have deposited sand and silt along river margins, creating conditions suitable for seed germination. Gradual recession of spring flows allows for riparian tree establishment by providing soil moisture conditions that allow seeds to take up water, germinate, and form roots. Changes in the timing and magnitude of receding spring flows can limit establishment of cottonwood and willow seedlings. The Don Pedro and La Grange Projects have historically operated without a flow recession that would allow riparian forests to regenerate, resulting in a degraded riparian system that is dominated by older trees and shrubs. In order to mimic a natural decrease in flow from springtime snowmelt to summertime base flow, if water supply allows, the Districts' proposed flow regime would manage spring flow recession rates during the cottonwood seed dispersal and seedling establishment periods. However, the Districts did not evaluate their model's performance at providing recession flows suitable for riparian vegetation recruitment. In general, an ideal recession rate for seedling germination would be 2.5 cm per day drop in stage from April 1 to July 15 (Stillwater Sciences, 2006). Multiple studies suggest that a recession rate greater than 2.5 cm per day would prevent Fremont cottonwood seedling recruitment, and recession rates as slow as 1.5 cm per day could limit seedling recruitment (Mahoney and Rood, 1998; Rood et al., 2005; Stella et al., 2010).

To evaluate the recession rates of the Districts' proposed flow regime against other stakeholder's flow recommendations, we compared the frequency of days with potentially suitable recession rates. We calculated the number of days during April 1 to July 15 when the daily change in simulated stage height below the La Grange Diversion Dam fell by 1.5 to 3.5 cm per day when the prior day's simulated flow was at least 1,100 cfs. Table 3.3.3-5 provides a summary of the percentage of days when the simulated 24-hour river stage fell within that range.

In general, the modeled flow scenarios would not provide much opportunity for cottonwood recruitment in spite of the fact that FWS, NMFS, California DFW, Conservation Groups, and The Bay Institute's flow recommendations included parameters for achieving desirable recession rates. The Water Board's flow proposal performed better than all other flow proposals, and the simulated existing flow schedule (i.e., base case) generally achieved the target recession rates just as often as NMFS and California DFW's flow schedules. The Water Board's flow proposal did not contain specific recommendations for recession rates, but it performed better than flow proposals that included explicit recession rates. Under the draft Voluntary Agreement, the simulated daily change in river stage height below the La Grange Diversion Dam (RM 51.5) meets the recommended daily riparian rates suitable for woody plant recruitment on only 1 percent of days. We suspect that the poor performance of the recommended flow proposals for achieving recommended recession rates is due to the model's need to balance water supply and environmental resources among competing needs. For

example, during years when water supply is adequate to achieve floodplain inundation, the operations model may be constrained by the need to maintain water in Don Pedro Reservoir for future water releases for irrigation, municipal and industrial purposes, and other environmental benefits in the lower Tuolumne River. It should also be noted that the Tuolumne River floodplain is non-uniform, primarily as a result of topographic changes from mining and levee construction, which has limited the lateral extent of potential river influence (Stillwater Sciences, 2013e). Downramping rates based on a specified target daily change in gage height (e.g., 2.5 cm per day drop in stage) would produce variable changes across the length of the entire floodplain. It would thus be impractical to apply a specific downramping rate to achieve a suitable riparian recession rate for woody plant regeneration across the entire lower Tuolumne River. However, identifying elevations of suitable riparian establishment zones could identify areas where lower recession rates would be most beneficial. Adjusting recession rates to target elevations of suitable riparian establishment zones would be more productive than trying to identify a suitable recession rate for the entire floodplain of the lower river.

Despite the poor performance of the Districts' proposed flow regime to achieve target recession rates for enhancing woody riparian vegetation, as modeled, we do not discount that the Districts' proposed operations schedule would benefit riparian areas in the lower Tuolumne River. However, the Districts' flow regime could be more effective at restoring riparian ecosystems by specifying down-ramping rates of specified volume or at a volume that would achieve a drop in stage height of around 2.5 cm per day until the summer base flow is reached, depending on a recession flow initiation value and in above normal, below normal, and wet water years. In combination with other floodplain restoration projects by various stakeholders, including state and federal resource agencies, public utilities, and private organizations, the Districts' proposed spring pulse flows would provide for an increased distribution and diversity of riparian vegetation along the lower Tuolumne River. Given the relatively frequent (2−10 year) recurrence of inundation events lasting at least 30 days (HDR and Stillwater Sciences, 2017), and the Districts' commitment during spill years (60 percent of years during the 1971−2012 modeling period of record) to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions, the Districts' proposed flow regime would benefit riparian resources.

Table 3.3.3-5. Percentage of days with potentially suitable recession rates under flow proposals by the Districts and other stakeholders, from April 1 to July 15 (Source: Districts, 2018b,f; 2020a,b, as modified by staff).

Time Period	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWB REA	CG REA 10%	TBI REA-NoIG	ECHO REA-NoIG
April 01–April 30	0.44%	0.85%	0.85%	0.71%	11.16%	0.64%	2.11%	9.62%	11.45%	10.74%	11.56%
May 01–May 31	0.74%	0.22%	0.31%	0.38%	5.83%	0.24%	0.15%	6.51%	5.82%	6.31%	6.03%
June 01–June 30	2.51%	4.52%	1.83%	2.14%	3.12%	0.00%	0.92%	9.39%	3.12%	8.89%	7.68%
July 01–July 15	7.05%	8.15%	1.08%	1.0%	1.39%	5.81%	5.22%	5.46%	2.60%	1.80%	0.00%
Average	2.69%	3.44%	1.02%	1.06%	5.38%	1.67%	2.10%	7.75%	5.75%	6.94%	6.32%

Notes: See table 3.3.2-17 for a description of each flow proposal.

Quantified as the percentage of days that simulated average stage heights decrease between 1.5 and 3.5 cm on days following simulated flow of at least 1,100 cfs, below the La Grange Diversion Dam (RM 51.5).

It is unclear why the recession rates recommended by the Conservation Groups would apply in dry water years, but not wet years. As recommended in Stillwater Sciences (2006), riparian recruitment flows are not normally targeted for normal, dry, or critically dry water years because reservoir volumes would not likely be sufficient to meet riparian recruitment flow needs. In these years, we conclude that the most appropriate strategy is to conserve the limited water supply to meet human needs and to provide stable base flows for recharging water tables during late summer, when existing cottonwood and willow trees would be most vulnerable to drought mortality. Furthermore, recruitment of these species is naturally sporadic, with cohorts becoming established and surviving not every year, but primarily in high flow years. Stillwater Sciences (2006) also suggests that riparian recruitment flows should be targeted from mid-April to late May to improve cottonwood recruitment, and mid-May to late June to benefit Goodding's black willow. Our analysis shows that the Districts' proposed flows would provide a higher percentage of days during these periods when recession rates would benefit these species, as compared to California DFW flows. Thus, an adaptive management approach to pulse-flow timing and duration, and recession rate management by the Districts, based on real-time knowledge of the project operation, would provide necessary flexibility for balancing resource needs and satisfying riparian restoration objectives.

However, the Districts' proposed measure to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph is vaguely worded and would be difficult to enforce. The Districts do not describe the proposed efforts or how results would be quantified and evaluated. Similarly, there is no description of what flows the Districts would consider a reasonable mimic of the natural hydrograph. Modifying the proposed spill management plan by incorporating specific criteria about how these efforts would be quantified and evaluated would provide stakeholders the ability to review the efficacy of this measure and ensure the measure is enforceable. Such details could include specific water volumes in different water year types, target flow reduction rates based on previous daily flows, or a protocol for consultation with resource agencies to identify anticipated water availability based on reported snow pack and a plan to allocate spills to mimic natural conditions. Implementation of the Districts' proposed channel improvement projects at Riffle 1c and Buck Flat Riffle 3a/3b would increase the extent of gravel bars and side channels where riparian recruitment could occur. The Districts' proposed revegetation of 76.8 acres of the riparian zone associated with the Bobcat Flat Phase III Project would increase cover of riparian vegetation and habitat value for terrestrial wildlife.

Regarding The Bay Institute's recommended short-duration high recession rate followed by lower recession rates, Stillwater Sciences (2006) results show that during the initial 10 days of water table drawdown, there is little difference in seedling survivorship across variable drawdown rates (0 cm/day, 1 cm/day, 3 cm/day, 6 cm/day, 9 cm/day). After 10 days, there is a steep reduction in survivorship associated with the 9 cm/day high recession rate and more shallow reductions in survivorship for moderate and low

recession rates. The Bay Institute suggests that a high recession rate during the first 10 days followed by lower recession rates may not affect seedlings survivorship because it takes 10 days for the seedlings to start dying. However, there are differences in soil moisture that would exist following a 90 cm drop in the water table (9 cm/day for 10 days) compared to a 30 cm drop in the water table (3 cm/day for 10 days). Therefore, dewatering seedlings at a high rate up to the point where mortality rates are expected to increase and then continuing to dewater the seedlings at a slower rate would be beneficial.

Noxious Weeds

Ground disturbance due to vegetation management, human activity (e.g., recreation), reservoir water level fluctuations, and the presence and use of project roads have the potential to alter the composition of existing vegetation communities by increasing the potential introduction and spread of noxious weeds.

The Districts propose to manage noxious weeds according to the degree of threat posed to other resources (e.g., special-status plants) and California DFW's listing status and feasibility of control. The Districts' proposed Don Pedro TRMP includes three main components to manage noxious weeds: (1) using BMPs to prevent their introduction, establishment, and further spread; (2) surveying for noxious weeds beginning in the second year following license issuance, and every fifth year thereafter over the term of a new license; and (3) providing management guidelines to contain (and/or eradicate) existing and newly established infestations. BMPs in the plan for minimizing the potential introduction or spread of noxious weeds include: cleaning heavy construction equipment and vehicles that have been used off-road, minimizing ground disturbance during routine operation and maintenance activities, conducting revegetation in accordance with BLM guidelines for ground disturbance larger than 0.25 acre, using weed-free straw and native plants, and restricting travel to established roads.

To monitor the distribution of noxious weeds within the Don Pedro Project, the proposed TRMP also calls for conducting surveys on BLM-administered lands within the Red Hills ACEC and other lands within the project boundary that are subject to operation and maintenance activities. These noxious weed surveys would cover the Districts' developed recreational areas and would focus on recreational areas, along project roads, adjacent to facilities, and similar areas that are most likely to be prone to noxious weed infestations. The Districts would document species composition, location, and relative abundance of each noxious weed occurrence. To manage noxious weed infestations, the Districts' proposed TRMP would include using herbicides to control California DFA A- and B-listed plants and some localized infestations of C-listed noxious weeds. The Districts propose to treat multiple occurrences of three California DFA B-listed plants: barbed goatgrass (n = 6), smooth distaff thistle (n = 15), and tamarisk (n = 1) but would use manual control methods in areas within 50 feet of ESA/CESA-listed plant occurrences. According to their proposed plan, the Districts would use herbicides approved for use on BLM land in compliance with BLM standards. In addition, the

Districts would annually consult with the BLM about noxious weed management, including the current distribution and location of noxious weeds, proposed management plans and desired future conditions, and post-treatment monitoring methods and schedule.

The Districts did not submit a plan for managing noxious weeds at the La Grange Project, although due to its smaller size, overall project effects would be less than the Don Pedro Project. Furthermore, the potential for the spread of noxious weeds at the La Grange Project is limited by the lack of public access roads and facilities, or public access points.

To provide for early detection of new populations of noxious weeds, the Don Pedro TRMP includes protocols for environmental training of project staff and contractors once every two years for the term of any license. This biennial training would include information about the recognition of high-priority noxious weed species, emphasizing the Districts' noxious weed prevention guidelines and reporting procedures to document any infestations.

The Districts propose to consult annually with BLM about their noxious weed management activities, including the following information: (1) the current distribution and location of target noxious weed occurrence(s); (2) the proposed management method, duration, schedule, and specific application plans; (3) the desired future condition and criteria for success; and (4) the methods and schedule for follow-up monitoring of treated areas.

California DFW (10(j) recommendation M9-4.1), as well as FWS and BLM (in their comments on the Don Pedro TRMP) recommend that the Districts revise the plan to include the following BMPs that address noxious weeds:

1. Monitoring for new weed occurrences in special-status plant areas, such as Kanaka Point, where smooth distaff thistle is growing along the footpath that leads to Layne's butterweed occurrences.
2. Emphasizing manual control activities (such as hand trimming or weed whacking), when noxious weeds are in special-status plant areas, such as at Kanaka Point, where there is yellow starthistle in close proximity to Layne's butterweed.

Because the Districts did not conduct a noxious weed survey at the La Grange Project, BLM and FWS provided a draft TRMP that provides for a noxious weed survey of the La Grange Project during the first year following license issuance, and every fifth year thereafter.

Our Analysis

Noxious weeds pose a significant threat to native plant communities and wildlife habitat, especially the four California DFA B-listed species that were found at the Don Pedro Project (see table 3.3.3-1). Project operation and maintenance activities could potentially contribute to the spread of some noxious weeds, with the main potential

contributors being roads and ground disturbances around project facilities (e.g., grading, mowing and spraying), recreational use (e.g., camping and hiking), and livestock grazing. Disturbed areas are more susceptible to colonization by noxious weeds than undisturbed areas. Noxious weeds have the potential to outcompete and displace native species, which alters native plant community composition and function. Noxious weeds may negatively affect wildlife habitat and biodiversity, increase wildfire risk, reduce agricultural water-use efficiency, and diminish recreational values.

The Districts identified 10 noxious weed occurrences in areas with grading activities, 5 occurrences in waste or storage areas, and 19 occurrences in mowed areas. In these areas, ground-disturbance by vehicles, heavy equipment, or human traffic could expose soil to the establishment of noxious weeds. Routine project operation and maintenance activities could affect the presence and spread of noxious weeds in proximity to project facilities, as well as the Districts' three recreational areas. Project operations that affect water levels in Don Pedro Reservoir also influence the spread of several noxious weeds, such as bermudagrass, a California DFA C-listed noxious weed, which occurs as a discontinuous band around Don Pedro Reservoir just below the normal maximum surface elevation. Bermudagrass and medusahead grass, also California DFA C-listed, are also known to occur near the eastern edge of the La Grange Reservoir. Once established, these non-native plant populations could expand quickly and would alter native plant communities.

In the Don Pedro TRMP, the Districts propose to conduct surveys for noxious weeds on BLM lands in the Red Hills ACEC and other lands subject to operations and maintenance activities. We agree that the surveys, as proposed, are warranted and necessary due to documented project effects on the occurrence of noxious weeds. These surveys would help ensure that noxious weeds do not increase. It would be most effective for the Districts to focus on areas where noxious weeds are most likely to occur or be introduced, which include the Don Pedro Reservoir shoreline, along busy roads and trails of Don Pedro Project recreational areas, in heavily grazed areas, and around project facilities.

We are unable to determine the extent of noxious weeds at the La Grange Project because the Districts have not performed a noxious weed survey of the project. Operation and maintenance activities could contribute to the spread of noxious weeds at the La Grange Project, particularly in proximity to roads, canals, and facilities. Also, the Districts' proposed trail to the La Grange Reservoir could increase the likelihood of noxious weeds being introduced by recreational users. FWS commented that considerably more attention should be given to the potential adverse effects of recreation on sensitive wildlife and plant resources at the La Grange Project. In their reply comments, the Districts stated that there is limited recreation occurring within the La Grange Project and that they would conduct appropriate surveys prior to construction of the proposed trail to the La Grange Reservoir. We assume that this would include surveys for noxious weeds. However, to minimize the potential for project effects contributing to the spread of noxious weeds in the La Grange Project, conducting surveys

for noxious weeds within the proposed La Grange Project boundary would be beneficial, as recommended by BLM. It would be sensible to perform a noxious weed survey of the La Grange Project during the first year of license issuance and with the same schedule as the Districts have proposed for the Don Pedro Project thereafter (i.e., every five years).

As discussed below under *Special-status Plants*, noxious weeds could become established and outcompete populations of special-status plants, as over half of the known special-status plant occurrences at the Don Pedro Project had noxious weeds growing in their proximity. Revising the Don Pedro TRMP to include additional provisions for future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants would reduce potential for this adverse effect. By focusing noxious weed surveys on these areas, the Districts would document any further encroachment of noxious weeds on sensitive plants, especially in areas such as Kanaka Point where the Districts documented recreational activities as potentially increasing noxious weeds in proximity to special-status plants. For the Don Pedro Project, the Districts have proposed to conduct surveys for special-status plants with the same frequency, so these surveys could occur simultaneously. Also, the Districts could control some small noxious weed populations during the surveys, as they reportedly did for multiple occurrences (n = 8) during their 2012 surveys. It would also be beneficial to include these same protective measures in a La Grange TRMP.

The Districts' proposal to treat noxious weed infestations with pesticides could adversely affect adjacent special-status plants if precautions are not taken. Six of the smooth distaff thistle populations that the Districts propose to treat with pesticide are in the vicinity of three occurrences of the federally threatened Layne's butterweed (within 250 feet of one occurrence), located on Kanaka Point. The Districts' Don Pedro TRMP calls for a 50-foot buffer around ESA/CESA-listed plant occurrences where no pesticides application would occur for documented California DFA B-listed occurrences within the project boundary. However, the resource agencies recommended an emphasis on manual control of noxious weeds in all areas where special-status plants are likely to occur, including future infestations. Modifying the Districts' Don Pedro TRMP to emphasize the use of manual control methods of noxious weeds in areas with sensitive resources, where feasible, would be a simple modification to protect all special-status plants in addition to ESA/CESA-listed species. The use of manual control methods in areas with sensitive resources would also be appropriate at the La Grange Project. This treatment strategy would also avoid any adverse effects of pesticides on special-status plants, burrowing animals, wetlands and riparian areas, amphibians, reptiles, bats, and nesting birds. On BLM lands, the Districts would comply with BLM regulations, which includes using only approved pesticides in compliance with BLM standards. This would ensure that the treatment of smooth distaff thistle and other noxious weeds does not adversely affect Layne's butterweed, or other special-status plants. We discuss the benefits of flagging or fencing around special-status plants prior to any vegetation management activities, including noxious weed treatments, under *Special-status Plants*.

The Districts documented one occurrence of giant reed, a California DFA B-listed noxious weed, at the Don Pedro Project that was not proposed for management by the Districts in their Don Pedro TRMP. This population includes approximately 500 plants within an area of about 0.1 acre at a turn along the Don Pedro Powerhouse access road. Controlling this population of giant reed would reduce its potential spread to other areas of either project. Revising the Don Pedro TRMP accordingly would address the treatment of all known occurrences of California DFA A- and B-listed noxious weeds that the Districts identified. Future surveys at the La Grange Project would also document if there are any A- or B-listed noxious weeds in the La Grange Project.

Lastly, the recreational trail that the Districts propose to construct from the Don Pedro Visitor Center parking lot to the La Grange Reservoir would require ground-disturbing activities during construction, which could spread noxious weeds into adjacent plant communities. The Districts have documented numerous existing populations of medusahead grass and klamathweed in the general area of the proposed trail. Conducting pre-construction surveys following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat and monitoring noxious weed occurrences would determine if additional mitigation measures are needed to prevent their spread during trail construction.

Special-status Plants

The Districts reported four instances of project operation and maintenance activities that could affect special-status plants, including (1) road and campground maintenance, where one occurrence of Red Hills onion and six occurrences of Mariposa clarkia could be affected; (2) the use of a storage area, where one occurrence of Mariposa cryptantha is growing among stored equipment; (3) the removal and disposal of stockpiled wood, where one occurrence of Mariposa clarkia was growing among the debris pile; and (4) the management of Don Pedro Reservoir water levels, as portions of seven special-status plant occurrences of five species are located near or below the reservoir maximum inundation line.

Recreational activities, especially in the Red Hills ACEC, could affect several special-status plants that occur in that area. The Red Hills ACEC is important for special-status plants because of its serpentine soils and was designated to protect its rare plant species. The primary stressors on most special-status plant occurrences within the Don Pedro Project were noxious weeds and private cattle grazing activities (HDR, 2013g). In addition, portions of seven special-status plant occurrences of five species are located near or below the reservoir maximum inundation line, although the Districts reported them to not be adversely affected by current project operations. The Districts do not propose any changes to Don Pedro Reservoir water levels that could affect the duration or timing of these occurrences' inundation. Lastly, project activities that promote the establishment and spread of noxious weeds may have indirect effects on special-status plants, as over half of the observed occurrences of special-status plants were co-located with noxious weed occurrences (see *Noxious Weeds* above).

The Districts' proposed Don Pedro TRMP addresses project effects on special-status plants. The proposed plan includes protective measures for special-status plants on BLM lands and lands under the Districts' ownership, which include consultation with BLM, and conducting surveys prior to ground-disturbing activities. The Districts would develop specific-use plans for areas surrounding known occurrences of special-status plants that would be potentially affected by proposed project activities. Until such plans are developed, the Districts would exclude known special-status plant occurrences from routine Don Pedro Project activities. Also, prior to any new ground-disturbing activities affecting more than 0.5 acre, the Districts would conduct site-specific surveys for special-status plants, if warranted, during pre-activity review and consultation with BLM.

The Districts propose to monitor known occurrences of special-status plants within the Don Pedro Project beginning in the second year of license issuance, and every fifth year thereafter. They would consider additional monitoring or site-specific management efforts if data indicate substantial species decline, specific potential for project effects on special-status plants, or a need to evaluate individual activities.

California DFW recommends (10(j) recommendation M9-4.1), and FWS and BLM comment, that the Districts should revise the Don Pedro TRMP to include six BMPs to conserve special-status species. Two of those BMPs are also related to noxious weeds and were discussed previously under *Noxious Weeds*. The remaining four BMPs include:

1. Annual employee training for staff (employees and contractors), which would include information on recognition of special-status species, the location of existing occurrences of sensitive resources and areas to be avoided.
2. Implementing buffers around sensitive areas.
3. Flagging or fencing of sensitive areas with a site- and resource-specific buffers prior to any vegetation management activities, including noxious weed treatments, and removing the flagging when the work is complete.
4. Posting signs telling recreationists to "Stay on the Trail to Preserve Rare Plants and Their Habitat" when trails created by hikers and horseback riders go through special-status plant habitat, especially within the Red Hills ACEC at Kanaka Point where there is evidence of a walking trail near the occurrences of Layne's butterweed and in Poor Man's Gulch where equestrian trail riding occurs near several occurrences of Layne's butterweed and Red Hills vervain.

FWS made these same recommendations in its comments on the Don Pedro TRMP, although they were not included as 10(j) recommendations. The Districts replied that, if necessary under a new license, they would draft a revised plan with additional protective measures.

BLM Don Pedro revised 4(e) condition 7 specifies that the Districts would conduct surveys for special-status plants every five years in the Red Hills ACEC and

every 10 years on BLM lands elsewhere in the project. California DFW 10(j) recommendation M9-4.2 recommends that the Districts change the threshold for increased monitoring so that any substantial decline in special-status plants triggers consultation with California DFW, FWS, and BLM. California DFW also recommends that the Districts conduct surveys for special-status plants, in addition to known occurrences, in the following areas:

1. The Blue Oaks, Fleming Meadows, and Moccasin Point Recreation Areas and related facilities, including the 3.5-mile Don Pedro shoreline trail;
2. High-use dispersed recreational areas, as identified by the Districts' staff;
3. Don Pedro Dam, Powerhouse, and Switchyard, including related maintenance and storage facilities and the powerhouse access road;
4. Don Pedro spillway channel and related access roads;
5. Gasburg Creek diversion dike and related access roads;
6. Employee housing near Don Pedro Dam;
7. Don Pedro Recreation Agency Headquarters and Visitor Center;
8. Dikes A, B, and C near Don Pedro Dam; and
9. Ward's Ferry take-out.

The Districts did not conduct surveys for special-status plants in the La Grange Project area. BLM La Grange preliminary 4(e) condition 5 specifies that the Districts would conduct special-status plant surveys of the project every 10 years. BLM and FWS provided a draft TRMP for the La Grange Project as an attachment to their preliminary 4(e) conditions and 10(j) recommendations, which provides for a special-status plant survey on BLM lands within the La Grange Project boundary in the first year of license issuance and every tenth year thereafter.

Our Analysis

The Districts' proposed Don Pedro TRMP includes a section on special-status plants that would serve to protect known occurrences by ensuring that protection and consultation be undertaken prior to ground-disturbing activities. These protections, which include BMPs for the control of noxious weeds, bi-annual employee training, and surveys for known occurrences of special-status plants every five years, would help to protect known special-status plant populations from project operation and maintenance activities, as well as from the indirect effects from invasive weeds, water fluctuations, and recreational activities. In the draft EIS, we concluded that limiting surveys for special-status plants to areas of ground disturbance larger than 0.5 acre, as proposed, would be insufficient to minimize effects of new ground disturbance on these species. Instead, we recommended the Districts conduct pre-disturbance surveys for any new ground disturbance involving heavy machinery. However, after reevaluating this issue, we agree there could be potential adverse effects on special-status plants associated with

any project-related ground disturbance occurring in areas with suitable habitat for these species, regardless of what type of tools create the disturbance. Surveys for special-status plants prior to any project-related ground disturbance in areas with suitable habitat for special-status plants, rather than the proposed 0.5-acre minimum threshold for surveys, would ensure that adverse effects on special-status plant species are minimized during project activities.

Substantial numbers of special-status plants exist within the Don Pedro Project, and we conclude that the Districts' proposed management of special-status plants is insufficient because the proposed surveys would only focus on known occurrences of special-status plants. Undocumented populations of special-status plants (i.e., not found during surveys) likely exist at the Don Pedro Project, and new populations of special-status species could become established over the duration of a license period. Thus, monitoring only known populations would be insufficient to protect new occurrences from project effects. Revising the Don Pedro TRMP to include additional surveys for special-status plants following California DFW protocols within the Red Hills ACEC every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, roads and trails that are predominately used for project-related purposes, and where project-related disturbance is reasonably expected to occur would thus be necessary to prevent project effects on these species. Because special-status plant surveys were not performed at the La Grange Project, including a survey of special-status plants and a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance, would be beneficial. These surveys would include additional lands that are within the Don Pedro and La Grange Project boundaries and are subject to operations and maintenance activities (i.e., recreational areas, roads, and trails, as described above under California DFW 10(j) recommendation M9-4). The resource agencies mentioned numerous such locations for focusing surveys, including Kanaka Point and other areas mentioned previously.

The proposed bi-annual employee and contractor training would familiarize project staff with the ecology and management of plant communities at the projects. The analysis supports the Districts' revision of the Don Pedro TRMP to include additional information in the training about special-status plants and their habitats within the Don Pedro Project. It would be beneficial for this training to focus on the Red Hills ACEC and its special-status species because of their high abundance in that area. Increasing the frequency of employee training to an annual occurrence would provide greater protection of plant communities. BLM 4(e) condition 2 for both projects specifies that, as part of its employee training, the Districts provide employees with a confidential map of special-status plant populations and invasive plant locations, including GPS coordinates, and pictures and other guides to assist staff in recognizing special-status species, emphasizing the Districts' policies, management practices, and prevention guidelines. This would help project staff monitor existing populations of special-status plants or potentially identify unknown occurrences of special-status plants at the Don Pedro Project.

In addition, we agree with the resource agencies that the conservation of special-status plants in both projects would be provided by Districts' implementation of buffers around special-status plant occurrences, marked them with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities, including noxious weed treatments, and removing the flagging or fencing when the work is complete. The resource agencies did not provide a specific buffer distance in their recommendation. Consistent with the Districts' proposed buffer for herbicide use around threatened and endangered plants, implementing a 50-foot protective buffer around special-status plants would protect sensitive plants from ground-disturbing activities at both projects.

The Districts could avoid potential adverse effects on Mariposa clarkia resulting from woody debris removal from Don Pedro Reservoir if they follow the recommendations of FWS and California DFW to employ a different rapid wood removal and off-site storage strategy rather than stockpiling and burning the woody debris. The inclusion of buffers around special-status plants, as suggested above, would protect this population and avoid duplicative protective measures. We provide further discussion of the Districts' Woody Debris Management Plan under the potential project effects on California red-legged frog (see section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*).

Don Pedro Reservoir operations have the potential to affect seven special-status plant occurrences of five species (Red Hills onion, tripod buckwheat, Congdon's lomatium, shaggy-haired lupine, and Red Hills ragwort) located below the high-water mark of the reservoir. These seven special-status plant occurrences could be adversely affected by changes in duration or timing of inundation due to water level fluctuations. Several additional occurrences of other special-status plants are located on the reservoir shoreline near the maximum inundation line, including populations of Mariposa clarkia, Mariposa cryptantha, and shaggy-haired lupine. However, the Districts state they do not propose any substantial changes to increase reservoir water levels under a new license issuance, so there would be no adverse effects. The Districts' proposal to monitor known occurrences of special-status plants every five years would provide for the tracking of any future adverse effects of inundation on special-status plants near the reservoir shoreline.

The Districts located six occurrences of special-status plants in areas likely affected by recreational activities near developed recreational areas (two Red Hills onion, two Mariposa clarkia, and two Mariposa cryptantha). Other occurrences of these three species, in addition to populations of shaggyhair lupine, Red Hills soaproot, Congdon's lomatium, and Red Hills ragwort, were documented in proximity to other project operation and maintenance activities or recreational areas, although only the potential for effects from non-recreational activities were noted. In their comments on the Don Pedro TRMP, FWS and BLM described several special-status plant occurrences that they suggest the Districts add to the description of special-status plant occurrences with the potential to be affected based on their known proximity to project roads, day-use areas,

footpaths, and equestrian trails. Potential threats presented by recreational activities include trampling or soil disturbance, and the associated spread of noxious weeds. We agree that recreation is a valid threat to special-status plants at the Don Pedro Project, and the analysis suggests that public outreach or education could serve to further protect their habitat, specifically within the Red Hills ACEC. If the Districts consult with BLM and provide interpretive information about the unique plant communities of the Red Hills ACEC, such as posting signs telling recreationists to "Stay on the Trail to Conserve Rare Plants and Their Habitat," the Districts could reduce the potential for recreation to affect these species.

Vegetation Management

Under any licenses issued for the projects, the Districts would disturb vegetation resources through excavation, grading, topsoil stripping, or vegetation management during project operations and maintenance, and road maintenance (e.g., grading). Vegetation would also be affected during improvements to recreational resources (e.g., trail maintenance) and treatment of noxious weeds.

The Districts maintain facilities and associated roads, including three developed recreational areas at Don Pedro Reservoir, with a combination of mowing and periodically using pre-emergent herbicides, applied by licensed applicators, to manage vegetation growth. The Districts typically manage these areas, in proportion to their use, to minimize the spread of unwanted vegetation (e.g., noxious weeds) and the risk of fire. High-use sections of each recreational area are mowed, and shrubs and trees are frequently trimmed around structures and buildings to remove ladder fuels that could increase fire risk and to eliminate low branches that could injure passing humans. The Districts use herbicides to maintain bare ground around project powerhouses and switchyards and on Don Pedro Dam. They also annually apply herbicides to parking areas, campsite pads, roadsides, paths along irrigation canals, firebreaks, and the immediate area around restrooms and other recreational facilities.

In the Don Pedro TRMP, the Districts propose BMPs to minimize noxious weeds and ground disturbance during routine operations and maintenance activities. For ground disturbances larger than 0.25 acre in size, the Districts would conduct revegetation in accordance with BLM guidelines.

As detailed in section 3.3.1, *Geologic and Soil Resources,* BLM 4(e) condition 3 for both projects specifies that the Districts develop a soil erosion and sediment control plan for erosion and/or restoration actions on or affecting BLM lands that are within or adjacent to the project. The Water Board provides support with its preliminary 401 condition 9, which specifies that the Districts develop and implement a plan to minimize undesirable erosion or reduce sediment for ground-disturbing activities that include, but are not limited to, routine operation, maintenance, any new construction, and recreation improvement. Such a plan would specify the techniques that would be used to stabilize sites once ground-disturbing activities are completed, in order to support subsequent

reclamation or vegetation restoration. According to BLM, an effective soil erosion and sediment control plan would include: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities. Also, BLM Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 specify that the Districts consult with BLM regarding any additional ground-disturbing activities not specifically addressed in this license application. The Districts responded that they would work with BLM to identify any necessary site-specific BMPs for ground-disturbing activities on BLM land within both projects.

Our Analysis

The Districts' proposed Don Pedro TRMP does not provide a comprehensive list of BMPs that would be implemented to avoid adverse effects on plant communities and wildlife habitat from ground-disturbing activities. BLM's 4(e) condition to develop a soil erosion and sediment control plan, in consultation with the other resource agencies, would serve to limit potential effects on plant communities. The analysis of the recommended soil erosion and sediment control plan is provided above in section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*. Such a plan would provide overarching guidance for project construction and routine maintenance activities that require ground disturbance, ensuring that affected lands would be revegetated, noxious weeds would be prevented from establishing, and erosion does not adversely affect adjacent plant communities. Expanding the plan to apply to all project-related activities that entail ground-disturbing activities on all lands within the project boundary, rather than limiting the measure to BLM lands or areas greater than the Districts' proposed 0.25-acre minimum size, would provide additional protection during the Districts' vegetation management activities.

Special-status Bats

Bats are sensitive to human activity and can be adversely affected by disturbances to roost sites and foraging habitat. The Districts' study of bats in 2012 demonstrated that project facilities provide suitable habitat for several species of special-status bats, by evidence of bat night roosting at campground buildings and other project facilities. Because these areas are mostly used during the daytime, disturbance would not generally affect bats using these facilities as night roosts. As such, recreational activities are unlikely to result in abandonment of roosts by bats, although human use of these facilities at night may occasionally disturb bats. The Districts concluded that project operation and maintenance is not likely to affect special-status bats because the areas where bats were observed, such as the Fixed Wheel Gate building or access tunnel adjacent to the Don

Pedro Powerhouse, are used very infrequently. Furthermore, the Districts did not identify any maternity colonies or winter hibernacula during surveys of facilities or recreational sites.

The Districts' proposed Don Pedro TRMP includes guidelines for managing bats at the Don Pedro Project facilities, which includes the use of humane exclusion devices in coordination with California DFW, and BLM (if the facility is located on BLM-administered land). The Districts would install exclusion devices at project facilities that have a routine staff presence (i.e., at least daily or weekly) and with documented bat use, or signs of roosting. Where feasible, in the calendar year following discovery of bat presence, the Districts would install humane exclusion devices during periods when bats are absent from the facility to prevent further occupation of the structure. Thus, installation of exclusion devices would occur between November 1 and February 28. Prior to their installation, the Districts would perform an inspection of the facility to ensure that overwintering bats would not be trapped. FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 support these protective measures for special-status bats and recommend that roosting special-status bats be protected from project effects in a revised Don Pedro TRMP and a new La Grange TRMP. In its recommendation, FWS provided guidance for the placement of exclusion devices, recommending that they not be placed over bat roosts located on the exterior of project facilities or on project facilities where human presence is infrequent or non-existent. FWS also recommends foam sealant not be utilized as an exclusion device. They also support the Districts' proposal to conduct additional inspections of facilities prior to installation of exclusion devices to ensure that overwintering bats would not be trapped. If overwintering bats are present during the inspection, installation of humane exclusion measures would be delayed, and the Districts would consult with California DFW and BLM to identify future dates that would be suitable for installation of humane exclusion devices. The Districts' Don Pedro TRMP specifies that bats would not be excluded from day or night roosts discovered on the exterior of project facilities, night roosts at recreational area restrooms, and other project facilities where staff presence is infrequent or non-existent (e.g., the Fixed Wheel Gate building or access tunnel). The Districts would inspect the installed devices after six months to confirm their effectiveness (i.e., no evidence of bat presence) and annually inspect them thereafter for the duration of a new license. They would reevaluate facilities with exclusion devices for roosting bats every two years after the devices are installed to ensure that no new bat roosts or entry points have been established. FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 also supports this inspection schedule for maintaining bat exclusion devices in properly functioning condition and repairing or replacing them when necessary.

In their 2012 survey, the Districts identified two facilities that are likely used as bat day roosts: the Fixed Wheel Gate building and the tunnel adjacent to Don Pedro Powerhouse. Thirty-two night roosts were also identified, mostly at campground restrooms and other recreational facility buildings, which are likely subject to indirect

disturbance related to recreational use. The Districts state that, despite human activity in and around these facilities, disturbance to night roosts would be limited and would thus not likely result in abandonment by bats. At a small cinderblock structure near the A2 restroom in the Blue Oaks campground, a single instance of a pallid bats night roost showed evidence of human activity with potentially adverse effects. To prevent visitor activities from disrupting evening bat use of this building, the Districts propose in their RRMP to take measures to exclude humans from the building while still accommodating pallid bat use (e.g., partially boarding the doorway).

FWS expressed concern that the Districts' proposed Don Pedro TRMP does not provide for the protection of special-status bats within the project, especially concerning human disturbance from recreationists. FWS Don Pedro 10(j) recommendation 11 and La Grange 10(j) recommendation 10 recommend the Districts revise the Don Pedro TRMP and develop a La Grange TRMP within six months of license issuance to include protective measures for any maternity colonies, developed in collaboration with the resource agencies. These recommended measures include prohibiting pesticide usage within 500 feet of a bat maternity colony. FWS also recommends annual surveys that would entail: (1) performing one day of surveys, annually,[206] for bats and/or signs of bats roosting at project facilities, consisting of a daytime visual assessment and a nighttime emergence survey at all project buildings (e.g., powerhouses, storage buildings and valve houses), recreational facilities, dams, or other structures; (2) providing the resource agencies with a brief report[207] summarizing the results of the surveys within 30 days of completion of surveys, including a list of project facilities in which exclusion devices are proposed[208]; and (3) reevaluating project facilities for roosting bats every two years after the initial exclusion devices are installed to ensure that no new roosts or entry points have been established. FWS would prefer acoustic and visual surveys over methodologies that involve physically handling bats. FWS also recommends that the Districts maintain a map that identifies the locations of all installed bat exclusion devices and screen.

In its comments on both the Don Pedro and La Grange Projects, FWS states that the Districts did not provide any information about whether maternity roosts or winter

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[206] FWS recommends the surveys occur during the peak of the bat maternity season, which is July 1 through August 31.

[207] The report would include a table listing the project facilities surveyed and identifying the facilities at which bats and/or signs of bat roosting were found, a map showing the locations of the facilities, photographs of the facilities showing the bats and/or signs of bat roosting, and the bat exclusion materials (i.e., screens) proposed for each facility. The resource agencies would have 30 days to review the report and provide comments.

[208] FWS states that a goal of the plan, where feasible, is to install bat exclusion devices in the same calendar year that bat surveys occur.

hibernacula are present. It argues that this information is necessary to evaluate potential effects on special-status bats within the projects, because bats using winter hibernacula and maternity colonies are the most susceptible to adverse effects from disturbance. The Districts replied that measures to protect bat hibernacula and maternity roosts in the Don Pedro Project are unnecessary due to uncertainty about their existence, that the approved study plan did not require a complete survey of non-project facilities, and that no hibernacula or maternity roosts were identified at project facilities. The Districts did not comment on the resource agencies' recommendations for additional bat surveys.

The Districts did not perform any pre-licensing surveys for bats within the La Grange Project and did not discuss any environmental measures in their license application. FWS's recommended protective measures for bats within the La Grange Project are the same recommendations detailed above for the Don Pedro Project. FWS recommends the Districts incorporate these measures into a new La Grange TRMP.

California DFW recommends (10(j) recommendation M9-3.2) the Districts revise the Don Pedro TRMP to include a bat monitoring and management plan, developed in consultation with the resource agencies, within six months of license issuance. The items detailed in this plan would consist of: (1) survey protocols for bat monitoring; (2) protocols for monitoring white-nose syndrome (WNS); (3) BMPs to avoid or minimize project effects on bats; (4) protection guidelines and requirements to ensure that projects' operation and maintenance or construction activities minimize effects on bats and their roosting areas; (5) BMPs at project facilities to avoid and minimize impacts; and (6) public education actions about bats at the project. The Districts replied that that there is no reason to suspect that project operation and maintenance has any bearing on the occurrence of WNS. They did not reply to the FWS and California DFW recommendations for additional surveys. Regarding the need for additional protective measures, the Districts replied that while project effects on bats are limited, they would update the bat management plan to include information and educational materials on detection of WNS during annual employee and contractor training, and procedures to document and report evidence of bats affected by WNS to California DFW (e.g., via an on-line form[209]). We assume that the Districts intended to say "Terrestrial Resources Management Plan" because no bat management plan was included with the Districts' license application for either the Don Pedro or La Grange Projects.

At the 10(j) meeting held on September 19, 2019, FWS presented new information that the fungus that causes the WNS was recently detected in Spring 2019 samples collected from bats in Plumas County, California. FWS and California DFW are concerned about the potential spread of WNS and recommend incorporating protective

[209] Currently, an online reporting tool is available at https://wildlife.ca.gov/Conservation/Laboratories/Wildlife-Investigations/Monitoring/WNS/Report

measures into the new license for the projects. These measures include reporting any sick or dead bat found in the project areas to California DFW and FWS as soon as possible. Symptoms of a sick bat include: trouble flying, flying during the daytime or during cold winter weather, dying or sick bats (on the ground, unable to fly), or bats that have a white fungus on their face or wings. FWS also recommends following accepted decontamination protocols when entering areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).

Our Analysis

Bat signs were detected at several project buildings at Don Pedro recreational areas, as well as other project facilities. The Districts' proposed Don Pedro TRMP does not propose measures to exclude bats from using all facilities where project activities could disturb them. Potential effects from the project include not only maintenance at project facilities, but also human disturbance from recreationists. Installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting would ensure that project recreational uses do not adversely affect special-status bats.

To account for potential adverse effects on special-status bats, a stand-alone Bat Monitoring and Management Plan would not be necessary. Rather additional protective measures could be incorporated into a revision of the Don Pedro TRMP and a new La Grange TRMP. This could include additional consultation with the resource agencies to more accurately determine which project facilities are likely affected by human disturbance, which would guide the Districts' installation of exclusion devices.

The Districts last conducted a bat survey over five years ago, in 2012. Because bat habitat use could change for reasons such as drought or wildfire, a reevaluation of bat use at Don Pedro Project facilities, where the potential exists for conflict with humans, would provide for more accurate decisions about the proposed protective measures (i.e., exclusion devices). Performing this survey during peak bat maternity season (July 1 through August 31) would help to inform if and where any maternity roosts exist within the project boundary. In addition, surveys for bats surrounding the La Grange Project facilities were not performed. A comprehensive survey of the La Grange Project, focused on all areas of the project with any potential for project effects on bats, would indicate whether bat exclusion measures are also needed at La Grange Project facilities. If necessary, special-status bats at the La Grange Project could be protected with the installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting. Incorporating provisions in TRMPs for both projects for excluding bats from facilities where they would be affected by project activities, would afford special-status bats with adequate protections. Additionally, because bat roosting behavior and human activity at project facilities could change, periodic surveys would be necessary to ensure that project operations do not affect bats over the duration of any license. If the Districts resurvey all project facilities that have the potential for bat use every five years, rather than only resurveying those facilities where bat exclusion devices

have been installed, bats would be afforded further protection. This could also be incorporated into a revised Don Pedro TRMP and a new La Grange TRMP.

WNS is caused by a fungus that infects bats while they hibernate for the winter. It covers their nose, wings and ears with a white fuzz that invades the bat's skin and causes them to wake from hibernation and burn essential fat reserves that often leads to starvation. The potential occurrence of WNS and its deadly impacts on bats is a real concern given its steady westward spread across North America since being detected on bats in New York in 2006. The disease reached southwest Washington in 2016 and was documented in California in 2019 (White-nose Syndrome Response Team, 2018; 2019). Despite its impending threat, there is not a project nexus for the occurrence of WNS because project staff and recreationists do not regularly interact with bats at the projects. The exclusionary measures proposed for project facilities in the Don Pedro TRMP, combined with additional surveys to better understand bat usage around project facilities, would serve to avoid any potential for humans to spread the WNS fungus. A periodic evaluation of bat usage at project facilities, in combination with bat monitoring by California DFW and FWS, would provide adequate information for the Districts to evaluate whether WNS is adversely affecting special-status bats that roost within either the Don Pedro or La Grange Project boundaries. Furthermore, to prevent project activities from spreading WNS, following FWS-recommended protective measures such as installing bat exclusion devices would help identify if WNS is present in bats and would reduce the potential spread of WNS. Protective measures include reporting any sick or dead bat found in the project areas to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering areas with potential bat occurrence.

Disturbance to bat roosts due to human activity at project facilities can be especially harmful to bats during sensitive life-history periods, especially the maternity season and winter hibernating. Both types of roosts are typically used by successive generations of bats over many years. Disturbance to maternity colonies can cause bats to abandon young, and effects on maternity colonies can decrease fecundity of individuals and populations as well as subsequent generations of bats. If disturbed during hibernation, bats may awake prematurely, which can cause an elevation in body temperatures and promote the use of stored energy reserves, leaving insufficient energy to survive the rest of the winter. The presence of maternity roosts or winter hibernacula within the Don Pedro and La Grange Projects is uncertain because that was not a focus of the Commission-approved study plan. Another survey of all Don Pedro and La Grange Project facilities during the maternity season, and resurveys of potential roosting areas, would provide data to help determine if the projects supports any maternal roosts or hibernacula.

Lastly, because the Districts did not name the specific facilities where vegetation is controlled with pesticides, it is possible that some structures used by bats (e.g., campground pads and housing areas near Don Pedro Dam) could have pesticides applied in their vicinity. Although the Districts did not locate any maternity roosts, sexually

mature pallid bats were captured, which suggests that some of the identified bat day roosts could potentially be used as maternity roosts. Likewise, although no winter hibernacula were identified, bats were detected in winter months, indicating that winter hibernacula are likely present within the project boundaries. Accordingly, prohibiting the use of pesticides[210] within 500 feet of any documented maternity roosts would limit negative effects on prey populations and reduce bat's potential intake of exposed insects and the adverse effects of accumulating pesticides that have genotoxic effects on bats (FWS, 1981; Schmidt et al., 2001; O'Shea and Clark, 2002). However, restricting pesticide use could potentially prevent the Districts from applying pesticides to dam faces and groins, including spillway areas, where they are essential to control pests (e.g., ground squirrels and invasive weeds and vegetation). Controlling vegetation around project facilities would also be necessary for the Districts to perform visual inspections and to minimize the risk of wildfire. Although it could be beneficial to stipulate that pesticides be avoided in proximity to bat maternity roosts, we expect that the Districts will responsibly follow California pesticide regulations to avoid contamination of the environment, as set forth in California Code of Regulations, Title 3, Division 6, Chapter 3. If special-status bat roosts or foraging occur in proximity to areas where the Districts plan to use pesticides, mitigation to consider would include: (1) alternative pesticides; (2) reduced application rates; (3) protection buffers around bat roosts within which no pesticides are applied; (4) alternative forms of pesticides, such as the pelletized forms; or (5) alternative methods of herbicide application, such as spot spraying.

Bald Eagles

Don Pedro Reservoir supports multiple nesting bald eagles, and three active nests were observed during the Districts' 2012 nesting survey. Activities that could potentially disturb bald eagle foraging and nesting include project operation and maintenance, such as woody debris management, and recreational uses that include camping, hiking, motorized and non-motorized boating, and off-highway vehicle use. Bald eagles that roost during winter on Don Pedro Reservoir could also potentially be affected by these disturbing activities. Where human activity agitates or bothers roosting or foraging bald eagles to the degree that causes injury or substantially interferes with their breeding, feeding, or sheltering behavior and causes, or is likely to cause, a loss of productivity or

[210] Pesticide refers to many kinds of chemicals intended to control, destroy, repel, or attract pests, including insecticides, herbicides, and rodenticides. The Districts use herbicides annually for vegetation management and rodenticides occasionally for ground squirrel management. The resource agency recommendations frequently reference "pesticides," which we interpret as meaning both herbicides and rodenticides. For the purposes of this EIS, the use of the term "pesticide" includes both herbicides and/or rodenticides.

nest abandonment, the conduct of the activity constitutes a violation of the Bald and Golden Eagle Protection Act's prohibition against disturbing eagles (FWS, 2007a).

The Districts did not conduct surveys for bald eagles within the La Grange Project area. However, because of the abundance of fish, the La Grange Reservoir likely supports bald eagles, at least occasionally. Human recreation, primarily fishing, would potentially affect bald eagle foraging in the La Grange Reservoir and further downstream on the lower Tuolumne River.

The Districts' Don Pedro TRMP includes a section on bald eagle management, which includes the following measures to protect bald eagles: (1) conducting periodic surveys, beginning the first full calendar year after license issuance, repeated in year 2 and year 4, and then once every five years starting on year 10; (2) protecting existing nests; and (3) restricting human access to prevent disturbance during bald eagle mating and rearing. Upon completion of the first nest survey (in March of the first full calendar year following license issuance) and for all active nests identified after the initial nest survey, the Districts would establish a 660-foot (0.125-mile) protective buffer around all occupied bald eagle nests. Buoys and signs would be used to delineate the buffer. The plan also includes ongoing consultation with the FWS regarding any planned rodenticide use, and awareness training for employees for avoidance around active nesting areas. Beginning January 1 through August 31 of each year thereafter, the Districts would institute a limited operating period around all known active bald eagle nests for operation and maintenance and recreational activities (e.g., boating, camping, and hiking) within the 0.125-mile buffer. The Districts could remove, adjust, or establish new nest buffers if subsequent nesting surveys demonstrate that a territory is no longer occupied or if new bald eagle nests are identified.

In its 10(j) comments, FWS claims that the Districts' proposed plan is inadequate to protect nesting bald eagles on Don Pedro Reservoir because the Districts only propose to conduct nest surveys for 10 years out of a potential 40-year license term. It is unclear if this is the intent of the Districts' proposed schedule for bald eagle surveys, but during years when surveys are not performed, it would not be possible to impose protective buffers around active nests. Thus, FWS contends annual surveys are necessary to identify bald eagle nest locations.

BLM Don Pedro revised 4(e) condition 8 and La Grange preliminary 4(e) condition 9 specify, and FWS Don Pedro 10(j) recommendation 10, La Grange 10(j) recommendation 9, and California DFW 10(j) recommendation M9-1 recommend, that the Districts develop a stand-alone bald eagle management plan that is consistent with bald eagle management on other reservoirs. FWS provided a draft plan for the Districts to use, as an attachment to its 10(j) comments. FWS recommends and BLM stipulates that the plan include: (1) annually conducting bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 1 mile of the shorelines of Don Pedro Reservoir and La Grange Reservoir; (2) conducting surveys in accordance with the Bald Eagle Breeding Survey Instructions (California DFW, 2010) and the Protocol for

Evaluating Bald Eagle Habitat and Populations in California (Jackman and Jenkins, 2004); (3) if any new nests or communal night roosts are located, coordinating with BLM, FWS, and California DFW to establish a protective buffer around each nest or night roost; (4) conducting annual employee awareness training; and (5) holding an annual consultation meeting and completing annual reporting. FWS also recommends conducting bald eagle nesting surveys also be conducted within suitable habitat on all lands within 1 mile of La Grange Reservoir shoreline for the first three years of a new license and continuing annually if any nesting activity is observed, or once every three years if no nesting activity is observed.

FWS, in its 10(j) comments and attached stand-alone bald eagle management plan, filed January 29, 2018, recommends that the buffer around bald eagle nests be changed to 0.25 mile because of a recently documented nest failure and because a 0.25-mile buffer has been adopted at other projects. California DFW 10(j) recommendation M9-1 recommends establishing a 0.25-mile buffer around both nests and communal night roosts. FWS states that if it has been established that a bald eagle nest is successful with the 0.125-mile-radius buffer, the Districts should consult with BLM (on BLM-administered lands) and FWS to establish a site-specific buffer reduction. California DFW 10(j) recommendation 9-4.1 additionally recommends that water barriers (e.g., buoys, signage) and land barriers (e.g., fencing signage) be installed around occupied bald eagle nests to delineate the buffers restricting recreational activities near nests, if determined appropriate by BLM, FWS, and California DFW.

The Districts replied that although they disagree with many of the above components of the recommended plan, they are not opposed to preparing a stand-alone bald eagle management plan for the Don Pedro Project and a bald eagle management plan for the La Grange Project. No studies of bald eagle were requested or required for the La Grange Project, and the Districts contend that there is no evidence of bald eagle use of the project. The Districts replied that they would draft a stand-alone plan that is "suitable to the scale of the La Grange Project." The Districts contend that their proposed 0.125-mile protective buffer around active nests is sufficient and is compatible with successful bald eagle foraging and nesting. They cite, for example, that the Mine Island nest is in an area that experiences frequent and heavy recreational boat traffic during the spring and summer seasons. Similarly, the nest in the Woods Creek Arm is in an area that not only receives regular use by boaters but is located in a narrow portion of the canyon that exposes the nest to all passing boats. The Districts disagree with FWS's buffer assessment, stating that the bulk of the potential disturbance to bald eagle is from motorized watercraft on Don Pedro Reservoir. The Districts cite FWS's National Bald Eagle Management Guidelines as only recommending a 330-foot (0.0625-mile) buffer during breeding to protect against disturbance by motorized watercraft.

California DFW 10(j) recommendation M9-1 recommends that the golden eagle be added to the FWS-recommended bald eagle management plan to provide similar protections for golden eagles. The Districts replied that California DFW does not provide any supporting information or evidence of the need for including golden eagles in the

plan. They acknowledge that golden eagles may infrequently occur at the Don Pedro Project and would record any future opportunistic sightings of golden eagles.

Our Analysis

Bald eagle nest surveys in 2012 and 2013 on Don Pedro Reservoir identified nine bald eagle nests, three of which were occupied by nesting bald eagle pairs. Activities associated with project operation, maintenance, construction or recreation may adversely affect or disturb, resulting in take of bald eagles. The National Bald Eagle Management Guidelines (FWS, 2007a) report that recreational activities similar to those on Don Pedro Reservoir and La Grange Reservoir (e.g., boating, jet skis, hiking, camping, fishing, kayaking, and canoeing) have the potential to disturb nesting bald eagles. Also, routine maintenance, including vegetation management, and hazard tree removal activities have the potential to disturb bald eagles.

Recreational uses at the Don Pedro Project, such as motorized and non-motorized boating, highway vehicle use, and hiking, would potentially disturb bald eagles, especially nesting adults. Project operation and maintenance activities would be unlikely to adversely affect nesting bald eagles since no facilities or maintenance activities are located within 1.5 miles of a bald eagle nest. Under the Districts' proposed Woody Debris Management Plan, no staging or burning of woody debris in Don Pedro Reservoir would occur within 0.5 mile of an active bald eagle nest.

Adult eagles that are disturbed during the nesting season can become agitated to the extent that they abandon their nest before successfully raising chicks. It is uncertain if human disturbance at Don Pedro Reservoir has been responsible for any bald eagle nest failure, although the resource agencies suggested that it is likely the reason why a documented nest failed in 2012. Therefore, we agree that it would be prudent to increase the protective buffer around active bald eagle nests from 0.125 mile, as proposed, to 0.25 mile, and provide signs to inform recreationists of the temporary closure(s). This protective buffer distance has been adopted by the Commission for several other projects. If it has been established that a bald eagle nest has been successful with only a 0.125-mile buffer, then the Districts could consult with BLM (on BLM administered land), California DFW, and FWS to establish a site-specific buffer reduction.

To determine if and where protection buffers are needed around bald eagle nests, regularly scheduled annual surveys are necessary. FWS expressed concern that the infrequent schedule of proposed bald eagle nest surveys, every five years after the fifth year of license issuance, would result in no protections for nesting bald eagles during 75 percent of years of any potential license. The inclusion of annual nesting surveys in a revised, stand-alone bald eagle management plan would allow the Districts to protect active nests every year.

Golden eagles rarely occur at the Don Pedro or La Grange Projects, and no nests have been reported. However, including a provision for recording incidental sightings and consultation with California DFW and FWS to determine whether further protection

measures are warranted in the TRMPs for both projects would serve to protect golden eagle. This is discussed further in the next section, as it also pertains to several other special-status birds that may utilize both projects.

BLM and Central Sierra Audubon have conducted wintering counts for bald eagles near Don Pedro Reservoir during mid-January from 1994–2012. The number of bald eagles on Don Pedro Reservoir has varied from 5 to 34 per survey, with an average of 20 bald eagles per year (BLM, 2018). Project recreation and woody debris management on Don Pedro Reservoir could also affect wintering bald eagles on daytime hunting perches, while foraging in the reservoir, or at communal night roosts. The Districts could minimize potential adverse effects on wintering bald eagles by conducting annual winter population and night roost surveys as recommended by FWS in its revisions to the bald eagle management plan for the Don Pedro Project. They suggest the Districts annually monitor the size and distribution of wintering bald eagle populations along established survey routes around Don Pedro Reservoir. Wintering surveys are typically conducted during the 2-week, nationwide mid-winter bald eagle survey, typically scheduled during the first part of January every year (Jackman and Jenkins, 2004). FWS's recommended plan provides for protecting wintering bald eagles by restricting activities from November 15 through March 15 within 0.25-mile of the Don Pedro Reservoir, and within 0.25 mile of the Don Pedro Dam. The National Bald Eagle Management Guidelines' (FWS, 2007a) recommendations for avoiding disturbance at foraging areas and communal roosts, such as wintering areas, include the avoidance of "important foraging areas," avoiding aircraft use within 1,000 feet vertical or horizontal distance from communal roost sites, and limiting explosives within 0.5 mile of communal roosts. Communal night roosting is one of the most important phenomena of wintering eagles. We are unable to evaluate the Districts' conformance with these guidelines without knowing the locations of bald eagle communal night roosts or important foraging areas of wintering eagles.

Human recreation on Don Pedro Reservoir has been ongoing since the project was constructed but has increased and is expected to continue to increase. Two of the three occupied bald eagle nests observed during pre-licensing surveys were in areas of high recreational use. Given the relatively high level of motorized recreation on Don Pedro Reservoir, we agree with the resources agencies that bald eagles would be better protected by the development of a stand-alone bald eagle and special-status bird management plan for both the Don Pedro and La Grange Projects, with any revisions developed in consultation with the resource agencies.

Burrowing Owls

Project operation and maintenance of the Don Pedro Project includes periodic gopher control (e.g., California ground squirrel and valley pocket gopher) in developed recreational areas. Beginning in 2016, the Districts ceased to control rodents with burrow blasting and pelleted rodent poison, and now use a Gopher X smoke and carbon monoxide system that poses less risk to other wildlife and leaves burrows intact

following treatment. The Districts propose to continue using this system during any new license term for the Don Pedro Project. The La Grange Project license application makes no mention of any gopher control activities, so we assume it does not occur. If the need to use rodenticides within the Don Pedro Project boundary arises, the Districts state that prior to application, they would consult with the California DFW, FWS, and BLM on the type and location of use.

The burrowing owl and Blainville's horned lizard are two special-status species that potentially occupy small mammal burrows within the Don Pedro Project. The burrowing owl depends on rodent burrows for nesting. The western subspecies of burrowing owl appears to have been overlooked during project scoping but was addressed by the resource agencies' recommendations and mandatory conditions. In absence of surveys, FWS and California DFW assume the species may be present.

FWS Don Pedro 10(j) recommendation 11 and FWS 10(j) La Grange recommendation 10 suggest that the Districts revise the Don Pedro TRMP and develop a La Grange TRMP within six months of license issuance to include protective measures that would apply to burrowing owls within the project boundaries.[211] Specifically, FWS recommends:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for western burrowing owl.
2. Provisions to minimize impacts from roads on western burrowing owl, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.
3. Provisions to minimize impacts from transmission lines on the western burrowing owl, developed in collaboration with the resource agencies. This would include measures to discourage raptor use of transmission lines as perches within suitable habitat for burrowing owls.
4. Measures to avoid impacts to western burrowing owls from vegetation management and ground squirrel control. Vegetation management and burrow fumigation activities should avoid all occupied western burrowing owl dens in all months of the year. Protective buffers for occupied dens should be developed in collaboration with the resource agencies.

[211] FWS 10(j) recommendations 11 for the Don Pedro Project and 10 for the La Grange Project are also intended to address potential effects on San Joaquin kit fox, California red-legged frog, and California tiger salamander. We discuss effects on these species in section 3.3.4, *Threatened and Endangered Species.*

5. Development of species monitoring, in collaboration with the resource agencies, for western burrowing owl with surveys to be conducted every three years or as determined by the resource agencies.
6. Include actions in the plans, as appropriate for the project(s), provided in the Guidance for Burrowing Owl Conservation (California DFW, 2008).

The Districts replied that because they have documented no evidence of these species at the Don Pedro Project, there is no basis for developing a management plan with monitoring and protection measures for them. They argue that their relicensing studies, environmental analyses, and draft Biological Assessment (BA) for terrestrial species found that the projects are unlikely to adversely affect burrowing owl and contend that FWS presents no data or studies to refute this conclusion. The Districts believe that their Don Pedro TRMP, as currently drafted, provides adequate protection for all terrestrial species.

Our Analysis

The potential effects of project operation and maintenance on special-status burrowing wildlife such as the burrowing owl include the Districts' use of pesticides and rodent control activities. We discuss the use of pesticides (i.e., herbicides) below, under section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Special-status Bats* and *Special-status Amphibians and Reptiles.*

The Districts' use of a Gopher X extermination machine for rodent control in proximity to the three Don Pedro Project developed recreational areas could adversely affect burrowing owl if they were to occur within the project boundary. The Gopher X machine works by heating a mixture of castor oil and mineral oil to create a smoke and force it into rodent burrows. Although it is a preferable alternative to fumigation or rodenticide, the smoke and carbon monoxide would cause non-target burrowing wildlife to also die from asphyxiation. The Districts did not propose any protective measures for burrowing animals, including burrowing owls, in the Don Pedro or La Grange Projects because they concluded that there would be no project effects. While the potential effects are less than fumigation or rodenticides, the Districts' rodent control activities would present some risks to other non-target wildlife. Furthermore, while their method leaves rodent burrows intact following treatment, burrows would likely collapse without maintenance by ground squirrels and the important habitat they provide to other species would be lost. Including BMPs to protect burrowing owl in the Don Pedro TRMP would avoid this potential effect. Such measures would include specific descriptions of where ground squirrel activity is problematic and where the Districts' rodent control would potentially occur, conducting surveys in accordance with California DFW protocols prior to any rodent control, and instituting avoidance measures for any occupied or potentially occupied burrows.

Other Special-status Birds

Project operation and maintenance, and recreational activities could disturb several birds of prey that potentially nest and forage at the Don Pedro Project, including the American peregrine falcon, white-tailed kite, osprey, golden eagle, and Swainson's hawk. Of these, the Districts have only documented occurrences of osprey and golden eagle within the project areas, although the Swainson's hawk has been documented within 4 miles of the Don Pedro Project boundary. Osprey are generally less sensitive to human disturbance than bald eagles but would be susceptible to the same potential effects as described above for bald eagles.

California DFW recommends (10(j) recommendation M9-1.5) the Districts collect and maintain records of incidental observations of the above five special-status raptors, and other special-status species such as the least Bell's vireo. These observations would occur while conducting bald eagle surveys or while performing any project operation and maintenance activities. They request that Districts maintain a map of all special-status birds and their nests located while surveying or incidentally observed in the projects' vicinity. Furthermore, California DFW recommends that if any active nests of these species are observed, the Districts should protect the nest with a minimum 500-foot avoidance buffer until the breeding season has ended.

Our Analysis

It is difficult to develop species-specific avoidance and minimization measures due to the lack of known occurrences for several special-status birds that could potentially occur at the Don Pedro and La Grange Projects. For example, golden eagles and Swainson's hawks likely use lands within the project areas, but it is unknown if they ever occur in proximity to project operations and maintenance activities. We agree that special-status birds would benefit from the Districts' collection of incidental observations while performing other activities at both the Don Pedro and La Grange Projects. The bald eagle nesting surveys on Don Pedro Reservoir and La Grange Reservoir would provide an opportune time to also document other special-status avian species. We suggested previously in the *Bald Eagles* section that these surveys would be more informative of project effects if they were to occur on an annual basis, rather than the Districts' proposed schedule on Don Pedro Reservoir.[212] A more frequent survey interval would increase any potential incidental sightings of additional raptor species. Recording the locations of special-status bird observations would inform any future need for management actions to conserve special-status birds. Furthermore, implementing a protective buffer around active nests of these special-status birds would ensure the project would have "no effect" on them. The buffer distance would vary by species. For

[212] The Districts propose to conduct bald eagle nesting surveys in the first full calendar year after license issuance, in year 2 and year 4, and once every five years starting on year 10.

example, ospreys are generally less sensitive to disturbance than bald eagles, as demonstrated by documented nest success in areas of Don Pedro Reservoir that experience high levels of motorized boating. For other special-status birds, further consultation with FWS and California DFW would determine if protective buffers are needed around any discovered nests and what buffer distances are appropriate based on species sensitivity to disturbance.

Special-status Amphibians and Reptiles

Project operation and maintenance could affect one special-status amphibian, the foothill yellow-legged frog, and two special-status reptiles, the Blainville's horned lizard and western pond turtle. Effects on amphibians and reptiles could occur due to pesticide usage, rodent control activities, water level fluctuations of Don Pedro Reservoir, woody debris management, and the presence of American bullfrogs and predatory fish. The projects could affect two federally listed amphibians, the California red-legged frog and California tiger salamander, which are discussed below in section 3.3.4, *Threatened and Endangered Species.* Water level fluctuations in Don Pedro Reservoir associated with project operation could affect western pond turtle habitat by affecting water temperatures and the availability of both basking substrates and vegetated, shallow shoreline areas that are necessary for juvenile western pond turtles. Traffic associated with project operation and recreation may also affect the species.

The use of pesticides to control vegetation around project infrastructure and facilities has the potential to cause significant adverse effects on amphibians. The active and inert ingredients of pesticides are known to have deleterious effects on amphibians (Cox and Surgan, 2007). For example, glyphosate (the active ingredient in a common herbicide) has been found to be poisonous to frogs and other amphibians and is extremely toxic to the tadpoles. To reduce potential adverse effects on amphibians, the Forest Service's guideline from its current Forest Plan for the nearby Stanislaus National Forest is to avoid application of pesticides to areas within 500 feet of sites known to be occupied by sensitive amphibian species. BLM does not provide specific distance buffers, but its Don Pedro revised 4(e) condition 32 and La Grange preliminary 4(e) condition 23 specify that pesticides are not to be used in areas affecting BLM lands without the prior written approval of BLM. The Districts would need to submit to BLM an annual request for approval of planned uses of pesticides for the upcoming year, which would include specific herbicides proposed for use, the specific locations, application rates, and safety risk and time frames for application. Also, BLM requests that any pesticide use deemed necessary to use on BLM lands within 500 feet of known locations of western pond turtles, California red-legged frog, or known locations of BLM special-status plant populations, be designed to avoid adverse effects. FWS 10(j) recommendation 8 for both projects suggests that the Districts initiate formal ESA consultation with FWS for future planned use of pesticides within the projects. FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 recommend protective buffers for the use of pesticides, but do not state distances.

In their reply comments, the Districts state that they conducted a detailed assessment of habitat availability for federally listed amphibians, in accordance with the approved study plan for the Don Pedro Project, and that these studies found a very limited potential for project effects on these species. They argue that FWS provided no data or analyses to refute this conclusion.

In its REA comments, FWS notes that the projects' influence on water flow and temperature could affect western pond turtle habitat, behavior, reproduction, and survival. Water level fluctuations in Don Pedro Reservoir and its inlet creeks could affect western pond turtle habitat by changing the availability of both basking substrates and the vegetated, shallow-water areas that are necessary for juvenile western pond turtles. Changes in water temperatures in Don Pedro and La Grange Reservoirs may affect the species' life history, such as growth patterns, age at maturity, and size at maturity, which in turn could affect turtle survival and reproduction. FWS contends that the significant amount of time western pond turtles spend in upland environments (for nesting and overwintering) means that effects of roads and canals and extreme flow fluctuations during winter months, in both rivers and reservoirs, need to be evaluated. FWS notes that canals can act as barriers to upland movements and potentially result in mortality if turtles fall in and cannot climb out. Road mortality effects on sex ratios (reduction in adult females) have been documented for many other species of turtles (Gibbs and Steen, 2005).

BLM Don Pedro revised 4(e) condition 7 specifies the Districts record incidental observations of western pond turtle during other monitoring efforts to gain a better understanding of its distribution and population status within the project, and the Districts propose this recording in their Don Pedro TRMP. California DFW 10(j) recommendation M9-2 suggests the Districts' plan includes provisions for avoiding potential disturbance to western pond turtles unless approved by California DFW, BLM, and FWS. The Districts responded that their study of special-status amphibians and reptiles found no project effects on western pond turtle, and that the Don Pedro TRMP provides for appropriate management measures to monitor occurrences of western pond turtles during the new license term. They argue that their plan provides for employee training on western pond turtle identification and that incidental observations by staff and contractors would be recorded, assembled, and made available to BLM and California DFW, allowing their input about any necessary future protective measures.

Our Analysis

The Districts' proposed use of pesticides for noxious weed control or other vegetation management could adversely affect amphibians. Using caution during these activities, and only using the minimum manufacturer-recommended amounts of chemicals, would serve to protect special-status amphibians. As discussed in the analysis under *Noxious Weeds*, manual vegetation control methods would also avoid any potential adverse effects from pesticides use. Several of the 15 infestations of smooth distaff thistle, a California DFA B-listed species that the Districts propose to treat, occur near the

Don Pedro lakeshore. Because such infestations could occur near western pond turtle habitat, manual control methods would be beneficial. This recommendation and its benefits to amphibians is discussed further in section 3.3.4.2, *Threatened and Endangered Species*, *Environmental Effects*, *California Red-legged Frog.* Furthermore, adverse effects from pesticide use within 500 feet of known locations of western pond turtles could be avoided or minimized on BLM land if the Districts design noxious weed treatments to avoid individuals and their habitats, consistent with BLM riparian conservation objectives. Additionally, compliance with California pesticide regulations would require the Districts to avoid any pesticide application where there is a reasonable possibility of adverse effects on nontarget animals, which would apply to any pesticide use in proximity to suitable aquatic habitat for amphibians and reptiles.

We see no reason to expect that the project is adversely affecting the Blainville horned lizard. The resource agencies did not express concern about any potential effects on the species. Any protective measures to reduce the projects' effects from pesticides would benefit this species, as well as other reptiles and amphibians that occur in both projects.

The Districts' desktop habitat analysis and visual encounter surveys indicate limited suitable habitat for foothill yellow-legged frog in the project boundaries or surrounding streams. The nearest extant population occurs in Moccasin Creek, a tributary to Don Pedro Reservoir, located approximately 4 miles upstream near the confluence with Big Jackass Creek. This reach of Moccasin Creek is fragmented by Moccasin Reservoir 1 mile upstream of Don Pedro Reservoir, created by Moccasin Dam. Therefore, there is limited potential for this population to expand or colonize the Don Pedro project area. Operation and maintenance of the projects is unlikely to affect foothill yellow-legged frog because: (1) foothill yellow-legged frog are not present in Don Pedro Reservoir; (2) habitat suitability is poor within the major tributaries, and (3) the reservoir supports abundant introduced predatory fish and American bullfrog populations.

The Districts observed western pond turtles in Don Pedro Reservoir at Poor Man's Gulch, Sixbit Gulch, Hatch Creek Arm, Moccasin Creek, West Fork Big Creek, and Woods Creek Arm, including Slate Creek, suggesting that suitable habitat is common within backwater inlets or coves, associated with tributary streams. Also, the Districts observed adult western pond turtles in the Don Pedro Dam spillway channel and within the Don Pedro Dam emergency spillway, but their presence downstream in the La Grange Reservoir is unknown because no surveys have been done. Although western pond turtle nesting was not documented, the Districts reported abundant suitable nesting habitat around Don Pedro Reservoir with some habitat concentrated near where adult and/or juvenile turtles were observed. It appears that an unquantified amount of suitable nesting habitat identified by the Districts is below the normal maximum surface water elevation of the reservoir. Thus, fluctuating reservoir water levels could cause western pond turtle nests to fail if eggs become inundated or too saturated (Feldman, 1982), although western pond turtles select nest sites with some vegetation (Holte, 1998) and would likely avoid

areas subject to the most frequent inundation. Furthermore, because peak water surface elevation in the reservoir generally occurs in May or June, relatively little suitable nesting habitat is likely to be exposed during most of the May to July egg-laying season or during the 90- to 120-day incubation period. Therefore, reservoir water level fluctuations during the fall and winter could only affect small numbers of hatchlings that remain in their nests for approximately one year prior to emergence (Holte, 1998). Water level fluctuations in the reservoir could also affect the availability of western pond turtle basking substrates, and the extent of vegetated shallow water that is important for by juveniles. In most cases, we suspect that adult western pond turtles would adjust their use of habitat based on existing conditions, and project effects would be minimal. However, reduced recruitment of juveniles as a result of nest inundation and hatchling predation due to bullfrogs and predatory non-native fish could have population effects on western pond turtles.

In its comments on the La Grange Project, FWS noted that no surveys have been conducted for western pond turtles within the La Grange Project and recommended that the Districts collaborate with California DFW, FWS, and BLM to determine measures to support and conserve the species. The Districts' proposed flows below Don Pedro Dam in La Grange Reservoir would more closely resemble the natural hydrograph and would likely benefit western pond turtles below Don Pedro Dam. Changes in Don Pedro Dam operations would affect water temperature at the La Grange Project. Simulated Don Pedro outflow temperatures range between 7 and 18°C for the Districts' proposed operations and draft Voluntary Agreement (Districts, 2018a,b; 2019c), which is well within the temperature tolerance (1 to 40°C) for western pond turtle (University of Michigan, 2019) and varies little from existing temperatures of 10 to 17°C (see figure 3.3.2-4). Recording incidental observations of western pond turtles and an evaluation of habitat suitability for the species within the La Grange Project boundary would be necessary to conclude whether the species is present and if any protective measures are necessary. It is unclear how additional monitoring would isolate potential project effects from other sources of turtle mortality, or how the results of monitoring data would be used to modify project operations. Consulting with FWS and California DFW to develop protective measures for the western pond turtles would ensure that the La Grange Project does not adversely affect western pond turtles.

The woody debris that has accumulated as large rafts of floating wood in the upper reaches of Don Pedro Reservoir is very likely having adverse effects on native wildlife, especially special-status frogs and reptiles. The woody material can become a haven for non-native invasive American bullfrogs, which would adversely affect any potential occurrence of native frogs in the Don Pedro Reservoir. This issue is also discussed further in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects, California Red-legged Frog.*

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Aquatic Species

Central Valley spring-run Chinook salmon, California Central Valley steelhead, and North American green sturgeon are listed as threatened under the ESA and are under the jurisdiction of NMFS. NMFS also manages Chinook salmon EFH under the Magnuson-Stevens Fishery Conservation and Management Act.

La Grange Diversion Dam, located on the Tuolumne River about 52.2 river miles upstream of the Tuolumne River's confluence with the San Joaquin River, has no fish passage facilities. Upstream fish migration has been blocked at about RM 52.2 since the construction of the Wheaton Dam in 1871. In 1893, construction of the La Grange Diversion Dam replaced the Wheaton Dam and continued to provide a complete barrier to fish migration. Don Pedro Dam, about 2.6 river miles upstream of La Grange Diversion Dam is also a complete barrier to fish passage. Prior to the construction of dams in the basin, the Tuolumne River and its tributaries upstream of Don Pedro Reservoir are believed to have provided spawning and rearing habitat for spring-run Chinook salmon and steelhead (Lindley et al., 2006; Yoshiyama et al., 2001). In July 2014, NMFS published its Recovery Plan for Central Valley Chinook Salmon and Steelhead and identified the loss of most historic spawning habitat and degradation of the remaining habitat to be primary threats to the recovery of Central Valley spring-run Chinook salmon and steelhead (NMFS, 2014). NMFS is currently preparing a recovery plan for the Southern DPS of North American green sturgeon, but it cites the reduction of historic spawning area as the principal factor in decline of this species (NMFS, 2018b).

Central Valley Spring-run Chinook Salmon Evolutionary Significant Unit

NMFS listed the Central Valley ESU of spring-run Chinook salmon as threatened on September 16, 1999 (64 FR 50394). On June 14, 2004, following a five-year species-status review, NMFS proposed that the Central Valley spring-run Chinook salmon remain listed as threatened, based on the Biological Review Team's strong majority opinion that the Central Valley spring-run Chinook ESU is "likely to become endangered within the foreseeable future" because of the greatly reduced distribution of Central Valley spring-run Chinook salmon and hatchery influences on the natural population. This threatened status was reaffirmed on June 28, 2005, when the Feather River Fish Hatchery spring-run Chinook salmon population, a part of the Central Valley spring-run Chinook salmon ESU, was included in the listing (70 FR 37160).

Distribution and Abundance—Spring-run Chinook salmon once occupied all major river systems in California where there was access to cool-water reaches that would support over-summering adults. Historically, they were widely distributed in streams throughout the Central Valley. Prior to the construction of dams in the Sacramento and San Joaquin Basins, spring-run Chinook salmon migrated during spring

snowmelt flows to access coldwater holding and spawning habitat higher up in the basins. For many decades, Central Valley spring-run Chinook salmon were considered extirpated from the Southern Sierra Nevada diversity group in the San Joaquin River Basin, despite their historical numerical dominance in the Basin (Fisher, 1994). However, more recently, there have been reports of adult Chinook salmon returning in February through June to San Joaquin River tributaries, including the Tuolumne River (Franks, 2014). These spring-running adults have been observed in several years and exhibit typical spring-run life history characteristics, such as returning to tributaries during the springtime, over-summering in deep pools, and spawning in early fall (Franks, 2014). Additionally, the San Joaquin River Restoration Program operates the Interim Salmon Conservation and Research Facility, located below Friant Dam on the San Joaquin River. The San Joaquin River Restoration Program released juvenile Central Valley spring-run Chinook salmon smolts into the San Joaquin River annually during 2014–2016.

After maturing in the ocean, adult spring-run Chinook salmon return between the ages of 2 to 5 years and enter the Delta beginning in January, reaching their natal spawning streams from March to July (Myers et al., 1998). Adults require large, deep pools with moderate flows for holding over the summer prior to spawning in the fall. Water temperatures for adult spring-run Chinook salmon holding and spawning are reportedly best when less than 60.8°F (16°C), but lethal when greater than 80.6°F (27°C) (Hinze, 1959; Boles et al., 1988). There is evidence that spring-run Chinook salmon in the San Joaquin River were exposed to high temperatures during migration and holding under historical conditions (Clark, 1943; Yoshiyama et al., 2001). It is possible that Central Valley spring-run Chinook salmon are adapted to tolerate warmer temperatures than other Chinook salmon stocks, but there is no experimental evidence to confirm this hypothesis, although short-term exposure to temperatures as high as 77 to 80.6°F (25 to 27°C) is known to be tolerated by adult Chinook salmon (Piper et al., 1982; Boles et al., 1988).

Egg incubation for spring-run Chinook salmon extends from August to March (Fisher, 1994; Ward and McReynolds, 2001). Egg incubation generally lasts between 40 and 90 days at water temperatures of 42.8 to 53.6°F (6 to 12°C) (Heming, 1982). Pre-emergent fry remain in the gravel for two to three weeks after hatching while absorbing their yolk sacs. Emergence from the gravel occurs from November to March (Fisher, 1994; Ward and McReynolds, 2001).

Fry and juvenile rearing takes place in the natal streams, the main stem of the Sacramento River, inundated floodplains, and the Delta. The rearing and outmigration patterns exhibited by spring-run Chinook salmon are highly variable, with fish rearing anywhere from 3 to 15 months before outmigrating to the ocean (Fisher, 1994). Some may disperse downstream soon after emergence as fry in March and April, with others smolting after several months of rearing, and still others remaining to oversummer and emigrate as yearlings (FWS, 1996).

Critical Habitat Designation—Critical habitat was designated for the Central Valley spring-run Chinook salmon ESU on September 2, 2005 (70 FR 52488), and includes stream reaches of the Feather and Yuba Rivers, Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear Creeks, the Sacramento River, and portions of its northern Delta.

Steelhead

On March 19, 1998, NMFS listed the California Central Valley steelhead as threatened (63 FR 13347). NMFS concluded that the risks to California Central Valley steelhead had diminished since the completion of the 1996 status review, based on a review of existing and recently implemented state conservation efforts and federal management programs (e.g., Central Valley Project Improvement Act Anadromous Fish Restoration Program, CALFED Bay-Delta Program) that address key factors for the decline of this species. Furthermore, NMFS noted that additional actions benefiting California Central Valley steelhead included efforts to enhance fisheries monitoring and conservation actions to address artificial propagation (NMFS, 2014).

On September 8, 2000, pursuant to a July 10, 2000 rule issued by NMFS under section 4(d) of the ESA (16 U.S.C. § 1533(d)), the take restrictions that apply statutorily to endangered species began to apply with specific limitations to California Central Valley steelhead (65 FR 42422). On January 5, 2006, NMFS reaffirmed the threatened status of the California Central Valley steelhead and applied the DPS policy to the species because the resident and anadromous life forms of steelhead remain "markedly separated" as a consequence of physical, ecological, and behavioral factors, and may therefore warrant delineation as a separate DPS (71 FR 834). NMFS (1998) based its conclusion on conservation and protective efforts that "mitigate the immediacy of extinction risk facing the California Central Valley steelhead DPS" (NMFS, 2014).

On January 5, 2006, NMFS issued a final decision that defined California Central Valley steelhead as a DPS rather than an ESU and retained the status of California Central Valley steelhead as threatened (71 FR 834). The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations below natural and human-made impassable barriers in the Sacramento and San Joaquin Rivers and their tributaries, excluding steelhead from San Francisco and San Pablo Bays and their tributaries (63 FR 13347). Steelhead in two artificial propagation programs—the Coleman National Fish Hatchery and Feather River Fish Hatchery steelhead hatchery programs—are considered to be part of the DPS. NMFS determined that these artificially propagated stocks are no more divergent relative to the local natural population(s) than what would be expected between closely related natural populations within the DPS (71 FR 834).

Distribution and Abundance—Adult steelhead typically migrate into Central Valley rivers from August through March (McEwan, 2001; NMFS, 2004), and migration peaks in January and February (Moyle, 2002). Optimal migration and holding temperatures have been reported to range from 8 to 11°C (46–52°F; NMFS, 2014).

However, the *O. mykiss* (>400 mm or 16 inches) observed at the existing seasonal fish counting weir in the lower Tuolumne River (at RM 24.5) from 2011 to 2016 passed at temperatures ranging from 11.6°C to 20.5°C (53°F–69°F). Steelhead adults typically spawn in small streams and tributaries where cool, well-oxygenated water is available year-round. Spawning occurs from December through April, peaking from January through March. During egg incubation, steelhead require water temperatures less than 12.8°C to ensure successful embryonic development. After hatching, steelhead have a highly variable life history strategy. Juveniles may rear in fresh water for two to three years before emigrating to the ocean. Juvenile steelhead generally require water temperatures lower than 20°C to avoid physiological stress; however, some strains of *O. mykiss* have been shown to grow well at temperatures as high as 22°C and maintain weight at temperatures as high as 25°C. Information regarding the life stages of steelhead observed in the lower Tuolumne River is presented in table 3.3.4-1. The periodicities shown for adult upstream migration and smolt outmigration are estimates, because there is no evidence that existing conditions in the lower Tuolumne River support a self-sustaining steelhead run (HDR, 2017a). Between 2009 and 2016, only six *O. mykiss* longer than 16-inches were detected at the seasonal fish counting weir operated by the Districts at RM 24.5 (HDR, 2017a), and since then, none were detected in 2017 (Districts, 2018c) and one was detected in 2018 (Districts, 2019b).

Table 3.3.4-1. Life-stage-specific periodicities for *O. mykiss* in the lower Tuolumne River (Source: HDR, 2017a).

Note: Dark shaded areas represent known peak periods; light shaded areas represent presence. The absence of dark shaded areas indicates that the Technical Committee did not identify any particular peak period based on the available data.

Critical Habitat Designation—On February 16, 2000 (65 FR 7764), NMFS published a final rule designating critical habitat for California Central Valley steelhead. NMFS proposed new critical habitat for spring-run Chinook salmon and California Central Valley steelhead on December 10, 2004 (69 FR 71880), and published a final rule designating critical habitat for these species on September 2, 2005 (70 FR 52488). This critical habitat includes the lower Tuolumne River from La Grange Diversion Dam downstream to the confluence with the San Joaquin River, and downstream to the Delta.

North American Green Sturgeon

The Southern DPS of North American green sturgeon was federally listed as threatened on April 7, 2006 (71 FR 17757) and includes the green sturgeon population spawning in the Sacramento River and using the Delta and San Francisco Estuary.

Distribution and Abundance—Although green sturgeon spend most of their life in marine and estuarine environments, they periodically migrate into freshwater streams to spawn, spending up to six months in freshwater during their spawning migration. Upstream migration generally begins in February and may last until late July (Adams et al., 2002). Spawning occurs between March and July, peaking between mid-April and mid-June (Emmett et al., 1991). Following emergence in early summer, larval green sturgeon begin migrating downstream, becoming more tolerant of increasing water temperatures and salinities. Several studies suggest that juvenile green sturgeon rear in freshwater for one to four years, acclimating gradually to brackish environments before migrating to the ocean (Beamesderfer and Webb, 2002; Nakamoto et al., 1995).

The only known historical or current spawning population of green sturgeon in the Central Valley occurs in the Sacramento River Basin (71 FR 17757; Adams et al., 2002). Numerous fisheries studies in the Tuolumne River since the 1980's have not documented green sturgeon (FISHBIO and HDR, 2013). However, six green sturgeon have been self-reported to California DFW by three anglers in the San Joaquin River during spring 2009 and 2010, including one captured upstream of Highway 140 Bridge and five between Stockton and Highway 140 Bridge, ranging in size from 0.6 to 0.8 meter (24 to 31 inches).

Critical Habitat Designation—On October 9, 2009, NMFS (74 FR 52300) designated critical habitat for the Southern DPS of North American green sturgeon. This designated critical habitat includes most of the DPS' occupied range, including (1) coastal marine waters from Monterey Bay to the Washington/Canada border; (2) coastal bays and estuaries in California, Oregon, and Washington; and (3) fresh water rivers in California's Central Valley. In the Central Valley, critical habitat for green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Delta, and San Francisco Estuary. The San Joaquin River and its tributaries upstream of the Delta, including the Tuolumne River, are not designated as critical habitat.

Terrestrial Species

The Districts reviewed the status and distribution of federally listed threatened and endangered terrestrial species within the Don Pedro Project, revealing the potential occurrence of one mammal, two amphibians, one crustacean, one insect, and nine plants. Table 3.3.4-2 lists these species, along with their status and known occurrences within the project vicinity. No federally listed birds or reptiles with potential to occur within the Don Pedro Project were identified. In 2012, the Districts conducted field surveys for species that were determined as likely to occur within the project boundary. We discuss the results of these surveys in further detail below for those species.

For the La Grange Project, the Districts did not conduct any surveys for rare, threatened, endangered, protected, or special-status wildlife. The Districts relied on their studies of federally listed threatened and endangered species within the upstream Don Pedro Project. In some cases, those studies extended up to 0.25 mile downstream of Don Pedro Dam, towards the La Grange Project. They also consulted public agency databases (e.g., CNDDB [California DFW, 2018c], USDA PLANTS [USDA, 2018], and FWS IPaC [FWS, 2018b]) and provided a list of species potentially occurring within the La Grange Project boundary. The ESA/CESA-listed terrestrial species listed in table 3.3.4-2 could also occur within the La Grange Project.

Table 3.3.4-2. Federally and state-listed threatened and endangered terrestrial species with potential to occur within the Don Pedro and La Grange Projects (Source: Districts, 2017a,b, as modified by staff; California DFW, 2018d,e; FWS, 2018b).

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Mammals				
San Joaquin kit fox	*Pekania pennanti*	FE, ST	See text below	See text below
Amphibians				
California red-legged frog	*Rana boylii*	FT, SSC	See text below	See text below
California tiger salamander	*Ambystoma californiense*	FT, ST	See text below	See text below
Insects				
Valley elderberry longhorn beetle	*Phrynosoma blainvillii*	FT	See text below	See text below

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Brachiopods				
Vernal pool fairy shrimp	*Branchinecta lynchi*	FT	See text below	See text below
Plants				
Hartweg's golden sunburst	*Pseudobahia bahiifolia*	FE, SE, CNPS-1B	Cismontane woodland, valley and foothill grassland	None
Chinese camp brodiaea	*Brodiaea pallida*	CT, SE, CNPS-1B	Grows in vernal depressions, within open areas along seeps and intermittent springs in volcanic and serpentine soils in the California Sierra foothill woodlands between 984 and 1,312 feet in elevation	None
Layne's butterweed (or Layne's ragwort)	*Packera layneae* (or *Senecio layneae*)	FT, SR, CNPS-1B	See text below	See text below
Red Hills vervain (or California vervain)	*Verbena californica*	FT, ST, CNPS-1B	See text below	See text below
Succulent owl's clover	*Castilleja campestris* ssp. *succulenta*	FT, SE, CNPS-1B	Vernal pools	None
Hoover's spurge	*Chamaesyce hooveri*	FT, CNPS-1B	Vernal pools	None

Common Name	Scientific Name	Status[a]	Suitable Habitat Description	Occurrence Information within the Projects
Colusa grass	*Neostapfia colusana*	FT, SE, CNPS-1B	Vernal pools	None
Hairy orcutt grass	*Orcuttia pilosa*	FE, SE, CNPS-1B	Vernal pools	None
Greene's tuctoria	*Tuctoria greenei*	FE, SR, CNPS-1B	Vernal pools	None

[a] FE—ESA-listed as endangered; FT—ESA-listed as threatened; FC—ESA candidate species; SE—CESA-listed as endangered; ST—CESA-listed as threatened; SSC—California species of special concern; SR—California Rare Species; CNPS-1B—California Native Plant Society listed species considered rare or endangered in California and elsewhere.

In addition to the species in table 3.3.4-2, the Districts considered other federally listed species that were identified in Commission staff's Scoping Document for the Don Pedro Project, which included: riparian brush rabbit (*Sylvilagus bachmani riparius*); riparian wood rat (*Neotoma fuscipes riparia*), least Bell's vireo (*Vireo bellii pusillus*), and Conservancy fairy shrimp (*Branchinecta conservatio*). These four species and their critical habitats have not been reported to occur within five miles of the Don Pedro Project, nor within Tuolumne County, and no suitable habitat occurs within the project areas. The closest designated critical habitat for Conservancy fairy shrimp is over 10 miles from the projects, and no vernal pool habitats, which are required by the species, were found during field studies. The riparian woodrat and riparian brush rabbit inhabit forested river corridors on the eastern side of the San Joaquin Valley and are do not occur near either project. The least Bell's vireo also requires riparian shrub habitats and its current range is hundreds of miles to the south of the projects. These species were thus removed from further discussion.

San Joaquin Kit Fox

The San Joaquin kit fox was originally listed as endangered under the ESA in 1967 (32 FR 4001) and was listed as threatened by California four years later. The *Final Recovery Plan for Upland Species of the San Joaquin Valley*, which includes the San Joaquin kit fox, was issued in 1998 (FWS, 1998). A five-year review was completed for the species in 2010 and no change to its listing status was recommended (FWS, 2010). Population declines are attributed to habitat loss and degradation caused by agriculture and urban land uses. To date, conservation efforts for the San Joaquin kit fox have not been successful at reversing their declining trend, and the conservation needs of kit foxes have not been met. Mortality from predation, shooting, habitat loss, and poisoning

through the consumption of poisoned rodents also contributes to population declines (FWS, 1998). No critical habitat has been designated for San Joaquin kit fox.

The San Joaquin kit fox inhabits grasslands and agricultural lands in the San Joaquin Valley. They mate in winter and have between four and seven young in February or March. They use multiple underground dens throughout the year, sometimes using pipes or culverts as den sites in addition to other animal burrows greater than 5 inches in diameter. Their primary prey is usually the most abundant nocturnal rodent or lagomorph[213] in their area, although they also feed opportunistically on carrion, birds, reptiles, insects, and fruits.

The Districts reviewed the CNDDB and found a single record from 1972 of a San Joaquin kit fox within the general vicinity of the Don Pedro Project, approximately 2.1 miles southwest of the project boundary. No other occurrences of San Joaquin kit fox have been recorded within five miles of the project since 1973. During the Districts' surveys of the Don Pedro Project in 2012, no kit fox sightings or large burrows were documented, although suitable habitat for the species is reportedly common. The Districts did not evaluate the potential presence of San Joaquin kit fox in the La Grange Project, where suitable habitat also occurs. As a result, the presence of kit foxes cannot be ruled out.

California Red-legged Frog

The California red-legged frog was listed as threatened in 1996 (61 FR 25813); FWS published a Recovery Plan in 2002 (FWS, 2002a) and designated critical habitat for the species in 2010 (71 FR 19244). The California red-legged frog is the largest native frog on the west coast. It is primarily associated with perennial ponds and low-gradient, slow-moving perennial or seasonal streams and rivers, including natural and manmade (e.g., stock) ponds. To support breeding populations, the waterbody must hold water continuously for a minimum of 20 weeks beginning in the spring (i.e., sufficiently long for breeding to occur and tadpoles to complete development). The minimum depth of breeding habitat is 20 inches; however, deep water pools, ponds, and lake areas are not suitable. Dense, shrubby riparian vegetation (e.g., willow, bullrush, and tule species) and bank overhangs are important features of California red-legged frog breeding habitat, although they sometimes use sites that lack these features. Locations with the highest densities of California red-legged frogs exhibit dense emergent or shoreline riparian vegetation closely associated with moderately deep (greater than 2.3 feet), still, or slow-moving water.

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[213] Lagomorphs are the members of the taxonomic order Lagomorpha, of which there are two living families: the Leporidae (hares and rabbits) and the Ochotonidae (pikas).

The current range of the California red-legged frog is greatly reduced, with most remaining populations found along the coast from Marin County to Ventura County. In the Sierra Nevada foothills, where the species was once widespread, there are only six known extant populations, most of which contain few adults. There are five known historical occurrences of California red-legged frog within 10 miles of the Don Pedro Project boundary, with the most recent approximately 5.5 miles to the northeast in 1984. Furthermore, the FWS's recovery plan for the species lists California red-legged frog as extirpated from the Tuolumne River Watershed. The species has declined in habitats with introduced fish or where non-native invasive American bullfrogs have become dominant. The recovery plan notes that the Tuolumne River Core Area was historically occupied and has potential for reestablishment but does not contain a source population and does not provide connectivity between known populations.

The Districts conducted a study of California red-legged frog in the Don Pedro Project area in 2012. They performed a desktop evaluation of 337 sites within one mile of the project boundary, including 73 within the project boundary. Based on potential habitat identified during desktop assessments and property access, the Districts assessed 85 sites in the field for evidence of California red-legged frog and habitat suitability for the species, including 66 within the project boundary. They identified 52 aquatic habitat locations with characteristics potentially suitable for California red-legged frog breeding based on the minimum criteria. Ten sites were assessed to be more favorable for breeding due to the presence of suitable vegetation and lack of predators. However, no California red-legged frog were observed during this or any other pre-licensing studies. Don Pedro Reservoir itself does not possess the essential components of California red-legged frog breeding habitat because of the absence of suitable vegetation. This reservoir is also stocked with a variety of introduced, predatory fish, which diminish suitability for California red-legged frog. The Districts did not perform surveys for California red-legged frog or prepare a draft BA for terrestrial species for the La Grange Project.

The projects are within the Sierra Nevada Foothills and Central Valley Recovery Unit, as defined by the Recovery Plan for the California Red-Legged Frog (FWS, 2002a). However, neither the Don Pedro Project nor the La Grange Project contains designated critical habitat for California red-legged frog; they are also not within a core area as defined in the recovery plan. Core areas are geographic units where recovery actions are focused and are distributed throughout portions of the species' historic and current range. The Piney Creek Core Area encompasses an adjacent watershed; Piney Creek is a tributary to Lake McClure. Although California red-legged frogs are thought to be extirpated from this drainage, the task in the recovery plan is to "develop and implement a watershed management and protection plan for Core Area #7 (Piney Creek)." The conservation needs for the California red-legged frog in the Piney Creek Core Area are to control American bullfrogs and reestablish red-legged frog populations. Also, the Tuolumne River Core Area is located upstream of the projects, encompassing portions of the projects' contributing watershed within Stanislaus National Forest and Yosemite

National Park. Conservation needs for the California red-legged frog in the Piney Creek Core Area, as specified for the Tuolumne River Core Area in the Recovery Plan, are to "control non-native fish and amphibians, reestablish populations (e.g., at Swamp Lake, Miguel Meadows)" (FWS, 2002a). The nearest extant occurrence is 29 miles northwest of the projects within Critical Habitat Unit CAL-1 in Calaveras County.

California Tiger Salamander

The Central Valley DPS of California tiger salamander was listed as threatened under ESA in 2004 (69 FR 47212) and is listed under the CESA. Critical habitat was designated in 2005 (70 FR 49380), including an area approximately one mile southwest of the Don Pedro Project boundary in Stanislaus County.

California tiger salamanders breed from December through February in shallow, seasonal (i.e., continuously flooded for a minimum of 10-12 consecutive weeks), or semi-permanent pools and ponds that fill during heavy winter rains, and occasionally in intermittent streams or in permanent ponds where predatory fish are absent. Adults spend little time at breeding sites before returning to upland habitats where they typically utilize small mammal burrows or other underground retreats throughout most of the year, located in grassland, savanna, or open woodland habitats. California tiger salamander populations generally do not persist where fish, American bullfrog, or predacious insects are well established. According to the California DFW's *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or a Negative Finding of the California Tiger Salamander*, the criteria for breeding habitat includes the presence of standing water for a period sufficient for larvae metamorphosis following breeding, which occurs from December through and February. Larvae may metamorphose in as little as 10-12 weeks, but typically not until May to July. Natural vernal pools, stock ponds, drainage ditches, and pools in low-gradient streams are potential habitats. Juvenile salamanders migrate into uplands and settle into animal burrows, and like adults, they leave their burrows to feed on insects and worms during nights of high humidity and return to the burrow before morning. Suitable upland habitats are thus equally important to the survival of adult California tiger salamanders (FWS, 2018c).

There are five known historical California tiger salamander occurrences within five miles of the Don Pedro Project boundary; the most recent was documented in 2007, approximately 0.4 mile from Don Pedro Reservoir. The Districts surveyed all suitable aquatic habitats within 1.24 miles of the project boundary in 2012, consistent with FWS requirements, and did not locate any occurrences of California tiger salamander. Potential California tiger salamander breeding habitat (standing water for at least 10 weeks during the breeding season) was documented at or near 247 habitat sites, which varied from large streams with substantial overhanging vegetation to manmade agricultural or water treatment ponds with no cover and limited vegetation. Small burrows were present in proximity to many sites surveyed. Field surveys revealed that most of these sites were perennial streams that were unsuitable because of high gradient or a lack of upland habitat suitable for dispersal. Within the project boundary, 38

field-assessed sites were characterized as potentially suitable for California tiger salamander breeding, 29 of which were more favorable to breeding due to the presence of small burrows and upland habitat suitable for dispersal.

The Districts reported one occurrence of the California tiger salamander within the La Grange Project boundary in the CNDDB records but did not perform any field surveys for the species at the La Grange Project. Critical habitat for the California tiger salamander is located approximately 0.5 mile south of the La Grange Project boundary, designated as Unit 8 (La Grange Ridge Unit) of the Central Valley Region (70 FR 49379). This is beyond the average dispersal distance of the salamander (1,844 feet) but is within the maximum known dispersal distance (1.3 miles) for the species (FWS, 2018c).

Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle was listed as threatened in 1980 (43 FR 35636) and FWS designated critical habitat for this species on the same year (45 FR 29373). It is associated with its host plant, elderberry (*Sambucus* spp.) shrubs, throughout the California Central Valley and foothills below 3,000 feet mean sea level. The projects are outside the designated critical habitat zones, but portions of the project areas include potential habitat for the beetle. The valley elderberry longhorn beetle occurs within riparian vegetation communities where it feeds exclusively on elderberry shrubs in both adult and larval stages. Adult females lay eggs in crevices in the bark of the host elderberry plant. After hatching, larvae spend one to two years feeding inside the plant. Prior to pupating, valley elderberry longhorn beetle larvae chew an exit hole in the elderberry trunk for the emerging adult, leaving boreholes in the elderberry stems.

The Districts conducted surveys for elderberry plants at the Don Pedro Project (HDR, 2013k). Surveyors examined elderberry plants for evidence of valley elderberry longhorn beetle presence, encompassing the area surrounding all project facilities within the project boundary. The Districts located 73 occurrences elderberry plants, of which 14 had evidence of valley elderberry longhorn beetle presence. Of the 14 elderberry plants with exit holes, only two were found in riparian areas; the majority were in partially disturbed habitat near roads or developed recreational areas. These occurrences include: four at Moccasin Point Recreation Area; one below Don Pedro Dam; one near a sewage pond across from Blue Oaks Recreation Area; one along Hatch Creek; four along Jacksonville Road; one along the Moccasin transmission line; and two at Rogers Creek Arm of Don Pedro Reservoir. No surveys for the valley elderberry longhorn beetle or its host plants were performed within the La Grange Project area.

The most commonly observed potential stressors to elderberry plants at the Don Pedro Project included proximity to roads and trails (19 occurrences), cattle grazing (18 occurrences) and noxious weeds (15 occurrences). Also, two elderberry occurrences were located directly next to sewage treatment plants and would be subject to disturbance by project operation and maintenance. Direct signs of disturbance to elderberry

occurrences included trash within the branches of two occurrences, fencing through plant branches at two occurrences, trampling of plants at three occurrences, and noxious weeds directly under plants at seven occurrences. Less common potential stressors included a fuel break located in the immediate vicinity of one occurrence, dumping of refuse at six occurrences, the proximity of transmission lines at two occurrences, and the proximity of housing at one occurrence. Two occurrences were in non-riparian areas on the Rogers Creek Arm and could be affected by fluctuating water levels of the reservoir.

Vernal Pool Fairy Shrimp

The vernal pool fairy shrimp was listed as threatened under the ESA in 1994 (59 FR 48136). Critical habitat for vernal pool fairy shrimp was designated in 2003 (68 FR 46684) and revised in 2006 (71 FR 7118). Of the 35 designated critical habitat units, unit 21 (Stanislaus Unit) is the closest to the Don Pedro project, at approximately 2.5 miles from the edge of the project boundary. FWS issued a Recovery Plan for Vernal Pool Ecosystems of California and Southern Oregon in 2005. A five-year status review for vernal pool fairy shrimp was completed in 2007 and a second status review was initiated in 2011 (76 FR 30377).

Vernal pool fairy shrimp occur mostly in vernal pools but may also occur in natural and artificial seasonal wetland habitats, such as alkali pools, ephemeral drainages, stock ponds, roadside ditches, vernal swales, and rock outcrop pools. Vernal pool fairy shrimp tend to occur primarily in smaller pools of less than 0.05 acre and with water temperatures between 4.5°C and about 23°C. Because vernal pools are mostly rain-fed, they usually have low nutrient levels and often have dramatic daily fluctuations in pH, DO, and carbon dioxide.

The CNDDB includes one occurrence of vernal pool fairy shrimp in the Don Pedro Project vicinity. The Districts performed terrestrial resource studies within in the Don Pedro Project boundary in 2012, during which no vernal pools or vernal pool plants that might indicate their presence were observed. The Districts also state that no vernal pools are located within one mile of the La Grange Project area. Because this crustacean does not occur within either project area, and it is not likely to colonize the projects, the Don Pedro and La Grange Projects would have "no effect" on the vernal pool fairy shrimp, and no further discussion is warranted.

Federally Listed Plants

The Districts completed a study of threatened and endangered plants in 2012 for the Don Pedro Project (HDR, 2013l). Prior to completing field surveys, the Districts reviewed the CNPS database and CNDDB for federally listed plant occurrences within a one-mile buffer of the Don Pedro project boundary, which revealed five occurrences each of Layne's butterweed and Red Hills vervain. FWS listed Layne's butterweed and Red Hills vervain as threatened under the ESA in 1997 (62 FR 49398) and in 1998 (63 FR 49022), respectively.

The Districts identified an additional two federally listed species with documented occurrences within the USGS quadrangle (quad) maps that cover the Don Pedro Project boundary—Chinese Camp brodiaea (*Brodiaea pallida*) and Hartweg's golden sunburst (*Pseudobahia bahiifolia*). The Districts reported an additional six federally listed plants located within the adjacent nine USGS quads, including succulent owls-clover (*Castilleja campestris* ssp. *succulenta*), Hoover's spurge (*Chamaesyce hooveri*), delta button-celery (*Eryngium racemosum*), colusa grass (*Neostapfia colusana*), hairy orcutt grass (*Orcuttia pilosa*), and Greene's tuctoria (*Tuctoria greenei*).

The Districts performed botanical surveys that covered approximately 3,870 acres between March 5 and June 29, 2012. Surveys were floristic in nature and carried out by qualified botanists on foot and by boat, generally following California DFW (2018e) protocols. Surveys were conducted using a random meander technique with particular focus in high quality habitat or areas suitable for supporting the target plant species.

Two perennial herbs, Layne's butterweed and Red Hills vervain, were located within the Don Pedro Project boundary. Layne's butterweed is a perennial aster that flowers from April to August and occurs in chaparral and woodland habitats with gabbro, or serpentine, soils in the central Sierra Nevada foothills. The Districts documented 25 occurrences of Layne's butterweed on BLM lands within the Red Hills ACEC, in Sixbit Gulch and Poor Man's Gulch. Layne's butterweed populations ranged from five to 250 plants, totaling approximately 1,200 individuals with a total estimated area of 2.9 acres. Layne's butterweed occurrences near the projects face several potential stressors, including cattle grazing, recreation, noxious weeds (i.e., barbed goatgrass, smooth distaff thistle, and bermudagrass), and Don Pedro Reservoir operations. FWS further cites habitat loss and fragmentation as primary threats for this species, but other threats also include herbicide spraying, change in fire frequency, off-road vehicle use, overgrazing, and competition from noxious weeds (FWS, 2017b). FWS has not designated critical habitat for this species but issued a *Recovery Plan for Gabbro Soil Plants of the Central Sierra Nevada* (FWS, 2002b), which included Layne's butterweed, among other species.

Red Hills vervain is endemic to the Red Hills ACEC. It is only found along small or intermittent perennial streams that run through areas with serpentine soils, usually in woodland and grassland habitats. The Districts documented two occurrences of Red Hills vervain, one in Poor Man's Gulch containing over 200 individuals in an area of about 0.2 acre, and the other occurrence in Six Bit Gulch consisting of only two individuals in a 4-foot square patch. Both were located within riparian zones containing arroyo willow, sedges, white brodiaea, and Baltic rush. The Districts noted that potential stressors around the Red Hills vervain includes cattle grazing and recreation near one population. Also, the California DFA B-listed barbed goatgrass was observed near both occurrences. Other threats to Red Hills vervain include recreational activities such as gold mining, mountain biking, hiking, and hydrological fluctuations (FWS, 2017c). FWS has not designated critical habitat for Red Hills vervain but is currently developing a recovery plan.

The potential for other federally listed plants to occur in the Don Pedro and La Grange Project vicinity is low. Based on life history information gathered through the literature review and field observations during floristic surveys, the remaining seven federally listed plant species that either require vernal pools habitats or are not present in the projects, which includes Hoover's spurge, succulent owl's clover, colusa grass, Greene's tuctoria, Chinese camp brodiaea, Hartweg's golden sunburst, and hairy orcutt grass. Because these seven federally listed plant species do not occur within the area of project effects and are not likely to colonize the projects, the Don Pedro and La Grange Projects would have "no effect" on them, and no further discussion is warranted.

The Districts did not perform surveys for federally listed plants in the La Grange Project area. Hartweg's golden sunburst is documented as occurring within the La Grange USGS quad.

3.3.4.2 Environmental Effects

Aquatic Species

During the ILP process, the Districts prepared a draft BA for aquatic species that summarized the status of California Central Valley steelhead and evaluated the effects of the Don Pedro Project (including the proposed environmental measures) on California Central Valley steelhead and its designated critical habitat. In the draft BA, the Districts determined that the continued hydroelectric power generation at the project was not likely to adversely affect California Central Valley steelhead or its designated critical habitat. The Districts also determined that several project actions would not likely adversely affect the Central Valley spring-run Chinook salmon but did not make an overall determination of the projects' effect for the ESU. The Districts' draft BA for aquatic species did not evaluate project effects on the Southern DPS of North American green sturgeon. However, in their amended final license application for the Don Pedro Project, the Districts state that, based on NMFS's determination that the Tuolumne River does not provide critical habitat for green sturgeon (NMFS, 2009), and 36 years of fisheries monitoring without encountering any sturgeon, the species is unlikely to occur within the Tuolumne River Basin.

In this section, we address the effects of relicensing the projects under the staff alternative (the recommended alternative) on California Central Valley steelhead, Central Valley spring-run Chinook salmon, and North American green sturgeon, and their designated critical habitat. The action area for ESA section 7 consultation extends from La Grange Diversion Dam to the Delta.

Although the presence of a population of California Central Valley steelhead in the Tuolumne River is uncertain, several of the measures included in the staff alternative that are intended to benefit non-ESA listed *O. mykiss* and fall-run Chinook salmon or the aquatic ecosystem in general would also benefit steelhead if they are present. These measures are described in detail in section 2.3, *Staff Alternative,* and include:

- Maintain minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources;
- Provide spring pulse flows to facilitate outmigration of juvenile fall-run Chinook salmon;
- Develop a coarse sediment management program for the lower Tuolumne River between RM 24.5 and RM 52;
- Provide gravel mobilization flows of 6,000 to 7,000 cfs to improve salmonid spawning habitat;
- Make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years, subject to other requirements and constraints, including flood control, water supplies, spill management, project safety, and rapidly changing weather patterns;
- Develop a water quality monitoring plan in consultation with resource agencies;
- Develop a water temperature monitoring plan in consultation with resource agencies;
- Develop an erosion and sediment control plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs; and
- Develop a hazardous material plan for storage, use, transportation, and disposal of hazardous materials in the project areas, in consultation with resource agencies.

Our Analysis

California Central Valley Steelhead (Oncorhynchus mykiss)—Although the staff alternative does not involve any construction-related modifications to existing project facilities, actions including routine project maintenance, as well as non-routine ground-disturbing activities, have the potential to result in water quality-related impacts on *O. mykiss* downstream of La Grange Diversion Dam. For example, ground-disturbing activities could result in temporary increases in turbidity, loss of habitat, degradation of water quality, construction debris, and disturbance and noise. Heavy equipment also has the potential to release hydrocarbon-based contaminants that could enter the Tuolumne River. In section 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*, we analyze measures that the Districts propose to reduce any future construction-related effects, and measures specified under BLM 4(e) condition 3 and Water Board preliminary 401 condition 9, both of which apply to both projects. The Districts' implementation of these measures would minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by projects' operation and maintenance. In addition, as described in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Spill Prevention, Control, and Countermeasures*, implementing

the Districts' proposed Spill Prevention Control and Countermeasure Management Plan, BLM's Don Pedro revised 4(e) condition 43 and La Grange preliminary 4(e) condition 34, and Water Board's preliminary 401 condition 10, would minimize the extent of any hazardous material spill and include protocols to prevent adverse impacts to beneficial uses in the event of a spill. Furthermore, in any construction and future maintenance of the project, the location and standards of roads and trails, and other land uses, including the location and condition of any future quarries, borrow pits, and spoil disposal areas, and sanitary facilities, would be subject to the approval of the department or agency of the United States having supervision over the lands involved, if located on federal lands, and would also be required to meet Water Board regulations.

Both the Districts' proposed minimum flow regime and the staff-recommended minimum flow regimes (which incorporates some minor changes in flows included in the draft Voluntary Agreement) in the Tuolumne River are expected to improve aquatic habitat conditions (increase WUA compared to existing conditions) for *O. mykiss* downstream of La Grange Diversion Dam. For example, the Districts' recommended base flows would provide from 71 to 95 percent of maximum WUA for *O. mykiss* (depending on life stage and water year type). In addition, these base flows would maintain cool water temperatures for *O. mykiss* upstream of RM 43. Finally, our recommended ramping rate restrictions would reduce the risk of juvenile salmon and *O. mykiss* stranding and redd dewatering in the gravel-bedded reach of the lower river from about RM 52.2 to RM 24.

While designed to increase rearing habitat and improve the survival of out-migrating juvenile fall-run Chinook salmon, the staff-recommended spring and floodplain pulse flows would further reduce water temperatures at a given location and extend the beneficial plume of colder water farther downstream relative to that provided by the base flows alone, which would also benefit *O. mykiss*.

Under the Districts' proposed coarse sediment management program (as modified by staff), the Districts would place spawning gravel in the Tuolumne River downstream of La Grange Diversion Dam, which would maintain the availability of high-quality *O. mykiss* spawning habitat. Placing the gravel following the *O. mykiss* fry rearing period also would minimize any risk of smothering *O. mykiss* fry within substrate interstices. Juvenile *O. mykiss* would also be able to more readily move away from the augmentation area during sediment placement, thereby minimizing effects on juveniles. Because gravel would be clean, release of fines would be minimized, and along with it, potential adverse effects on *O. mykiss*, such as gill abrasion resulting from pulses of suspended sediment.

Furthermore, the staff-recommended gravel mobilization flows of 6,000 to 7,000 cfs would likely reduced fine sediment storage in the river channel and in spawning gravels, which could increase *O. mykiss* egg-to-emergence survival and fry production, and BMI production; increase fine sediment storage on floodplains, which could improve regeneration of native riparian plant species in wetter water years, and increase lateral channel migration, bar formation, and large wood introduction, which together could

create new floodplain habitat and complex hydraulic environments for improved adult *O. mykiss* holding, spawning, and juvenile rearing. While these mobilization flows could cause localized, short-duration pulses in turbidity, no significant associated effects on *O. mykiss* are anticipated. These flows would be released at a time when high-flows naturally occur (i.e., March–June in wet and above normal water years) and would have effects similar to what would take place in a natural system during a minor channel-forming event.

Shaping the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years is expected to provide soil moisture conditions that allow seeds to take up water, germinate, and form roots. Increasing natural recruitment of snowmelt-dependent hardwoods would likely increase the number of stands of trees that could contribute large wood to the channel over the long-term and provide cover and shade for aquatic species, which could have a beneficial cooling effect on water temperature in localized areas. Benefits to the overall ecosystem could translate into benefits for *O. mykiss* occupying the lower river.

Implementation of the staff-recommended LWM management plan is expected to provide favorable microhabitats for *O. mykiss* by increasing structural and hydraulic complexity in the channel and improve spawning habitat for *O. mykiss* as localized scour displaces fines from gravel beds. In addition, LWM augmentation would create pools by forcing flows to scour channel beds and banks, and afford structural partitioning that provides protection from predation, and visual isolation that lowers interspecies competition (Dolloff, 1983). The LWM would also supply nutrients and substrate for aquatic organisms (Anderson et al., 1978) and aid in the retention of salmonid carcasses, which provide important marine-derived nitrogen to terrestrial ecosystems and organic nutrients to salmon juveniles, macroinvertebrates, terrestrial animals, and birds (Naiman et al., 2002; Merz and Moyle, 2006). Short-duration disturbance of juvenile *O. mykiss* could occur during LWM placement, but no significant injury or mortality is anticipated. It is anticipated that LWM would be placed after July 15, i.e., following the fry rearing period, which would minimize the risk of disturbance of *O. mykiss* fry within substrate interstices.

Based on the above analysis, the aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to California Central Valley steelhead relative to the environmental baseline. However, it is likely that some individual *O. mykiss* could be injured or killed during the placement of gravel or LWM during implementation of the staff-recommended measures. Considering the potential for incidental take of individuals associated with the proposed action, we determine that issuing a new license for the Don Pedro Project and an original license for the La Grange Project as proposed with staff-recommended measures (the proposed action) is “likely to adversely affect” the California Central Valley steelhead, and “may affect, but is not likely adversely affect” the designated critical habitat for this species.

Central Valley Spring-run Chinook Salmon (O. tshawytscha)—Spring-run Chinook salmon may have historically occurred within the vicinity of the Don Pedro and La Grange Projects. However, they were extirpated from the San Joaquin River and its tributaries, as the watersheds became highly modified and access and other habitat conditions were degraded or destroyed. The modifications accompanied gold and gravel mining and associated dams and water diversions, agriculture, urbanization, levee construction, clearing of riparian vegetation for agriculture, introduction of exotic plant and fish species, and pollution from point sources like abandoned mines, among other factors. Agricultural and urban encroachment along the lower river has resulted in relatively static channels within floodways confined by dikes and agricultural uses. Many miles of riverbank have been leveed and stabilized with riprap by agencies or landowners. These activities have collectively resulted in substantial changes in channel morphology, modified the flow and temperature regime, reduced riparian vegetation, increased siltation, induced armoring of the streambed, reduced gravel recruitment, and increased non-native predatory fish habitat.

The ESU for Central Valley spring-run Chinook salmon is defined as all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries, including the Feather River Fish Hatchery population (70 FR 37160). The ESU and its critical habitat do not include the San Joaquin River or the Tuolumne River, even though attempts to introduce the species (as an experimental population) into the San Joaquin River and its tributaries were initiated in spring 2014 under the San Joaquin River Restoration Settlement Act. In addition, the San Joaquin River Restoration Settlement Act specifies that Central Valley spring-run Chinook salmon ESU introduction into the San Joaquin River Restoration Area (which includes the Tuolumne River), if it were to occur, would be as a non-essential experimental population and would not impose more than *de minimus* water supply reductions, additional storage releases or bypass flows on unwilling third parties due to such re-introduction.

The aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to Central Valley spring-run Chinook salmon ESU in the action area relative to the environmental baseline. Designated critical habitat occurs for this species within a small part of the Delta portion of the action area, and the staff alternative would not affect this portion of the Delta. Therefore, the staff alternative would have "no effect" on the Central Valley spring-run Chinook salmon ESU and its critical habitat.

North American Green Sturgeon (Acipenser medirostris)—Adult migration and spawning and early development and growth of green sturgeon in the Central Valley occurs primarily in the Sacramento River between Red Bluff Diversion Dam and Keswick Dam and in some tributaries, including the Feather River (NMFS, 2012). Subadults and adults also occur throughout the Delta to feed, grow, and prepare for their outmigration to the ocean (74 FR 52300, October 8, 2009). Designated critical habitat for the Southern DPS of North American green sturgeon includes the Sacramento River, lower Feather River, lower Yuba River, the Delta, and San Francisco Estuary. However,

North American green sturgeon are not known to occur in the Tuolumne River or San Joaquin River portions of the action area. The staff alternative would result in some slight increases in flow within the Delta during certain periods of the year. Considering that the Tuolumne River is part of a much larger San Joaquin River Watershed and that the Sacramento River Watershed also contributes to Delta inflow, the minor increase in flow contributed from the Tuolumne River would have no detectable effects on habitat conditions within portions of the Delta that are occupied by the Southern DPS of North American green sturgeon or its designated critical habitat. Consequently, the aggregate effects of the staff alternative would not introduce new stressors or substantially exacerbate ongoing stressors to North American green sturgeon relative to the environmental baseline. Therefore, the staff alternative would have "no effect" on the Southern DPS of North American green sturgeon and its critical habitat.

Essential Fish Habitat—EFH for Pacific salmon refers to those waters and substrate necessary for salmon production needed to support a long-term, sustainable salmon fishery and salmon contributions to a healthy ecosystem. To achieve that level of production, EFH must include all those streams, lakes, ponds, wetlands, and other currently viable waterbodies and most of the habitat historically accessible to salmon in Washington, Oregon, Idaho, and California (PFMC, 1999). In the estuarine and marine areas, Pacific salmon EFH extends from the near shore and tidal submerged environments within state territorial waters out to the full extent of the exclusive economic zone (230.2 miles) offshore of Washington, Oregon, and California north of Point Conception (PFMC, 1999). The Pacific Coast Salmon Plan covers Chinook salmon, coho salmon, Puget Sound pink salmon (odd-numbered years only), and any other federally listed salmonid species that is "measurably impacted" by Pacific Fishery Management Council fisheries (PFMC, 1999). The plan does not cover steelhead.

EFH guidelines published in the federal regulations identify Habitat Areas of Particular Concern as types or areas of habitat within EFH that are identified based on one or more of the following considerations:

- the importance of the ecological function provided by the habitat;
- the extent to which the habitat is sensitive to human-induced environmental degradation;
- whether, and to what extent, development activities are or would be stressing;
- the habitat type; and
- the rarity of the habitat type.

In the Tuolumne River (HU 18040009), EFH extends from La Grange Diversion Dam (RM 52.2) to the confluence with the San Joaquin River. As described in Scoping Document 2, the action area for this EFH Assessment includes all EFH in the Tuolumne River from La Grange Diversion Dam to the confluence with the San Joaquin River, and

in the San Joaquin River from RM 84 (i.e., the confluence with the Tuolumne River) downstream through the Delta to San Francisco Bay.

Based on the above analyses and on our analyses in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the staff alternative would have only minor and, in most cases, beneficial effects on Chinook salmon EFH. In addition, the staff-recommended measures would likely improve EFH over the long term.

Terrestrial Species

The Districts prepared a draft BA for terrestrial species at the Don Pedro Project, which summarized the status of the Don Pedro Project's effects on five animals (San Joaquin kit fox, California red-legged frog, California tiger salamander, valley elderberry longhorn beetle, and vernal pool fairy shrimp) and two plants (Layne's ragwort [butterweed] and California [Red Hills] vervain). The Districts determined that the Don Pedro Project would have "no effect" on any terrestrial species. Because of this determination, the Districts' proposed few environmental measures for threatened and endangered species in the Don Pedro Project. In its 10(j) comments, FWS suggests that the effect determinations are incorrect and, at a minimum, should all be changed to "may affect". The Districts' intent for the BA is to serve as the basis for consultation between the Commission and FWS, pursuant to section 7 of the ESA. The Districts did not prepare a draft BA for terrestrial species at the La Grange Project. FWS 10(j) Don Pedro recommendation 11 and 10(j) La Grange recommendation 10 recommend the Districts revise the draft Don Pedro TRMP and develop a La Grange TRMP within six months of license issuance to include protective measures for federally listed terrestrial wildlife.

In general, FWS and California DFW contend that the Don Pedro amended final license application and draft BA for terrestrial species, and La Grange final license application, do not contain adequate protective measures for federally listed terrestrial species. They cite project activities that could result in take of listed terrestrial species, including, but not limited to, burrow fumigation, wood stockpiling and burning, and pesticide use. FWS 10(j) recommendation 8 for both projects recommends that operation and maintenance activities not proceed within habitat for San Joaquin kit fox, California red-legged frog, California tiger salamander, or valley elderberry longhorn beetle until ESA consultation with FWS is concluded. FWS also included two federally listed plants, Layne's butterweed and Red Hills vervain, in this recommendation for the Don Pedro Project. It recommends that the Districts revise the BA to correct deficiencies pertaining to consultation and species conservation, including (1) procedures to minimize adverse effects on listed species; (2) ensuring compliance with site management plans for special-status species; and (3) developing implementation and effectiveness monitoring of measures taken to reduce impacts to listed species. FWS 10(j) recommendation 8 for both projects recommends that that the Districts generate a new threatened and endangered species list for the projects every 120 days for the duration of the project licenses and contact the FWS within 5 days if a new species becomes listed. Also, FWS recommends that the Districts annually review the list of all special-status species that

could occur at the projects. When a species is added, FWS and BLM, in consultation with Districts, would determine if the species or un-surveyed suitable habitat could occur in areas affected by Project activities. For any newly listed species, FWS 10(j) recommendation 8 recommends that the Districts develop and implement a study plan in consultation with FWS and BLM to assess project effects on the species and prepare a draft BA. If any new species is listed or critical habitat is designated within the projects' boundaries, the Districts would initiate consultation with the FWS and develop measures to avoid project effects. Also, if any terrestrial listed species or critical habitat affected by the project is outside of the projects' boundaries, the Districts would also consult with the FWS about whether a section 7 nexus exists with another federal agency or if an ESA section 10 Habitat Conservation Plan and permit is needed.

Lastly, FWS 10(j) recommendation 8 requests that the Districts comply with the terms and conditions of any biological opinion issued by FWS for the Don Pedro and La Grange Projects and allow for conservation actions for federally listed species to occur within the projects. Additionally, BLM Don Pedro revised 4(e) condition 28 and BLM La Grange preliminary 4(e) condition 19 specify that, before constructing new project features on BLM lands that were not addressed in this EIS, the Districts would submit a biological evaluation for BLM approval that evaluates the potential impact of the action on threatened and endangered species or BLM special-status species or their habitat. In coordination with the Commission, BLM could require mitigation measures for the protection of the affected species. We discuss the benefits of these and other recommendations and conditions below as they pertain to the specific federally listed terrestrial animals that could occur within the projects' boundaries.

Following issuance of the draft EIS, FWS filed a non-concurrence letter dated March 19, 2019. FWS provided additional recommendations to further reduce effects of the Don Pedro project on listed plants, valley elderberry longhorn beetle, San Joaquin kit fox, California tiger salamander, and California red-legged frog. FWS provided additional measures to further reduce effects of the La Grange project on listed plants, valley elderberry longhorn beetle, San Joaquin kit fox, and California tiger salamander. These additional measures are identified and analyzed below.

San Joaquin Kit Fox

Noise caused by project maintenance activities and recreation could affect San Joaquin kit fox in the Don Pedro and La Grange project vicinities. As mentioned in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, *Burrowing Owls*, the use of smoke and carbon monoxide to control rodents around recreational areas would adversely affect San Joaquin kit foxes if foxes are inhabiting burrows at the time of fumigation. The Districts do not engage in any other predator control that could affect San Joaquin kit fox, and no habitat conversion is proposed that would alter potential San Joaquin kit fox habitat within the Don Pedro and La Grange projects. FWS also suggests that the projects are dispersal barriers to San Joaquin kit foxes, increasing their vulnerability to

starvation and predation if adequate ground squirrel habitat is not present on both the north and south sides of the projects.

The Districts maintain that, due to a lack of evidence of San Joaquin kit fox at the Don Pedro Project, there is no potential for adverse effects on any kit foxes that could occupy potentially suitable habitat within the project boundary. Furthermore, because of their lack of observations of kit foxes in the Don Pedro Project area, the Districts did not perform additional surveys for the subspecies within the La Grange Project area. In their draft BA for terrestrial species in the Don Pedro Project, the Districts addressed their rodent control practices, claiming that because the Districts do no perform burrow blasting or use rodenticide, the project would have "no effect" on the San Joaquin kit fox.

FWS disagrees with the Districts' reasoning for excluding an evaluation of project effects on the San Joaquin kit fox. FWS 10(j) recommendation 8 recommends that operation and maintenance activities for the projects should not proceed until consultation with FWS is concluded for San Joaquin kit fox. They also recommend that the Districts prohibit the use of burrow fumigants or rodenticides on Federal land unless authorized by BLM, especially within San Joaquin kit fox habitat, until either ESA section 7 consultation is completed or a permit is issued under ESA section 10. The Districts replied they do not plan to utilize rodenticides.

FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 recommend the Districts revise the Don Pedro TRMP and develop a La Grange TRMP within six months of license issuance to include protective measures for the San Joaquin kit fox that include:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for the San Joaquin kit fox.
2. Provisions to minimize impacts from roads on San Joaquin kit fox, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.
3. Provisions to minimize impacts from transmission lines on the San Joaquin kit fox, developed in collaboration with the resource agencies. This would include measures to discourage raptor use of transmission lines as perches within suitable habitat for the San Joaquin kit fox.
4. Monitoring and habitat surveys for the San Joaquin kit fox to be conducted every three years, or as determined by the resource agencies.
5. Considering the Recovery Plan for Upland Species of the San Joaquin Valley (FWS, 1998) for inclusion of protective measures in the plan.
6. Consultation with FWS for San Joaquin kit fox during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the species.

7. Direction for formal consultation with the FWS for any pesticides planned for use within the project area.
8. Direction for consultation with FWS during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the San Joaquin kit fox.

BLM Don Pedro revised 4(e) condition 7 and La Grange preliminary 4(e) condition 5 support the Districts' development, subject to BLM's approval, of a revised Don Pedro TRMP and additional La Grange TRMP within one year of license issuance. The Districts replied that they would review the plans submitted by BLM and would draft revised TRMPs.

California DFW 10(j) recommendation M9-3 specifies that the Districts' license applications are missing management actions to address potential adverse effects on San Joaquin kit fox. Specifically, its recommendation M9-3.1 suggests that rodent control measures, which could result in take of San Joaquin kit foxes, should have burrow-specific monitoring and require avoidance of burrows occupied or potentially occupied by San Joaquin kit fox. California DFW also recommend that the Districts prohibit the use of burrow fumigants or rodenticides on federal land unless authorized by BLM, or in potential San Joaquin kit fox habitat until either ESA section 7 consultation is completed or a permit is issued under ESA section 10. The Districts replied that additional protective measures for San Joaquin kit fox are unwarranted because they found that the project is not likely to adversely affect San Joaquin kit fox, which has not been observed in the project vicinity for more than 40 years. Additionally, the Districts state that they do not conduct burrow blasting or use rodenticide for rodent control activities, and they will not conduct any rodent control on BLM lands without prior consultation.

In its March 19, 2019, non-concurrence letter, FWS filed additional recommendations for the protection of San Joaquin kit fox during rodent control and project-related ground disturbance. These measures include following measures consistent with the standardized recommendations in FWS (2011) for the species' protection.

Our Analysis

Project activities, such as maintenance activities and recreation, could result in noise that could disturb kit fox in the project vicinity. The Districts' proposed rodent control could adversely affect the San Joaquin kit fox by reducing prey availability and eliminating potential burrows.

The Districts did not find any evidence of San Joaquin kit fox within the Don Pedro Project boundary during field surveys, although they did not complete protocol-level surveys. They performed daytime reconnaissance surveys and focused on potential natal dens for detecting San Joaquin kit fox. The Districts found no large burrows within the Don Pedro Project area, but San Joaquin kit fox often change dens throughout the year and most dens often do not show evidence of use (Orloff et al., 1986). The Districts

did not use scent stations, camera traps, or spotlighting, which are required by the FWS protocol (1999a). FWS commented that that the Districts' surveys should have used a methodology that can detect kit foxes when numbers are low (i.e., using dogs to detect kit foxes by scent).

The Districts' lack of detecting San Joaquin kit fox does not constitute known absence of the species and additional information is needed to sufficiently assess potential project effects on the species. Suitable habitat and historical occurrences nearby indicate that kit foxes could potentially be present within the projects. Also, most of the uplands within the project boundaries are potential San Joaquin kit fox dispersal habitat. Under the right conditions, San Joaquin kit foxes could occur within the Don Pedro and La Grange Projects. Thus, conducting protocol-level surveys in accordance with FWS (1999a or 2011) within the Don Pedro Project, and documenting incidental sightings or anecdotal evidence of San Joaquin kit fox during other biological surveys of both projects, would help to document the use of the projects by San Joaquin kit fox. Including these provisions in the TRMPs, in consultation with FWS, the Water Board, California DFW, and BLM would ensure that appropriate protection and mitigation measures are consistent with agency guidelines.

The San Joaquin kit fox can be adversely affected by rodent control and insecticide use. As noted by FWS, the San Joaquin kit fox populations in the project vicinity are likely suppressed as a result of the basin-wide ground-squirrel eradication programs and predation pressure. By lethally removing ground-squirrel and thus reducing availability of their burrows, kit foxes could experience increased risk of predation by coyotes. This could also cause San Joaquin kit foxes to be increasingly vulnerable to starvation and predation due to the loss of ground-squirrels for prey and burrows for cover. As described in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Burrowing Owls*, including BMPs in the Don Pedro TRMP for managing burrowing rodents would minimize potential project effects on San Joaquin kit fox. Additional provisions to avoid potential incidental take of San Joaquin kit fox could include conducting protocol-level surveys in accordance with FWS (2011) prior to rodent control or any other project-related ground disturbance within suitable habitat, and instituting avoidance measures for any occupied or potentially occupied burrows, as well as documenting any incidental observations or anecdotal evidence of San Joaquin kit fox during other biological surveys of both projects. These revisions would also provide a means for continued consultation regarding potential project effects on San Joaquin kit fox. No rodent control activity occurs in the La Grange Project, so this potential effect would not be a concern. Also, the Districts could ensure that any potential project effects are minimized by reviewing the Recovery Plan for Upland Species of the San Joaquin Valley (FWS, 1998) and including any suggested protective measures, if applicable, in their TRMPs.

Raptors such as large hawks and owls and golden eagles can be a significant source of mortality for adult and juvenile San Joaquin kit foxes. Raptors opportunistically use powerlines for perches, which could facilitate predation on kit

foxes. These potential predators of kit fox would likely be attracted to powerlines in proximity to where kit foxes occur because their primary prey item, California ground squirrels, provides burrows that are often modified and used by kit foxes. Conducting surveys of ground squirrel habitat in proximity to power lines would document if this potential effect is occurring within the projects. The Districts have not mapped California ground squirrel colonies within the Don Pedro and La Grange Projects, and the FWS recommendation does not specify where this effect could occur. Nonetheless, no project nexus exists for this recommendation because the Districts are not responsible for any primary transmission lines: the project ties into the electric grid at the Don Pedro Powerhouse.

Vehicles are another major cause of kit fox mortality. However, the analysis reveals that the roads used by the Districts within the Don Pedro Project boundary do not experience traffic volumes high enough to warrant mitigation measures for wildlife-friendly road crossings. For example, Cypher et al. (2005) found few negative effects on kit foxes by two-lane highways with moderate traffic volumes (800 to 1,500 vehicles per day). Additional measures to protect kit foxes from pesticide usage beyond those already specified for special-status amphibians and reptiles would be duplicative. Project activities such as human recreation at Don Pedro recreational areas, particularly those occurring at dusk and dawn, could directly affect kit fox through disturbance. However, there is not a demonstrated project effect that would necessitate additional surveys of the project due to these activities. Any sightings or evidence of San Joaquin kit fox during surveys associated with rodent control activities and other biological surveys would provide the necessary information to determine if additional protective measures are needed.

Because there is a lack of definitive evidence from protocol-level surveys that San Joaquin kit foxes do not occur in the Don Pedro and La Grange Projects, we cannot support the Districts' assessment that the Don Pedro Project would have "no effect" on the species. While the Districts do not propose major changes to project operation or construction activities that would adversely affect potential habitat for San Joaquin kit fox, rodent control measures and any non-routine ground disturbance with potential to destroy burrows could affect this species. Implementing protocol-level surveys for San Joaquin kit fox prior to the Districts' rodent control and ground disturbing activities within suitable habitat kit fox habitat, following the FWS (2011) standardized recommendations, would identify any kit fox present at the time of these activities. If kit fox are identified and the Districts follow FWS' standardized recommendations (contact FWS, monitor occupied dens, and refrain from disturbing or destroying occupied dens without formal consultation with FWS), potential effects would be reduced to insignificant levels. Documentation of incidental sightings or anecdotal evidence of the species during other biological surveys would also provide data on where kit fox are occurring within project lands and inform future needs for surveys. While rodent control is not currently proposed for the La Grange project, we cannot discount the potential need for non-routine ground disturbing activities over the term of any license issued for the

project. Therefore, implementing the same survey and avoidance measures at the La Grange project would reduce potential effects of San Joaquin kit fox. With implementation of these measures, we conclude that the proposed action for both the Don Pedro and La Grange Projects "may affect, but is not likely to adversely affect" the San Joaquin kit fox.

California Red-legged Frog

Project operation and maintenance activities that have a potential to affect California red-legged frog include vegetation management and other ground-disturbing activities, recreation, the application of pesticides, the spread of the non-native invasive American bullfrog and chytrid fungus, the management of water levels in Don Pedro Reservoir and La Grange Reservoir, and woody debris management in Don Pedro Reservoir. However, no California red-legged frogs are known to occur within the project areas, so any actual effects are uncertain.

In their draft BA for terrestrial species in the Don Pedro Project, the Districts determined that there would be "no effect" on California red-legged frogs. FWS claims this determination is incorrect, and FWS 10(j) recommendation 8 for both projects recommends that operation and maintenance activities should not proceed until consultation with FWS is concluded for the species. If California red-legged frogs were to occur within the projects, roads and facility maintenance could cause fatalities from vehicle collisions. The Districts' facility and road maintenance and construction, as well as recreation, could also cause minor erosion and sedimentation of aquatic habitats used by the species. Recreationist could also trample shoreline vegetation that is important to California red-legged frogs and could also potentially spread chytrid fungus between water bodies. The California red-legged frog could be adversely affected by the use of pesticides s to control vegetation around project infrastructure and facilities. The perimeters of wastewater treatment facilities are sprayed annually, using pesticides labeled for aquatic use, when appropriate to manage aquatic weeds and algae. The Districts' proposed Don Pedro TRMP does not include any measures to avoid or minimize the potential adverse effects of pesticide use within the project. We discussed the use of pesticides near aquatic areas above in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Special-status Amphibians and Reptiles*.

American bullfrogs are a threat to native species of frogs within the Don Pedro and La Grange Projects. These large predatory invasive frogs threaten the California red-legged frog, and combined with non-native predatory fishes, are likely a major reason for the species' decline in the Tuolumne River Watershed. American bullfrogs outcompete and prey upon California red-legged frogs and are a primary reason for the decline of this species. Any project effects that cause American bullfrog populations to increase would have direct and indirect adverse effects on California red-legged frogs. For example, project operation could indirectly affect California red-legged frogs by causing seasonally low-water surface elevation at the mouths of certain tributaries (coves) on Don Pedro Reservoir, which provide conditions that are suitable for American

bullfrogs. Their spread from Don Pedro Reservoir into the upper Tuolumne River could also threaten California red-legged frog habitat within the Core Area #6 (Tuolumne River), which occurs upstream of the project on Park Service and Forest Service lands.

The management of woody debris (e.g., trees and limbs) that floats down the Tuolumne River and accumulates in Don Pedro Reservoir could affect the recovery of California red-legged frogs. Stockpiling of logs and other woody debris within Don Pedro Reservoir provides artificial habitat for American bullfrogs. In recent years, the Districts and BLM have not agreed about the need for a burn permit and large mats of woody debris have accumulated along the reservoir shoreline. This would also provide artificial habitat for any California red-legged frogs that could disperse from the nearby Piney Creek Core Area, which could be injured during subsequent burning or removal of this debris. California DFW 10(j) recommendation M9-2 recommends that the TRMPs for both projects include provisions to avoid woody debris stockpiling and the burning of those piles. The Districts' proposed Woody Debris Management Plan for the Don Pedro Project does not mention of how they would avoid potential adverse effects on the California red-legged frog.

To minimizes the threat of death or injury to California red-legged frogs, FWS Don Pedro 10(j) recommendation 9 and California DFW 10(j) recommendation M4-4 both request that the Districts revise the plan to address safe and expeditious wood-removal in Don Pedro Reservoir when the volume exceeds 5,000 cubic yards of woody debris entering the reservoir in any one year. The recommended method would use an excavator placed on dry land and loading the wood from the water onto trucks. The wood would be hauled off-site promptly and transported to a lumber yard, chipping facility, or storage area for wood used in lower Tuolumne River salmonid habitat restoration. The Districts contend that additional protective measures for California red-legged frog during woody debris management activities are unnecessary due to the presumed extirpation of the species from the Don Pedro Project.

The Districts identified 17 sites that met the minimum criteria for California red-legged frog breeding habitats and were considered potentially affected by the Don Pedro Project operation and maintenance. Ten sites were located within or adjacent to the Don Pedro Dam spillway channel. Plunge pools and seepage pools that occur at the base of most dams are prime California red-legged frog habitat, and viable populations have persisted despite dams in other watersheds (FWS, 2002a). The Districts identified another seven sites that could potentially support California red-legged frog breeding that would be affected by project operations and maintenance activities, including six sewage treatment ponds near the project recreational areas and the Fleming Meadows swimming lagoon (HDR, 2013m). Most of the sewer treatment ponds have little to no emergent vegetation, but California red-legged frogs have been found in such habitats elsewhere (FWS, 2018a). Nevertheless, the Districts considered those sites to be marginal habitat due to their lack of dense emergent and overhanging vegetation and lack of suitable adjacent upland habitat.

FWS argued that protocol-level surveys are the only means to determine whether California red-legged frogs exist within the suitable habitats identified by the Districts. In their reply comments, the Districts state that they conducted a detailed assessment of habitat availability for federally listed amphibians, in accordance with the approved study plan for the Don Pedro Project. The Districts believe their studies were adequate to demonstrate that the Don Pedro Project offers extremely limited potential for the California red-legged frog and argue that FWS provides no data or analyses to refute this conclusion.

FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 state that the Districts should revise the Don Pedro TRMP and develop a La Grange TRMP within six months of license issuance to include protective measures for the California red-legged frog that include:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for the California red-legged frog.
2. Suppression or control of aquatic invasive species populations (bullfrog and crayfish), in collaboration with the resource agencies. Surveys should be conducted to determine the extent of their range within the project, assess their spread, and management actions to control their spread should be included in the plan.
3. Efforts to manage chytrid fungus, including survey efforts to determine its status within the project boundary, its vectors for movement, potential interactions between the disease and other stressors (such as pesticides, recreation, non-native species, and flows), and management actions to control its spread should be included in the plan.
4. Establishment of decontamination protocols in collaboration with BLM, FWS, and California DFW to ensure that any project activities that require movement from one waterbody to another have decontamination measures implemented (use protocols from Peek et al., 2017).
5. Provisions that any cut hazard trees or fuels reduction debris be removed within 24 hours, or be left in place in perpetuity, and not be stored within 1,000 feet of a wetland or riparian area, or core areas for federally listed species recovery.
6. Provisions to work with the resource agencies to develop additional minimization measures for when ground disturbance actions are planned within 300 feet of wetlands, riparian areas, critical habitat, or core areas for federally listed species recovery.
7. Provisions to minimize impacts from roads on California red-legged frog, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.

8. Monitoring and habitat surveys for the California red-legged frog to be conducted every three years, or as determined by the resource agencies.
9. Considering the California Red-Legged Frog Recovery Plan (FWS, 2002a) for inclusion of protective measures in the plan.
10. Direction for formal consultation with the FWS for any pesticides planned for use in the project.
11. Consultation with FWS for California red-legged frog during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the species.

The Districts did not reply to these specific conservation measures because they argue that additional protective measures for California red-legged frog management activities are unnecessary due to the presumed extirpation of the species from the Don Pedro Project.

California DFW 10(j) recommendation M9-2 specifies that the Districts' license applications are missing management actions to address potential adverse effects on California red-legged frogs. Specifically, it suggests that wood stockpiling and burning could result in take of California red-legged frogs and should be phased out and replaced with a rapid wood removal strategy that includes immediate off-site transport. As discussed above, they provide specific details for LWM management under California DFW 10(j) recommendation M4-4. The Districts replied that additional protective measures for California red-legged frog are unwarranted because their studies demonstrate that project effects on the species are limited or discountable, and that California DFW provides no data or analysis refuting their conclusions. The Districts contend that their proposed bi-annual environmental training and annual agency consultation would provide a path for new protection measures for California red-legged frog in the event they become established at either project.

In its non-concurrence letter, FWS reiterated that project activities like application of pesticides, burning of woody material, and vegetation management could affect California red-legged frog. FWS recommends the applicants avoid use of pesticides within 500 feet of suitable aquatic and upland habitat for California red-legged frog and reiterates its recommendation that that any cut hazard trees or fuels reduction debris be removed within 24 hours, or be left in place in perpetuity, and not be stored within 1,000 feet of a wetland or riparian area, or core areas for federally listed species recovery. However, FWS provides no new information to suggest that the statements in the recovery plan that this species has been extirpated from the Tuolumne River basin are outdated. Nor does FWS provide any evidence of planned reintroductions in the Piney Creek Core Area.

Our Analysis

The Districts conducted reconnaissance surveys of California red-legged frog habitat. Although this followed FWS (2005) protocol, the Districts did not conduct protocol-level surveys for the species within areas of suitable habitat in the Don Pedro or La Grange Projects. The Districts found suitable breeding habitat at 17 sites at the Don Pedro Project. The Districts thus cannot conclude that the species does not occur within either project. However, based on the evidence presented by the Districts' surveys and the recovery plan listing the frog as extirpated in the Tuolumne River basin (including both the Piney Creek and Tuolumne River core areas), we conclude that it is very unlikely that any California red-legged frogs occur in the Don Pedro or La Grange Projects. Therefore, project operation and maintenance, as well as non-routine ground-disturbing activities are not likely to affect the California red-legged frog or its habitat. These activities would include operation of the three recreational areas, facilities and road maintenance, vegetation management, woody debris management in Don Pedro Reservoir, new project construction and other ground-disturbing activities.

The potential adverse effects of pesticide use in proximity to suitable habitat for California red-legged frog is a valid threat, even if the species is absent from the Don Pedro and La Grange Projects. Given the lack of documented occurrences of California red-legged frog in the projects, BLM's recommendation to implement BMPs to avoid adverse effects from pesticide use within 500 feet of known locations of California red-legged frogs would be unnecessary. However, we agree that it would be a reasonable recommendation to limit potential effects on sensitive amphibians and reptiles within the projects. Pesticide drift has been documented as occurring nearly 100 feet away from its application (Segawa et al., 2001). Any potential adverse effects would be avoided by including BMPs in the TRMP to minimize potential for pesticides to affect non-target species and avoidance and minimization measures where project-related ground disturbance authorized by the license would involve heavy machinery within 300 feet of wetlands and riparian areas.

American bullfrogs are arguably the greatest threat to the recovery of California red-legged frogs. The Districts documented this invasive species as well established across all portions of the Don Pedro Project. For example, American bullfrogs were found in three of the pools in the spillway channel that were identified as suitable California red-legged frog breeding habitat and are likely present in other potential breeding habitats. American bullfrogs would be extremely difficult to eradicate due to their lack of predators, prolific breeding, and large dispersal ability. No effective American bullfrog suppression strategies exist, and successful bullfrog eradication is usually labor-intensive and costly, with methods not applicable to large, open aquatic systems or elimination of established populations (Adams and Pearl, 2007; Hull and Rushton, 2012; Kraus, 2009; Snow and Witmer, 2010). Furthermore, unless eradication programs are performed on a large enough area to encompass whole landscapes, their populations would recover. Such a large-scale effort in the Don Pedro and La Grange Projects would not be feasible to perform.

While we agree that an evaluation of the status of chytrid fungus[214] in the projects would provide useful information, FWS provides no details on how this evaluation would be used to inform project operation or indicate how the projects affect the spread of chytrid. Spread of the fungus between bullfrogs and red-legged frogs is a concern (FWS, 2002a) because red-legged frogs are susceptible to chytrid fungus infection, and although direct mortality has not been documented, this fungus likely has sub-lethal effects (Padgett-Flohr, 2008). However, as noted above, bullfrog control is not feasible. The Districts did not address the recommendation for decontamination protocols for project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus or other undesirable aquatic invasive species. Including procedures for decontaminating field equipment in accordance with appendix B of FWS (2005) to prevent spread of aquatic pests and disease between waterbodies in the plan would provide additional protections for California red-legged frog, as well as other fish and wildlife.

Lastly, vegetation management or other ground-disturbing activities, when carried out within 300 feet of a wetland or aquatic feature, could result in negative effects on California red-legged frog habitat. The proposed TRMP does not provide buffer distances or other minimization measures to protect wetlands and riparian areas from project activities. Including additional provisions, in consultation with the resource agencies, would be a beneficial measure to ensure that California red-legged frogs would not be affected. The Districts could also stockpile woody debris within suitable upland habitat or dispersal habitat, which could attract California red-legged frogs and cause them to be killed if the Districts burn or remove the debris. FWS recommends that adverse effects could be avoided by removing any fuels, slash, or hazard trees within 24 hours, leaving them in place or removing them the same day when cut, and not storing any debris within at least 1,000 feet of a wetland, riparian area, or critical habitat. However, based on the vegetation management practices proposed by the Districts and the lack of any known California red-legged frogs within the projects, this protective measure would not be necessary.

The Recovery Plan for the California Red-legged Frog (FWS, 2002a) identifies the following conservation needs in the nearby Piney Creek Core Area: "control bullfrogs, reestablish populations." However, as discussed above, bullfrog control is not feasible. Our analysis indicates that, although some suitable habitat exists and the Districts did not conduct protocol-level surveys, the species is very unlikely to occur within the project boundaries. The Piney Creek population is extirpated, and the Districts' surveys found no evidence of the species at the Don Pedro Project. Implementing measures to minimize the effects of vegetation management and pesticide usage on aquatic habitats and

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[214] The chytrid fungus (*Batrachochytrium dendrobatidis*) affects the skin of amphibians, causing a disease known as amphibian chytridiomycosis and has been linked to dramatic population declines in amphibian species across the United States.

reducing the possible spread of chytrid fungus by project staff, would avoid and minimize effects on California red-legged frog and its potential habitat within the projects. Therefore, we conclude that the proposed action for both the Don Pedro and La Grange Projects would have "no effect" on the California red-legged frog or its critical habitat.

California Tiger Salamander

California tiger salamanders occupy ground squirrel burrows for more than 10 months of the year. Without access to ground squirrel burrows, California tiger salamander populations are not able to persist. As discussed above, under *California Red-legged Frog*, the Districts' lethal control of ground squirrels and pocket gophers would cause California tiger salamanders to die from asphyxiation and lose protective habitat due to burrow collapsing after ground-squirrel control.

The Districts documented nearly 40 field-assessed sites that were characterized as potentially suitable for California tiger salamander breeding, 29 of which would be more favorable to breeding due to the presence of small burrows and upland habitat suitable for dispersal. Although no evidence of the species was documented by the Districts, FWS, in its 10(j) comments, suggests that they were not provided the opportunity to identify sensitive locations where California tiger salamanders were likely to occur in the Don Pedro Project. The Districts replied that FWS's statement that burrows within the project are "highly likely" to be occupied by California tiger salamander is speculative and unsupported by data. However, because suitable habitat is present, and protocol-level surveys were not conducted, it must be assumed that California tiger salamanders are present in the project.

The Districts determined that the Don Pedro Project would have "no effect" on the California tiger salamander. FWS claims this determination is incorrect, and FWS 10(j) recommendation 8 recommends that operation and maintenance activities for the projects should not proceed until consultation with FWS is concluded for the species. FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 state that the Districts should revise the Don Pedro TRMP and develop a La Grange TRMP within six months of license issuance to include protective measures for the burrowing wildlife, which include:

1. Protective buffers for use of pesticides, including rodenticides. Pesticide use should be avoided within suitable habitat for the California tiger salamander. Providing direction for formal consultation with the FWS for any pesticides planned for use in the project area.
2. Provisions that any cut hazard trees or fuels reduction debris be removed within 24 hours, or be left in place in perpetuity, and not be stored within 1,000 feet of a wetland or riparian area, or core areas for federally listed species recovery.
3. Provisions to work with the resource agencies to develop additional minimization measures when ground disturbance actions are planned within

300 feet of wetlands, riparian areas, critical habitat, or core areas for federally listed species recovery.

4. Provisions to minimize impacts from roads on California tiger salamander, developed in collaboration with the resource agencies. This should include potential measures for wildlife-friendly road crossings in the plan.
5. Monitoring and habitat surveys for the California tiger salamander to be conducted every three years, or as determined by the resource agencies.
6. Direction for formal consultation with the FWS for any pesticides planned for use in the project area.
7. Direction for consultation with FWS during the annual meeting with the resource agencies, which would ensure that the project is following the most current conservation guidelines for the California tiger salamander.

California DFW 10(j) recommendation M9-2 specifies that the Districts' license applications are missing management actions to address potential adverse effects on California tiger salamanders. It specifies that all rodent control measures should have avoidance of small mammal burrows occupied or potentially occupied by California tiger salamanders. The Districts replied that additional protective measures for California tiger salamanders are unwarranted because their studies demonstrate that project effects on the species are limited or discountable, and that California DFW provides no data or analysis refuting their conclusions. They argue further that their environmental training requirements and annual agency consultation would provide a path for new protection measures for California tiger salamander if they become established at either project.

In its non-concurrence letter, FWS filed additional recommendations for the protection of California tiger salamander during pesticide use and project-related construction activities. These measures include:

1. Only conduct project-related ground disturbance or vegetation management within 300 feet of suitable salamander breeding habitat during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions).
2. Only conduct project-related ground disturbance in suitable upland habitat between July 1 and October 15.
3. Avoid pesticide use within 500 feet of suitable aquatic and upland habitat for California tiger salamander.
4. Provide training from a biologist meeting FWS standards for all contractors, work crews, and on-site personnel.
5. Inspect all construction pipe, culverts, or similar structures that are stored at the construction site for one or more overnight periods before the pipe is subsequently moved, buried, or capped. If during inspection a salamander is

discovered inside a pipe, refrain from moving that section of pipe until the salamander has escaped on its own and contact FWS for further instruction.

6. Inspect all vehicles and equipment for the presence of salamanders prior to moving. If a salamander is found, refrain from moving the vehicle until the salamander has left voluntarily.
7. At the end of each work day, cover all excavated, steep-walled holes or trenches with plywood or similar materials or provide one or more escape ramps constructed of earth fill or wooden planks. Inspect such holes or trenches for trapped animals prior to filling. If at any time, a trapped salamander is located, cease all work in the immediate area until the animal leaves on its own or contact FWS for further instruction.
8. Refrain from using monofilament netting for erosion control measures in suitable habitat. Instead, use tightly woven (less than 0.25-inch diameter) biodegradable fiber netting or biodegradable coconut coir matting.
9. Avoid pesticide use within 500 feet of suitable aquatic and upland habitat for California tiger salamander.
10. Monitor work sites to ensure BMPs are implemented.

Our Analysis

Our review of the Districts' study report for California tiger salamander reveals inconclusive evidence that California tiger salamander would not be affected by project activities. The species is presumed to potentially occur within the Don Pedro Project boundary and implementation of protection measures would minimize project effects. Field assessments documented the minimum components of California tiger salamander at 38 field-assessed sites within 1.24 miles of the project boundary, including 22 within the project boundary. A total of 16 sites met the minimum criteria for California tiger salamander breeding and are potentially affected by project operations and maintenance. Thus, the study demonstrates that suitable habitat does exists in numerous locations at the Don Pedro Project. Furthermore, suitable California tiger salamander habitat was documented in proximity to the historic (2007) occurrence of the species within the project boundary. Those sites, south of Fleming Meadows Recreation Area, were not field-assessed, presumably due their location on private property (see map 14 of 18 in attachment B of HDR, 2013n). Adult California tiger salamander movements can extend as far as 1.3 miles to and from breeding ponds (Orloff, 2011). Several perennial ponds in the Don Pedro Project are within the dispersal distance of project activities (e.g., rodent control).

The granting of a new license for the Don Pedro Project could adversely affect California tiger salamander if they occur within ground squirrel burrows subject to rodent control. California tiger salamander could also experience adverse effects associated with any construction activity authorized by any license issued for the project that occurs

within suitable habitat for this species. As discussed above for San Joaquin kit fox, the Districts' rodent control activities include the occasional use of a Gopher X smoke and carbon monoxide-producing machine. California tiger salamanders spend most of their lives underground, usually in ground squirrel burrows, and depend on this habitat for cover and protection from desiccation. Without access to ground squirrel burrows, California tiger salamander populations are not able to persist. The reduction of ground squirrel populations would reduce the availability of burrows. California tiger salamanders could also die from asphyxiation if their burrows are smoked. However, this is one of the most effective and environmentally benign rodent control techniques because it has far fewer adverse effects on non-target wildlife.

The analysis suggests that potential adverse effects from the Districts' rodent control on California tiger salamander could be avoided if the Districts take measures to avoid small mammal burrows occupied or potentially occupied by salamanders. This is not possible because the Districts have not performed surveys for the presence of California tiger salamander in either project. As discussed above for burrowing owls and San Joaquin kit foxes, including provisions in the Don Pedro TRMP for checking ground squirrel burrows for occupancy by California tiger salamanders prior to rodent control would avoid any incidental take of salamanders. No rodent control activity occurs in the La Grange Project, so this potential effect would not be a concern. Conducting protocol-level surveys in accordance with FWS (2003), and instituting avoidance measures for any occupied or potentially occupied burrow, prior to any rodent control or ground disturbance activities that could destroy potential burrows would ensure the protection of California tiger salamanders. Furthermore, including a provision in the plan requiring the Districts to seek authorization from BLM for any rodent control on Federal land would further ensure appropriate avoidance of California tiger salamanders. Additionally, implementing BMPs in the TRMPs as FWS recommends to avoid use of pesticides within 500 feet of suitable aquatic and upland habitat for California tiger salamander would further reduce potential effects on this species.

Proposed construction activities include installing the infiltration galleries, constructing a trail from the old Don Pedro Visitor Center to La Grange Reservoir, and installing a fish barrier at the La Grange sluice gate channel. Habitat at the location of the proposed infiltration galleries is not likely to support California tiger salamander because the upland areas are extensively developed for agriculture and aquatic habitats support predatory fish species. Habitat along the proposed trail between Don Pedro Reservoir and La Grange Reservoir is also unlikely to support this species and because the trail would follow existing infrastructure development, little soil disturbance is anticipated. Installing a fish barrier in the La Grange sluice gate channel would include construction activities within potential habitat for California tiger salamander. Material storage and parked vehicles or machinery could provide shelter habitat for California tiger salamander. If salamanders were present when materials, vehicles, or machinery are relocated, injury or mortality could occur. Salamanders could also occupy holes or trenches that are left open overnight or be injured or killed during backfilling.

Salamanders could become ensnared in materials used for erosion control or be injured or killed during vegetation management activities occurring during periods when salamanders are most likely to be present. Modifying the La Grange TRMP to include FWS-recommended measures to train personnel; implement limited operating periods; monitor work sites; inspect construction materials, vehicles, and machinery prior to moving; and use recommended materials for erosion control in suitable habitat for California tiger salamander would minimize potential adverse effects associated with project-related construction activities. However, requiring stoppage of work to wait for observed animals to relocate on their own is unrealistic and poses a risk of workers either ignoring observations or moving animals without following proper handling procedures. Biological monitors would be on site and properly trained to relocate animals out of harm's way. Such relocation would prevent injury without requiring extended work stoppage periods. Based on this analysis, we conclude that the proposed action for both the Don Pedro and La Grange Projects "may affect, but is not likely to adversely affect," the California tiger salamander.

No critical habitat for California tiger salamander exists within the La Grange project boundary, and based on our analysis, we conclude that the indirect effects of the La Grange Project would not likely jeopardize the continued existence of California tiger salamander or result in the destruction or adverse modification of designated critical habitat in the nearby La Grange Ridge Unit.

Valley Elderberry Longhorn Beetle

Project operation and maintenance activities such as vegetation management, road maintenance, and other ground-disturbing activities could affect elderberry shrubs, which the threatened valley elderberry longhorn beetle requires for survival and reproduction. FWS assumes the valley elderberry longhorn beetle is present for any elderberry shrub located within a riparian area and uses exit holes to evaluate the site for occupancy when a shrub is in non-riparian habitat.

The valley elderberry longhorn beetle is the only federally listed animal for which environmental measures are proposed in the Districts' Don Pedro TRMP. The Districts would avoid injury to the valley elderberry longhorn beetle by following the FWS conservation guidelines for the species (FWS, 1999b), as attachment B of the Don Pedro TRMP. Protective measures would include a 100-foot avoidance buffer around potential elderberry shrubs with stems greater than 1 inch and providing for FWS consultation before any ground disturbance within the buffer area occur. If effects on elderberry shrubs are unavoidable, the guidelines also detail the appropriate methods for transplanting shrubs into a conservation area that would be protected in perpetuity. FWS 10(j) recommendation 8, for both Don Pedro and La Grange Projects, supports the Districts' adherence to these guidelines, but also recommends the Districts follow the *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle* (FWS, 2017a). FWS 10(j) recommendation 8 also states that project operation and maintenance should not proceed within valley elderberry longhorn beetle habitat until ESA

consultation with FWS is concluded for the species. The resource agencies otherwise generally agree that valley elderberry longhorn beetles are provided sufficient protections in the Districts' proposed license application.

The Districts did not perform surveys for valley elderberry longhorn beetle or prepare a draft BA for terrestrial species in the La Grange Project area. The Districts claim that their license application for the La Grange Project provides sufficient information for consultation purposes. They note that no study requests were made, or studies required, in the La Grange Project licensing process to investigate the presence of valley elderberry longhorn beetle.

Following issuance of the draft EIS, FWS filed a non-concurrence letter providing avoidance and minimization measures that it recommends implementing if elderberry shrubs are identified within 165 feet of activities that could damage or kill the shrub. These measures, which are listed in section 5.1 of the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a), include:

1. Flagging or fencing all avoidance areas as close to the construction limits as feasible;
2. Providing a 20-foot buffer from the elderberry shrub drip line for all activities that could damage or kill the shrub;
3. Providing training from a biologist meeting FWS standards for all contractors, work crews, and field personnel on the status of the beetle, its host plant and habitat, avoidance measures to avoid damaging elderberry shrubs, and possible penalties for noncompliance;
4. Providing a biological monitor who meets FWS standards to ensure all avoidance and minimization measures are implemented;
5. Limiting activities within 165 feet of elderberry shrubs during the valley elderberry longhorn beetle flight season (March through July);
6. Limiting any necessary trimming of elderberry shrubs to occur between November and February and avoiding the removal of any branches greater than 1 inch in diameter;
7. Prohibiting the use of herbicides within the drip line of elderberry shrubs;
8. Prohibiting the use of insecticides within 98 feet of elderberry shrubs;
9. Limiting all chemical applications to the use of a backpack sprayer or similar direct application method;
10. Limiting mechanical weed removal within the shrub dripline to occur between August through February; and
11. Removing flagging once work is complete.

Our Analysis

Project operation and maintenance activities that could affect valley elderberry longhorn beetle include brush control, mowing, and pesticides use for vegetation control around campsites, structures, and roadsides, and recreational use that causes trampling of vegetation. The most common observed potential stressors to surveyed elderberry plants included: proximity to roads and trails, affecting 19 occurrences; cattle grazing, affecting 18 occurrences; and noxious weeds, affecting 15 occurrences. Additionally, two elderberry occurrences were located directly next to sewage treatment plants and may be subject to disturbance by project operation and maintenance. The Districts' amended final license application and associated draft BA for terrestrial species in the Don Pedro Project include sufficient detail regarding potential effects on and conservation measures for valley elderberry longhorn beetle. Therefore, any additional modifications to the Districts' proposed protection of known occurrences of valley elderberry longhorn beetle host plants in the Don Pedro Project boundary would not be necessary. In addition, the Districts' Don Pedro TRMP proposes site-specific surveys for special-status plants prior to new ground-disturbing activities affecting more than 0.5 acre, which we assume would also identify any elderberry shrubs. Incorporating protective measures for the valley elderberry longhorn beetle in a La Grange TRMP would be necessary to protect the species from project effects.

According to the FWS Conservation Guidance (FWS, 1999b), surveys for valley elderberry longhorn beetle host plants are valid for two years. The resource agencies did not recommend additional surveys during the duration of the licenses, but new elderberry shrubs could become established within the project boundaries during the term of any license issued for both projects. Thus, the continued recovery of valley elderberry longhorn beetle would be better facilitated by recording occurrences of elderberry plants during the Districts' special-status plant surveys of both projects.

We have reviewed the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a) to evaluate potential effects of the Don Pedro and La Grange Projects on the valley elderberry longhorn beetle. If elderberry shrubs occur within 165 feet of project-related ground disturbances, adverse effects on the valley elderberry longhorn beetle may occur as a result of project implementation (FWS, 2017a). The Districts surveyed for elderberry shrubs within 100 feet of Don Pedro Project features, so it is possible that elderberry shrubs could exist within the non-surveyed area between 100 and 165 feet of project activities. Undocumented elderberry shrubs that could host valley elderberry longhorn beetles may also occur within the La Grange project. Although most project operation and maintenance activities would be unlikely to affect nearby elderberry shrubs, because ground disturbance would be localized, these activities could affect beetles dispersing from the plants. Surveys for elderberry plants within a larger radius (165 feet) around ground disturbances, as recommended by FWS (2017a), would update the Districts' proposed management of the species based upon the latest understanding of its ecology. If elderberry shrubs were identified, implementing avoidance and minimization measures as

described in section 5.1 of the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a) would reduce potential adverse effects on the beetle. Incorporating language in the TRMP that requires the implementation of these measures would ensure compliance.

Based on this analysis, we conclude that the proposed action for both the Don Pedro and La Grange Projects "may affect, but is not likely to adversely affect" the valley elderberry longhorn beetle.

Federally Listed Plants

Potential adverse effects on plants listed under the ESA in the Don Pedro Project would include recreation on lands within the Red Hills ACEC, the treatment of noxious weeds in their vicinity, and fluctuating Don Pedro Reservoir levels due to project operations. Because the Districts did not perform surveys for federally listed plants in the La Grange Project area, the potential effects on any possible occurrences are unknown.

The Districts determined that the Don Pedro Project would have "no effect" on the Layne's butterweed and the Red Hills vervain. FWS claims this determination is incorrect and FWS Don Pedro 10(j) recommendation 8 recommends that operation and maintenance activities for the projects should not proceed until consultation with FWS is concluded for these federally listed plants. The three Layne's butterweed occurrences were recorded at Kanaka Point, near a day-use area off Jacksonville Road. Due to multiple footpaths throughout the area, including one that runs within a few feet of two occurrences, these three occurrences are potentially subject to trampling by recreationists in the area. Also, two noxious weeds, distaff thistle and barbed goatgrass, occur in the general vicinity of numerous Layne's butterweed occurrences, which could spread quickly and threaten the persistence of Layne's butterweed. BLM commented that four yellow starthistle populations, which the Districts documented on Kanaka Point next to a day-use recreational area, are also in the same vicinity as Layne's butterweed populations. Furthermore, BLM contends that noxious weeds on Kanaka Point are an indirect effect of the day-use parking area off Jacksonville Road and threaten ESA species in the Red Hills ACEC. The Layne's butterweed occurrences near Poor Man's Gulch and Sixbit Gulch are also subject to other potential stressors, including grazing and recreation. FWS speculated that suitable Layne's butterweed habitat occurs along many roadsides and the species may be prevented from growing because the Districts would spray pesticides in these areas.

As discussed in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, *Special-status Plants*, operation of Don Pedro Reservoir would potentially affect one Layne's butterweed occurrence, which was located near the reservoir shoreline. Small portions of this population extended below the reservoir normal maximum surface elevation. The Districts note that the Layne's butterweed plants at this site are not adversely affected by current operations but could be affected by substantial changes in the duration or timing of inundation. FWS 10(j) recommendation 8 notes that, because

Layne's butterweed can be killed or destroyed if inundated for too long, this potential threat from Don Pedro Reservoir's operation should not be discounted. The Districts reply that only a portion of the affected Layne's butterweed population could be affected by substantial changes in the duration or timing of inundation, but that no such changes are expected under a new license.

Our Analysis

Noxious weeds were documented as potentially threatening populations of Layne's butterweed. Six of the smooth distaff thistle populations that the Districts propose to treat with pesticides are in the general vicinity of three occurrences of Layne's butterweed (within 250 feet of one occurrence), located on Kanaka Point. For this reason, the resource agencies recommended an emphasis on manual control of noxious weeds in areas where special-status plants are likely to occur. The co-location of noxious weeds in proximity to federally listed plants could also occur in other locations not documented by the Districts' surveys. As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Noxious Weeds*, the analysis supports the benefits of emphasizing manual control over chemical usage in areas where special-status plants, including those listed under the ESA, are likely to occur. Furthermore, under *Special-status Plants*, we discussed the benefits of flagging or fencing around special-status plants prior to any vegetation management activities. This would also apply to federally listed plants to ensure that the treatment of smooth distaff thistle and other noxious weeds does not adversely affect Layne's butterweed, or other federally listed plants.

Because human recreation, such as hiking, horseback riding, and motorized vehicle use, is known to threaten occurrences of Layne's butterweed and Red Hills vervain, it would be prudent to better manage public access in these areas. As described in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Special-status Plants*, we support the installation of signage that informs visitors of their potential effects on special-status plants in the Red Hills ACEC. Increasing public awareness with signage could effectively reduce effects, but the issue should be monitored by the Districts in coordination with BLM. If adverse effects were to increase, future measures such as fencing may be needed to protect some populations of federally listed plants in the Red Hills ACEC. Because some adverse effects associated with future increases in project-related recreation are possible, we conclude that the Don Pedro Project "may affect, but is not likely to adversely affect" Layne's butterweed and Red Hills vervain. Because neither Layne's butterweed nor Red Hills vervain are expected to occur within the La Grange Project area, the La Grange Project would have "no effect" on either species.

Although no surveys for federally listed plants were conducted at the La Grange Project, records indicate one species, Hartweg's golden sunburst, as historically occurring within the La Grange USGS quad. However, these occurrences would comprise one of two known locations of the species in Tuolumne County, from 1937 and 1963, for which no field work has been done to verify the presence or location of the species (FWS, 2007b). Suitable habitat (mima mounds) is not known to occur within the La Grange

Project area. Furthermore, potential effects are unlikely due to the lack of public roads or recreation within the project area. Therefore, we conclude that the La Grange Project would have "no effect" on the Hartweg's golden sunburst. As we discussed for *Special-status Plants*, conducting a survey for special-status plants following California DFW protocols at the La Grange Project and performing pre-construction surveys following FWS and/or California DFW protocols prior to any project-related ground disturbance where suitable habitat exists, would provide for any conservation measures needed to ensure that the project has no effect on federally listed plants.

3.3.5 Recreation

3.3.5.1 Affected Environment

The Don Pedro and La Grange Projects, located on the Tuolumne River in Tuolumne and Stanislaus Counties, California, provide diverse and substantial recreation opportunities. Regional recreational resources near the projects extend from the crest of the Sierra Nevada Mountain range to the San Joaquin Valley of central California. Federally managed public lands along the Tuolumne River along and upstream of the Don Pedro Reservoir, include the BLM-managed Red Hills Recreation Area, Stanislaus National Forest, and Yosemite National Park, which provide extensive opportunities for many popular recreational activities, including hiking, camping, fishing, and whitewater boating in forested, mountainous settings that have little to no development. Downstream of La Grange Diversion Dam, which is located about 2 miles below Don Pedro Dam, the lower Tuolumne River provides opportunities for fishing, swimming, and low gradient or flat-water boating in rural and urban settings with evidence of agricultural use and gravel mining occurring along much of the river corridor.

Other large reservoirs near the projects include New Melones Reservoir, located to the north on the Stanislaus River, and Lake McClure and Lake McSwain, located about five miles to the south on the Merced River. Similar to the project reservoirs, these large reservoirs are situated in the Sierra Nevada foothills and provide settings for many recreational activities including flatwater boating, fishing, developed camping and day use, hiking, and bicycling. Several whitewater boating runs exist upstream of these reservoirs, and portions of the Tuolumne and Merced Rivers upstream of Don Pedro Reservoir and Lake McClure, respectively, are designated wild and scenic rivers. State Highway 49 (known as the Golden Chain Highway), a 317-mile state highway that is eligible for state scenic highway designation, also crosses the Tuolumne River at the upstream end of Don Pedro Reservoir. This route is popular for scenic driving through river canyons and touring small historic towns established during the gold rush-era in the Sierra Nevada Mountains (Sierra Nevada Geotourism, 2018).

Access to the lower Tuolumne River downstream of La Grange Diversion Dam for non-motorized, recreational river boating is available at eight public put-in and take-out locations located on the 46-mile reach from La Grange to Shiloh Bridge Fishing Access (west of Modesto). Points of public access within about 15 miles downstream of Don

Pedro Dam include Old La Grange Bridge, Basso Bridge, and Turlock State Park. This valley section of the Tuolumne River is scenic and an excellent beginner boating run. The river gradient is low but has many riffles, narrow channels, and sharp turns. Although minor maneuvering skills are necessary to avoid the occasional obstacle, it is a very forgiving stretch of water (American Whitewater, 2017). The Districts' 1995 Settlement Agreement that increased flows from the project to the lower Tuolumne River to protect aquatic resources also benefits boating use. Boater responses provided in *Lower Tuolumne River Lowest Boatable Flow Study Report*, indicate a flow of 200 cfs, as measured at the La Grange gage, provides the lowest boatable flow for canoes and hardshell and inflatable kayaks (HDR, 2013o). HDR (2013o) concludes that water hyacinth mats completely spanning the river in 2012 at two locations between Riverdale Park and Shiloh Bridge likely contributed to low boatability scores for a flow of 175 cfs. In 2015, water hyacinth mats completely spanning the river occurred as far upstream as the 7-11 gravel bridge near RM 37 (California DFW, 2019).

Whereas regional demand for recreation opportunities is reflected in the percent of the population participating in different recreational activities, population growth is the most determinant factor influencing future recreational demand. Project visitors most often reside in Stanislaus, Merced, Tuolumne, San Joaquin, and Santa Clara Counties. With the exception of Tuolumne County, which is only anticipated to see a 2 percent change in growth, these counties are expected to grow by 35% or more by 2050 (California Department of Finance, 2018). Because project visitors reside in high-growth counties, demand for the full spectrum of rural types of recreational activities, such as camping, hiking, boating (flatwater and whitewater), wildlife viewing, and fishing, are expected to similarly increase.

The county general plans for Tuolumne and Stanislaus Counties (see section 3.3.6, *Land Use and Aesthetics*), applicable to the area where these projects are located, contain general guidance for providing public recreational facilities, including funding for their acquisition, construction, operation, and maintenance. The Sierra Resource Management Plan (BLM, 2008a), BLM manuals, and Tuolumne Wild and Scenic River Management Plan (Forest Service, 1988) contain specific recreational resource management objectives applicable to the public land the agency manages within and adjacent to the projects' boundary.

- Provide for quality day-use and overnight recreation opportunities associated with the projects, and ensure that other resources are not adversely affected by this recreational use;
- Ensure adequate river flows for boating, fishing, swimming, and other water contact recreation;
- Ensure project-related facilities meet current BLM design standards and standards for accessibility;
- Provide a safe recreational experience for the public;

- Provide public safety information at project reservoirs and primary river recreational access points;
- Provide an administrative presence during the public recreation and whitewater boating season;
- Ensure licensees provide for, and are responsible for, project-related recreation, including providing facilities, long-term maintenance, and periodic heavy maintenance;
- Post appropriate signs, including interpretive signs; and
- For project-affected reaches and reservoirs, provide streamflow and reservoir level information that is available to the general public and adequate for river and reservoir recreational use.

Don Pedro Project

Don Pedro Reservoir

Don Pedro Reservoir, which is primarily operated as a storage reservoir, has a normal maximum surface area of slightly less than 13,000 acres at the normal maximum water surface elevation of 830 feet. After achieving peak storage, which typically occurs sometime between early June and early July, the water level is gradually drawn down until its lowest elevation is reached in mid-winter. By October 7 of each year, the reservoir must be lowered to at least elevation 801.9 feet to provide capacity for flood control storage. Current operating protocols permit reservoir drawdown to elevation 600 feet, at which point boating access to the reservoir upstream of old Don Pedro Dam (located at RM 56.4, 1.6 miles upstream of Don Pedro Dam) becomes limited. The Districts report that since its construction, the reservoir has been operated between 690 and 830 feet, depending on hydrologic conditions and water management factors. However, data recorded at the USGS gage on Don Pedro reservoir indicate that between 2015 and 2016, during California's recent 5-year drought, the reservoir elevation lowered to less than 690 feet (figure 3.3.5-1).

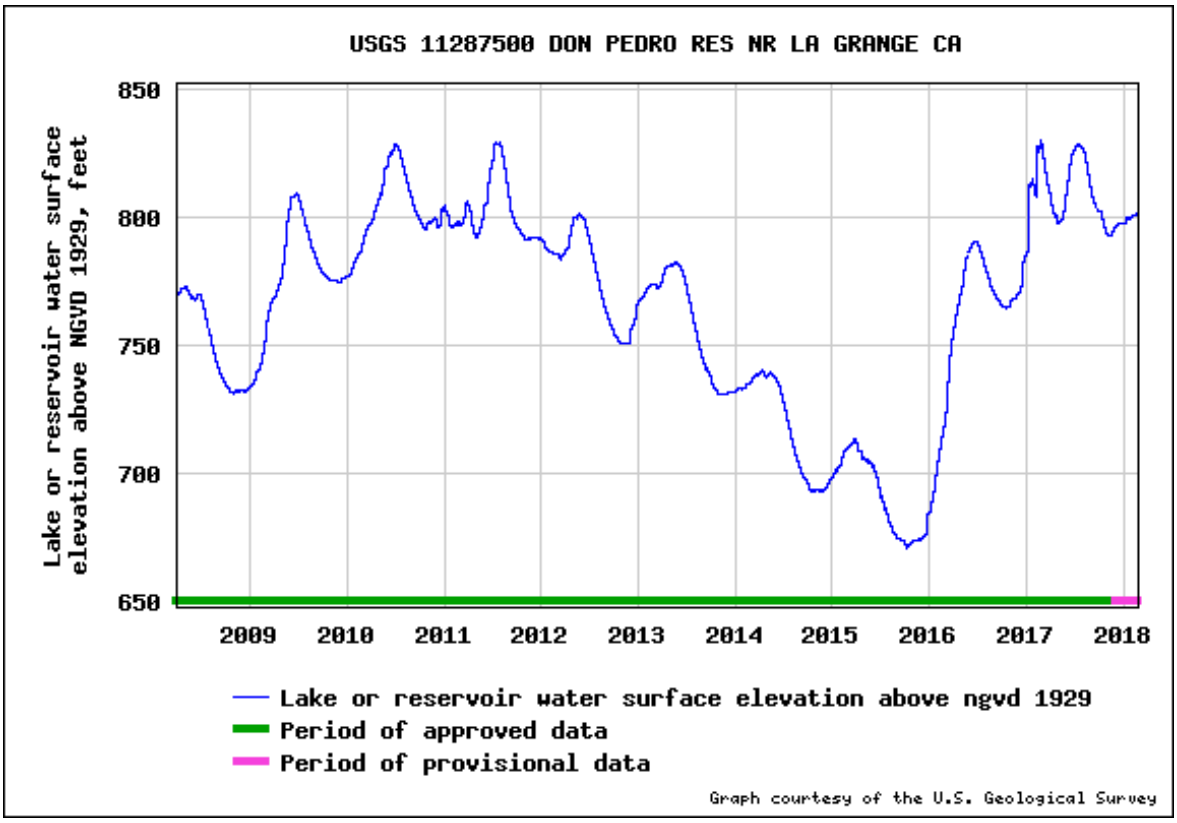

Figure 3.3.5-1. Don Pedro Reservoir water surface elevation, 2008 to 2018 (Source: USGS, 2018m).

Recreation Facilities

The three recreation areas located at Don Pedro Reservoir have many amenities provided for visitors' comfort such as paved roads, flush restrooms, showers, and campsites with recreational vehicle hookups. Facilities to support recreational activities, such as volleyball and baseball, are also provided. The recreational areas include Moccasin Point, Blue Oaks, and Fleming Meadows. Figure 3.3.5-2 shows the locations of these recreational areas, and table 3.3.5-1 lists the amenities provided at each development.

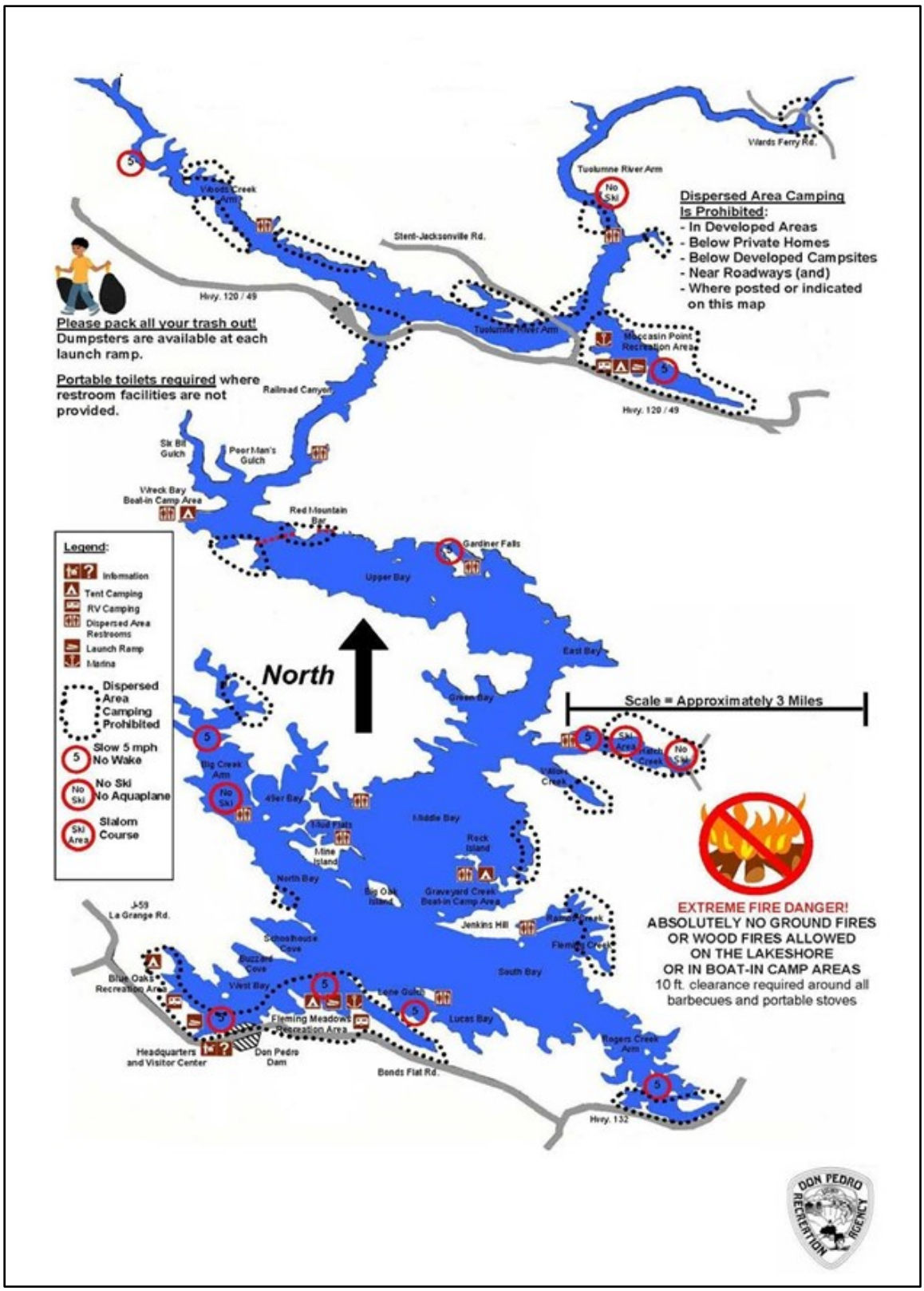

Figure 3.3.5-2. Recreation areas, amenities, and use restrictions at Don Pedro Reservoir (Source: Districts, 2017a).

Table 3.3.5-1. Capacities and amenities provided at developed recreational areas at Don Pedro Reservoir (Source: Districts, 2017a).

Amenities	Moccasin Point Recreation Area	Blue Oaks Recreation Area	Fleming Meadows Recreation Area
Camping units, total	96	195	267
With water and electric hookups	18	34	90
Picnic areas, total	2	1	2
Group picnic sites	1	1	1
Boat launch ramp	1	1	1
Fish cleaning stations	1	1	1
Restrooms, total	8	11	14
With hot showers	3	5	5
Additional On-site Recreation Amenities			
Concession store	Yes	No	Yes
Swimming lagoon	No	No	Yes
Volleyball/softball area	No	No	Yes
Marina	Yes	No	Yes
Amphitheatre	No	No	Yes
Houseboat mooring	Yes	No	Yes
Boat rentals	Yes	No	Yes
Houseboat rentals	Yes	No	Yes
Boat repair yard	No	Yes	No
Gas and oil	Yes	No	Yes
Sewage dump station	Yes	Yes	Yes

Don Pedro has approximately 160 miles of shoreline, including islands. The three developed recreational areas occupy less than 10 percent of the reservoir shoreline, and the remaining shoreline is undeveloped. Dispersed boat-in camping and day use is permitted, with some exceptions, along much of the undeveloped portions of the shoreline. Wreck Bay has six boat-in campsites, each with a picnic table and two restrooms. Eight floating restrooms and three vault restrooms are located around the

shoreline at areas with high visitor use, and an additional vault restroom is provided near Ward's Ferry Bridge.

The Districts report that, in general, the recreational facilities are in excellent to good condition. Individual components of the recreational facilities that are in fair and poor condition include:

- Fleming Meadows—marina access road and parking area, water faucets and fountain, and restrooms (loops A and D and entrance station), and sign;
- Blue Oaks—boat launch parking area (main), water faucets, tables, boat launch, restrooms (concrete roof support structures), and signs; and
- Moccasin Point—roads, marina parking lot, campsite spurs, food lockers, water faucets, trash receptacles, restroom (concrete roof support structures), and signs;
- Wreck Bay Boat-in Campground—restroom and signs; and
- Floating and dispersed restrooms—Exterior surfaces, roofs, and toilets.

Most, but not all, components of the three recreational areas are inaccessible to persons with disabilities. Most commonly identified inaccessible site components include campsites, picnic areas, water faucets, restrooms, roads, and parking areas. Campsites and restrooms at Wreck Bay Boat-in Campground and all floating and dispersed restrooms do not meet accessibility requirements.

Several hiking and biking trails are within, or partially within, the project boundary. Red Hills is a region of 7,100 acres of public land with about 17.3 miles of trails located just south of the historic town of Chinese Camp and immediately east, west, and northwest of the Railroad Canyon and Woods Creek arm of Don Pedro Reservoir. Common visitor activities include hiking, horseback riding, wildflower viewing, birding, mountain biking, and some limited hunting. Within the project boundary, scenic biking and hiking is available on the Shoreline Trail that extends between Blue Oaks Recreation Area and Buzzard Point (figure 3.3.5-3). The Districts are responsible for maintaining this 5.9-mile project trail, and the existing condition is unknown.[215]

[215] This trail is used for project operation and maintenance and non-motorized recreation. Although the Districts report the condition as "4WD and/or ATV passable" (Districts, 2017f), this description does not indicate whether the trail is properly maintained. The Districts also cite inconsistent lengths for this trail among various license application documents.

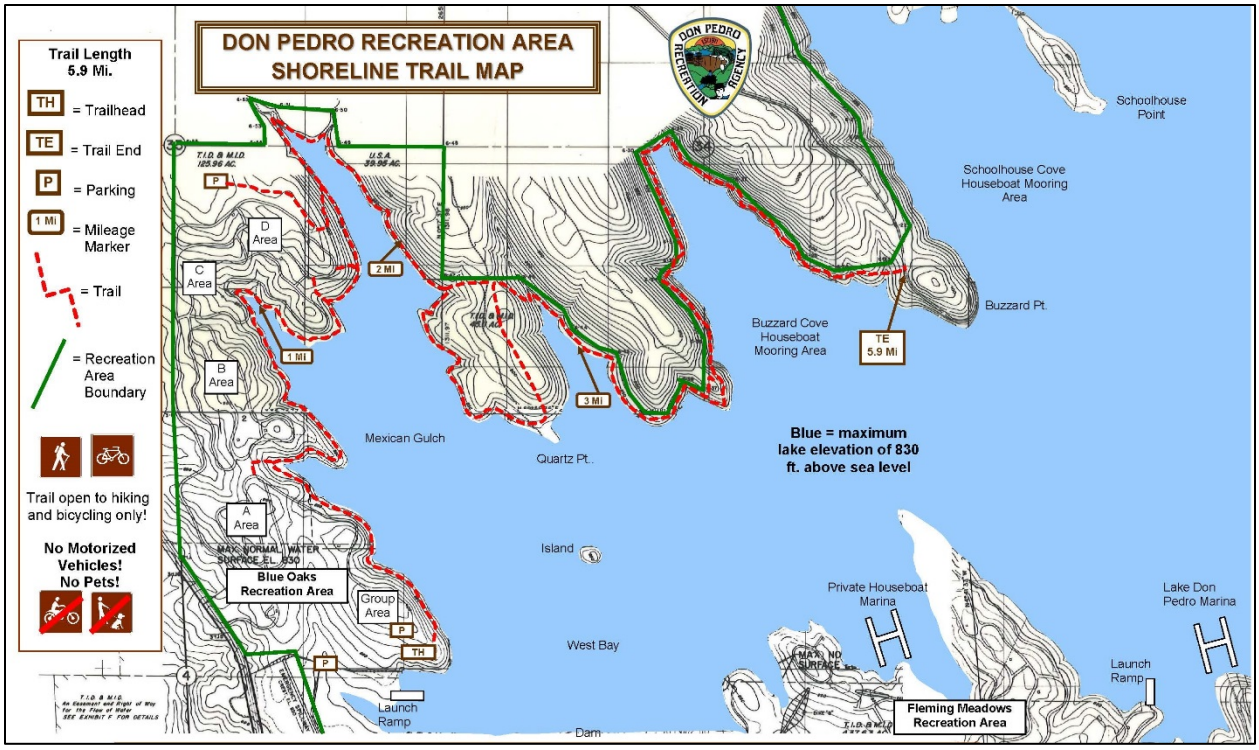

Figure 3.3.5-3. Shoreline trail at Don Pedro Reservoir (Source: Districts, 2017f).

Ward's Ferry Bridge, which crosses the Tuolumne River at the upstream end of Don Pedro Reservoir, is the downstream terminus for whitewater boating on the reach known as the Meral's Pool run (figure 3.3.5-4). The Forest Service manages commercial and private boating use on this reach, allowing 52 commercial boaters and 96 private boaters on the upper Tuolumne River each day. The estimated annual whitewater boating use from 2003 to 2012 on this reach was about 4,225 boaters. During the boating season, generally from May to October, commercial outfitters temporarily park as many as three truck cranes on the bridge to retrieve boats from the river. This area is on BLM-managed lands within the project boundary; however, Tuolumne County owns and maintains the road and bridge. Access to the shoreline is available at all river flows and water levels, although access at low water levels is challenging because of steep banks in a narrow canyon, and the unconsolidated surface at an elevation of about or less than 810 feet. Under the terms of the current license, the Districts maintain a restroom on the shoulder of Ward's Ferry Road near the south end of the bridge (river left). Despite the appearance of graffiti, the Districts report the building is in good condition. The area is not regularly patrolled, and the Districts report regularly occurring problems of vandalism and vehicle break-ins.

Figure 3.3.5-4. Whitewater boating take-out location and restroom at Ward's Ferry Bridge (Source: Google Earth; Districts, 2017a)

The Districts' recreation map (see figure 3.3.5-2) shows a visitor center and headquarters near the west end of the dam. The Districts report that the building was destroyed by a fire in 2016, and they plan to construct a new headquarters and visitor center near the entrance to Fleming Meadows Campground. The building was a Don Pedro Project recreation-related resource under the existing license.[216]

Recreation Visitation

Don Pedro Reservoir is a major recreational destination in the region, having an estimated annual visitation of 262,309 of visitor-days in 2012. By 2050, the Districts anticipate annual visitation to increase by 35 percent to 384,224 visitor-days. Seventy percent of the annual visitation to the project occurs during June, July, and August; however, the typically mild climate during other months provides suitable conditions for year-round recreational use.

Projected use at Fleming Meadows Recreation Area through 2050 is not expected to exceed the capacity of the campgrounds, picnic areas, and parking areas, except for the houseboat marina parking facility. In 2012, the peak season weekend occupancy at the houseboat marina parking area was greater than 80 percent and is projected to exceed capacity by 2020. The level of use correlates to the number of marina slips; however, marina expansion is not proposed at this time. The high level of existing use is attributed to marina users seeking to park as close to the marina as possible. Projected use at Blue Oaks Recreation Area through 2050 is not expected to exceed the capacity of the campgrounds, picnic areas, and parking areas (including boat launch and group picnic area parking). Projected use at Moccasin Point Recreation Area through 2050 is not

[216] See footnote on page 3-349 and table 3.7-11 on page 3-356 of the amended license application (Districts, 2017a).

expected to exceed the capacity of the campgrounds, picnic areas, and parking areas, except for the marina and group picnic parking facilities. In 2012, peak weekend occupancy of 115 percent at Moccasin Point marina parking area exceeded the facility capacity. The parking area for the group picnic area is expected to exceed the existing capacity by 2020, while occupancy at the other three parking areas is projected to be sufficient through 2050.

Recreational Activities

The most popular recreational activities at the project include fishing, boating, and camping. Don Pedro Reservoir supports year-round fishing for coldwater and warmwater species, and it is a popular location for fishing tournaments. California DFW manages the Don Pedro Reservoir fishery as a put-and-grow resource with substantial stocking. Boating on the reservoir is associated with a wide spectrum of activities including watersports (e.g., wakeboarding), fishing, kayaking, canoeing, personal watercraft use, windsurfing, and sailing. Commercial marinas at the reservoir provide boat rentals, repairs, docks, and moorings. Developed recreational facilities (table 3.3.5-1) provide abundant opportunities for overnight and day-use activities.

Dispersed use (both day and overnight) is permitted along the majority of the undeveloped Don Pedro Reservoir shoreline; however, use of some shoreline areas is restricted near developed recreational areas, roads, near-shore hazards, and adjacent to private land. Twenty-three discrete locations showing signs of recurrent dispersed shoreline recreational use were documented within the project boundary. The majority of the sites (70 percent or 16 sites) showed *low* impact; five sites (22 percent) showed *moderate* impact; and two sites (8 percent) showed *high* impact.[217] The Districts routinely patrol and maintain these shoreline areas.

Recreation Needs

The Districts investigated needed improvements and changes related to recreational resources in Study RR-01, *Recreation Facility Condition and Public Accessibility Assessment, and Recreation Use Assessment* (HDR, 2013d). In addition to conducting facility condition assessments, which is discussed above, the Districts

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[217] *Low*-impact sites either showed low or no sign of use impact or only a few minimal impacts. *Moderate*-impact sites had one to three signs of use impact with at least a few signs of litter and toilet paper, but also some unauthorized tree cutting, large areas of bare/compacted ground and/or user-created trails. *High*-impact sites had four or more signs of use impact but had significant or widespread impacts such as toilet paper (more than five occurrences); large areas of bare/compacted ground with trampled vegetation; user-created trails; and/or a fire ring without adequate clearance (Districts, 2017a).

surveyed project visitors about their perceptions, preferences, and desired changes relative to recreational facilities and management.

The Districts investigated potential effects such as shoreline/beach access, scenic quality, and boat use that could be affected by reservoir elevation; however, the survey responses indicate most visitors did not experience reservoir elevation-related problems. The most frequent responses for an individual effect as being *a large problem* accounted for no more than 6 percent of the responses for any given type of potential effect. The problems associated with these few responses related to the scenic quality of the shoreline, shoreline/beach access, and ability to launch and use a boat.

Study results indicate that only about 10 percent of visitors experienced some event or circumstance that conflicted with their recreational activity. The most common user conflicts were related to inappropriate behavior (e.g., noise and speeding watercraft) and were not the result of overlapping types of recreational activities. Most survey respondents said they either felt *not at all crowded* or *slightly crowded.* However, 17 to 78 percent of the visitors surveyed did not think the survey question about crowding at various locations was applicable to their visit. Of those few visitors who felt crowded, most did not modify their behavior, and the remainder moved to another location to avoid feeling crowded. Regarding water surface congestion, about 70 percent of the visitors perceived little to no crowding on the reservoir. Anglers' responses were similar with 76 to 81 percent saying they did not feel at all crowded.

Survey responses indicate a high level of satisfaction with the condition of the existing recreational facilities, but visitor responses indicate some needed improvements. Notable visitor comments about facility needs include: leveling or widening campsites; providing additional amenities such as lighting, electricity, restrooms, showers, food storage lockers, and trash receptacles; better facility cleaning and maintenance; improving directional signage; providing interpretive and educational signage; providing more parking/wider spaces; and providing or improving pedestrian shoreline trails.

The 2015 Statewide Comprehensive California Outdoor Recreation Plan was developed for all local agencies within California. It serves as a guide for all public outdoor recreation in urban and rural neighborhoods, cities, and regions, and provides a strategy for statewide outdoor recreational leadership and actions to meet the state's identified outdoor recreational needs (California DPR, 2015b). The plan lists broadly scoped actions including:

- Inform decision-makers and communities of the importance of parks;
- Improve the use, safety, and condition of existing parks;
- Use GIS mapping technology to identify park deficient communities and neighborhoods;
- Increase park access for Californians including residents in underserved communities; and

- Share and distribute success stories to advance park and recreational services.

Although the Statewide Comprehensive California Outdoor Recreation Plan does not make any specific recommendations about lands at or near the project, the Statewide Comprehensive California Outdoor Recreation Plan reports the results of the Survey on Public Opinions and Attitudes on Outdoor Recreation in California, 2012 (California DPR, 2014), which characterize Californians' recreational preferences and trends. Some of the relevant results from this survey are summarized below:

- During the past 12 months Californians mostly participated in picnicking (70.4 percent), walking (63.8 percent), beach activities (52.8 percent), shopping at farmers' markets (49.5 percent), and swimming in a pool (48.2 percent).
- The respondents would like to participate more often in picnicking (55.1 percent), walking (37.4 percent), camping (35.1 percent), and beach activities (34.6 percent).
- Few (7.9 percent) of the respondents reported engaging in off-road motor vehicle use once a month or more. Nearly 20 percent (18.2 percent) of respondents reported ever using an off-road vehicle in the last 12 months.
- The most important facilities were wilderness type areas with no vehicles or development; play areas for children; areas for environmental and outdoor education; large group picnic sites; recreational facilities at lakes, rivers, and reservoirs; and single-use trails.
- More than 60 percent of Californians thought more emphasis should be placed on protecting natural resources, maintaining park and recreational areas, protecting historic resources, and cleaning up pollution of oceans, lakes, rivers, and streams in park and recreational areas. About one-third of respondents felt that less emphasis should be placed on providing opportunities for motorized vehicle operation on dirt trails and roads.
- A majority of respondents (55.2 percent) reported spending between 5 and 10 minutes walking to the place they most often go to recreate. Meanwhile, a majority of respondents (54.5 percent) reported spending between 11 and 60 minutes driving there.
- The activities youth would like to participate in more often included horseback riding (50.2 percent), camping (47.1 percent), mountain biking (46.3 percent), and backpacking (46.3 percent).

La Grange Project

Project Recreation Resources

The 2-mile-long La Grange Reservoir is located in a narrow canyon between Don Pedro Powerhouse and La Grange Diversion Dam; recreational facilities and formal

public access points are not provided. The upper two-thirds of the reservoir is riverine in nature and the entire shoreline is undeveloped. Downstream of La Grange Diversion Dam, pedestrian access for fishing and other activities is available via La Grange Dam Road, which is gated near where the main canal crosses Highway 132. Visitors to the reservoir also gain access by walking and wading upstream from a public access point in the town of La Grange near the Old La Grange Bridge. Safety signs posted near the dam and powerhouse warn users of potential hazards.

The La Grange Diversion Dam is located at the exit of a narrow canyon, and the spillway, which spans between the two canal intakes, cannot be portaged because of steep canyon walls. The project operates in a run-of-the-river mode, and changing flows entering the reservoir from the Don Pedro Powerhouse have the potential to rapidly change the water level. When not in spill mode, the water surface elevation is between 294 and 296 feet about 90 percent of the time.

Recreation Needs

Although public use is not currently prohibited, recreational use is almost non-existent at the reservoir because of private landownership, steep topography, and public safety issues. The Districts conducted the Recreation Access and Safety Assessment Study to provide information about the adequacy of public access to support future recreational use (HDR, 2017f). The study report discusses the risk associated with various recreational activities (e.g., motorized and non-motorized boating, fishing, hiking, and swimming) that could take place on the reservoir and in the reach downstream of La Grange Diversion Dam.[218] The Districts determined that all these activities pose either a high or medium risk to public safety. The Districts' access assessment determined it may be possible to accommodate public shoreline use for land-based activities upstream of the La Grange Diversion Dam on river right at approximately RM 53.3 by constructing a non-motorized trail originating near the top of Don Pedro Dam, provided that public safety and project security concerns could be addressed. The Districts determined providing public access in the vicinity of the La Grange Diversion Dam and intakes is not appropriate because of project operation and infrastructure.

3.3.5.2 Environmental Effects

The projects provide suitable settings for various recreational activities that attract visitors, and if unmanaged, could affect environmental resources (e.g., soil erosion, vegetation removal). Additionally, consistent with Commission regulation 18 CFR § 2.7,

[218] The study area extended from RM 51.2 (which is approximately 0.25 mile downstream of the La Grange gage) upstream to Don Pedro Dam, located at RM 54.8 and included any potential public access ways that may be reasonably safe and feasible along the river left (east) and river right (west) banks of the Tuolumne River along this reach.

licensees are responsible for developing, operating, and maintaining suitable public recreational facilities providing public access, where appropriate, and informing the public of opportunities for recreation at licensed projects. Appropriate measures to address these issues consider the recreational needs of the area and effectiveness for minimizing or eliminating potential recreation-related effects on environmental resources.

The Districts propose one recreational measure that involves both projects—to construct and maintain a pedestrian trail extending between the parking area of the former visitor center located adjacent to the Don Pedro Dam and the shoreline of the La Grange Reservoir near the Don Pedro spillway channel. All other proposed measures are specifically related to individual projects.

Recreation Resource Management

The Districts propose to implement their RRMP[219] for the Don Pedro Project. The plan would address the development of new facilities downstream of Geer Road near RM 25 for non-motorized boating access and public viewing at a proposed fishway and counting window. Developing additional unspecified facilities during the license term would be based on need as determined by periodic monitoring. The plan states the Districts would be responsible for operating and maintaining: (1) three existing recreational areas with campgrounds, day-use areas, and boat launches; (2) areas with limited infrastructure (e.g., floating restrooms and boat-in campsites); and (3) areas receiving recurrent dispersed recreation that have no infrastructure. The Districts propose to report annual use every six years and summarize visitor survey responses collected every 12 years to assess recreational facilities and visitor needs and preferences. The report filed every 12 years would also recommend, for Commission approval, facility modifications, closures, or new facilities and include a proposed implementation schedule and a determination of whether the existing plan needs to be updated.

BLM Don Pedro revised 4(e) condition 14 would require implementing the Districts' plan as revised by BLM to: include information about facility condition and accessibility; include a GIS map showing landownership at recreational facilities; categorize Ward's Ferry as a developed, multi-use recreational facility; add text with guidance for constructing and reconstructing facilities on BLM-managed lands; consult BLM to develop visitor survey questions; and consult BLM about the need for updating the plan.

[219] Filed as appendix E-7 of the amended license application for Don Pedro Project.

Our Analysis

The proposed RRMP for the Don Pedro Project lists the existing project recreational facilities and their amenities and contains maps showing their locations. The plan thoroughly explains the Districts' responsibility for operating and maintaining campgrounds, day-use areas, and areas with few or no site amenities, and states that the Districts would ensure these project recreational facilities are safe and functional through the license term. However, because the plan does not identify the Don Pedro shoreline access trail, which is partially located on BLM-managed land, as a project facility, or describe the Districts' responsibility for operating and maintaining the trail, it is not clear whether safe and adequate public access to the project reservoir would be provided throughout the term of a new license. Consistent with study results that indicate the existing campgrounds and day-use areas have capacity to meet expected demand, the Districts do not propose constructing additional facilities for day and overnight use. The plan includes a monitoring component whereby the Districts would consider changes or revisions to the plan in response to visitor use data it compiles and reports every 12 years. Although an adaptive approach would respond to future trends, the plan does not describe any threshold or condition that would need to be met or specify how BLM (the public land manager) would be involved in the review to determine the need for additional facilities or a plan revision. Including this element in the plan would ensure agency objectives and land management guidance are incorporated into planning for project recreational development on public land.

Monitoring recreational use through the license term would document whether project visitor needs are being met and identify recreational use-related effects. The schedule and monitoring elements proposed in the plan would provide reports of annual recreational use at 6-year intervals. The reports would adequately describe recreational use, but because the plan does not specify regular and frequent agency consultation, project recreational management, actions, or adjustments that may be necessary to address recreational effects and visitor use needs could be delayed for up to 12 years—the minimum frequency stated in the plan for consulting with agencies. The effects of delaying necessary actions could result in health and safety issues at project recreational facilities and diminish the quality of visitors' experience.

Land management agency coordination is also a missing component of the plan with regard to constructing or reconstructing recreational facilities located on BLM-managed public land and designing visitor use surveys. BLM's Don Pedro revised 4(e) condition 14 specifies including text describing construction and reconstruction guidance on public land that would ensure project recreational facilities are designed and constructed consistent with BLM policies and regulations. Developing visitor survey questions in consultation with BLM would ensure relevant data are collected during recreational monitoring to make decisions about managing recreation on public land. Including these provisions in the plan would also be consistent with the Commission's regulation to encourage licensees to cooperate with agencies to determine recreational needs.

The Districts intend to construct a new visitor center near Fleming Meadows to replace the building destroyed by fire in 2016; however, the Districts state this facility is not part of the proposed project. The visitor center fits within the definition of a project recreational facility because the Districts would be building this facility at an existing project recreational development, and it is at a central location where project visitors can obtain information about the project. Additionally, providing the visitor center is consistent with Commission guidelines for licensees to inform the public about recreation opportunities available at licensed projects. Including this facility in the RRMP, and providing for its operation and maintenance, would ensure visitor information services are available to the public at a properly maintained and accessible site.

BLM's Don Pedro revised 4(e) condition 14 specifies some changes to the plan that would not necessarily improve its effectiveness or provide consistency with agency policy or requirements. Including information about facility condition and accessibility, as BLM specifies, would not be necessary because that information is already provided in the relicensing study results and would be outdated by the time the license is issued and the plan is implemented. Landownership is shown on GIS maps provided in relicensing study reports and Exhibit G maps; however, it may help readers to see this information on the recreational facility maps provided in the plan. BLM also specifies categorizing the restroom at Ward's Ferry as a day-use area described as a developed multi-use recreational facility. The Districts use this facility category for recreational areas that have abundant and diverse amenities such as Fleming Meadows which have campsites, an amphitheater, a boat launch, a picnic area, and a swim lagoon. Because Ward's Ferry consists of a single vault restroom and does not have tables, grills or other such site amenities, it appropriately fits within the Districts' category definition of a recreational area with limited facility infrastructure.

The Districts would be responsible for operating and maintaining the project recreational facilities. Under the Districts' proposed RRMP, the plan would be revised, as needed over the term of the license, to direct facility reconstruction and new construction in the project boundary. The Districts report most recreational facilities, which were constructed in the 1960s and 1970s, are in good condition. However, as confirmed by visitor survey responses, the facilities are worn and outdated. Further, the facility condition surveys indicate many facilities, especially restrooms, do not meet accessibility requirements. Without providing for recreational facility reconstruction during the license term, project visitor needs and expectations would not likely be met in the future and it is uncertain when project facilities would comply with accessibility requirements.

Two other proposed measures and agency conditions or recommendations involve recreational facility development: (1) constructing a trail between the parking area of the former visitor center and the shoreline of the La Grange Reservoir (Districts' proposed

measure,[220] California DFW 10(j) recommendation M7-3.1, and BLM La Grange preliminary 4(e) condition 8); and (2) constructing a new boat launch facility to be located upstream of old Don Pedro Dam (Districts' proposed measure). The various trail measures have slight differences, but all would be beneficial by creating about a 1-mile route of non-motorized access from the former visitor center parking lot to the La Grange Reservoir, where no trail currently exists, thereby increasing trail opportunities in the area. The scope of access development contained in the Districts' measure does not provide a schedule or describe the standard of trail that would be constructed, but this information is specified in BLM's condition and, if implemented, would provide suitable access consistent with BLM's land management guidance within a reasonable time frame. Implementing California DFW 10(j) recommendation M7-3.1, which includes providing boat access, would encourage boating and swimming at La Grange Reservoir. As documented in the Districts' Recreation Access and Safety Assessment Study Report, water contact recreation at the reservoir has a high-risk incident consequence rating because water velocities can rapidly change (HDR, 2017f). Accordingly, boating and swimming at the reservoir constitute high risk recreational activities and, if allowed or encouraged, could present unsafe conditions for the public.

The proposed non-motorized trail would provide access to the La Grange Reservoir, but the proposed route traverses land within the Don Pedro Project boundary owned by the Districts, and public land managed by BLM. Although the trail is contained in the Districts' proposed measures and agency conditions and recommendations for the La Grange Project, it would be more appropriate to include the trail in the license for the Don Pedro Project because: (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway. Identifying the development of the proposed non-motorized trail in the RRMP and specifying the Districts' responsibility for its operation and maintenance would ensure adequate and safe public shoreline access. Because the proposed route passes near project infrastructure, signage, fencing, and gates, diverting use away from project features could be incorporated into the trail design to address project security and public safety concerns. The route also passes near privately owned lands, so providing signage to identify private property boundaries near the trail would minimize the potential for trail users to inadvertently trespass.

The Districts' proposal to construct a new boat launch near old Don Pedro Dam would allow boating access to Don Pedro Reservoir when the water surface elevation is at or below 600 feet. This facility would be a project recreational facility but its location, design, concepts, and provision for operation and maintenance are not provided in the

[220] Conservation Groups support the Districts' measure to provide a pedestrian trail to support fishing and low impact activities such as birdwatching and nature viewing.

RRMP. Consequently, it is not possible to determine whether this facility, as described in the Districts' proposed measure, would adequately accommodate potential use and visitor needs for reservoir access. In terms of the boating access that would be needed to accommodate the new proposed minimum pool of 550 feet, simulations of the various operational scenarios presented in the Districts' application or in agency conditions and recommendations, maintain a minimum water surface elevation higher than 600 feet, the elevation of the existing minimum pool (table 3.3.5-2). However, sequential low-flow years would likely result in lower water surface elevations than simulated. Consequently, it appears the proposed new boat launch would not be necessary to maintain boating access to Don Pedro Reservoir unless hydrologic conditions are drier than those that occurred within the 42-year period of record that was analyzed, which would likely be very infrequent.

Table 3.3.5-2. Minimum water surface elevation of Don Pedro Reservoir under proposed and recommended flow regimes (Source: Districts' modeling data from Districts 2018b,f; 2020a,b, as modified by staff).

Flow Regime	Minimum Water Surface Elevation over the Period of Record (1971 to 2012) (feet)
Base case	617.9
Districts interim	618.5
Districts with-IG [a]	617.9
Draft Voluntary Agreement	621.6
FWS	601.1
NMFS	615.5
California DFW	647.2
Water Board	619.6
Conservation Groups [a]	601.0
The Bay Institute	635.0
ECHO	610.1

[a] Although values for the Districts with-IG and Conservation Groups scenarios are based on the Districts' March 17, 2020, filing (Districts, 2020a) to correct an inadvertent modeling error that was incorporated into the draft EIS, these values remained the same as in the draft EIS.

The Districts' relicensing studies report resource impacts ranging from low to high at some areas with recurrent dispersed recreational use. The Districts' proposal to periodically monitor and clean up these areas (i.e., continue the existing practice) would not address existing adverse effects associated with *high impact sites*. Under the

Districts' proposed measure, effects such as frequent signs of toilet paper, user-created trails, bare and compacted ground, trampled vegetation, and fire rings without adequate clearances would continue to exist and likely would be exacerbated. Additionally, these same conditions would likely emerge at additional locations unless specific actions, in addition to the current practice of monitoring and clean up, are implemented. Revising the RRMP to specify treatments for addressing recreation-related damage at areas receiving recurrent use would address these project effects.

Although project effects would be more fully addressed by modifying the plan, the general scope of improvements and recreational facility management described in the plan would be consistent with meeting California recreational demand as reflected in the Survey of Public Opinions and Attitudes, 2012. Specifically, the RRMP aligns with the public's desire for providing facilities for day use (including group use) and trails; providing facilities at lakes, rivers, and reservoirs; and maintaining park and recreational areas.

Coordination with Resource Agencies

Project recreational facilities and use occur on public land managed by BLM and land owned by the Districts. The proposed RRMP states the Districts would consult with BLM, Park Service, California Department of Parks and Recreation, California Division of Boating and Waterways, and California DFW to prepare the visitor survey report that would be filed every 12 years and would report annual visitor use and any proposed changes related to recreational facilities. BLM Don Pedro revised 4(e) condition 11 has a much broader scope than the coordination the Districts describe in the plan and specifies annual consultation about many recreation-related topics: garbage and sanitation needs; dispersed camping areas; recreational facility operation and maintenance issues (raised by BLM, Districts, or others); fees for public recreational facilities located on BLM-managed land (fee increases subject to BLM approval); recreational use data, including recreational facility construction and rehabilitation activities, status of ongoing program of work, implementation schedule, permitting and environmental documentation needs, and coordination with other activities or resource management needs.

BLM Don Pedro revised 4(e) condition 11 also specifies that the Districts invite BLM to participate in field evaluations and condition assessments and provide BLM with FERC inspection and follow-up documentation.

Our Analysis

As discussed above, the lack of scheduled and frequent consultation about the spectrum of recreational management topics may delay actions and adjustments necessary to address recreational impacts and visitor use needs for up to 12 years, the minimum frequency stated in the plan for consulting with agencies. BLM Don Pedro revised 4(e) condition 11 specifies annual consultation, at a minimum, to create an annual opportunity to initiate or adjust actions within the scope of the plan to meet visitor needs and protect environmental resources (e.g., periodic monitoring and cleaning at dispersed

sites, addressing deferred facility maintenance items). The comprehensive list of topics included in the preliminary condition provides a reasonable checklist of project recreation-related items that could prompt actions to address emerging recreational effects or needs. Implementing the BLM condition would ensure agency coordination to protect environmental resources when operating and maintaining project recreational facilities located on federal land. Considering that the Districts' programs of work and operating seasons for recreational facilities are established well in advance of implementation, consultation on an annual basis should be sufficient to achieve the objectives of the BLM preliminary condition. Consulting with BLM, Park Service, California Department of Parks and Recreation, California Division of Boating and Waterways, and California DFW every 12 years, as the Districts propose, would enable input from these agencies to be considered during the plan revision process. The overarching benefits of frequent and structured consultation include achieving or exceeding visitor needs and expectations and providing safe public recreational facilities that are consistent with applicable agency land management guidance and requirements.

Inviting BLM staff to participate in field and facility inspections, as BLM Don Pedro revised 4(e) condition 11 specifies, could be beneficial in terms of fostering the partnership between the Districts and BLM to jointly manage public recreational resources by efficiently identifying and addressing deficiencies. The element of the BLM condition about conducting joint inspections or reviews would not constrain the Districts' program of work because it specifies inviting, but does not require, BLM staff participation.

Large Woody Debris Management

LWM passes down the Tuolumne River to Don Pedro Reservoir where it can be a boating hazard and large concentrations of wood accumulating near Ward's Ferry Bridge can obstruct water surface and shoreline use. The Districts propose to implement their Woody Debris Management Plan, which calls for continuing the current practice of collecting LWM on Don Pedro Reservoir in boom rafts, anchored along the reservoir's edge; burning this material during fall and winter when reservoir levels are low; and informing BLM of its prior year actions in an annual memo. BLM Don Pedro revised 4(e) condition 4 specifies that the Districts obtain and maintain a BLM-approved burn plan for any LWM stored and burned on BLM-administered lands and make all reasonable efforts to prevent LWM from interfering with accessible take-out areas at Ward's Ferry Bridge. All Outdoors, OARS, Sierra Mac River Trips, Inc., American River Touring Association, and ECHO: The Wilderness Company also recommend that the Districts manage LWM on the reservoir to maintain access at Ward's Ferry Bridge and reservoir surface with an objective to maintain access and navigability.

In comments on the draft EIS, the Districts took issue with draft License Article 423 related to the management of woody debris in Don Pedro Reservoir. The Districts recommended that the text concerning disposal site maps, treatment descriptions, and consultation with resource agencies other than BLM be removed.

In the draft EIS, we also expressed uncertainty about BLM preliminary 4(e) condition 4 regarding who would be responsible for preparing the burn plan. In comments on the draft EIS, BLM clarified that it prepares the burn plan using information provided by the applicant of the plan.

Our Analysis

Although the existing license requires the Districts to collect and remove floating debris, documented problems associated with LWM accumulation on Don Pedro Reservoir include restricted access, impaired navigability, effects on public safety, and effects associated with delayed disposal. Because the Districts propose to continue the existing practices, these problems would continue to occur even if the Districts' Woody Debris Management Plan were to be implemented. The Districts' plan states removal would be conducted to limit public safety hazard, but it does not state any objective for maintaining navigability. Accumulations of LWM, topographic constraints, and the availability of few suitable disposal areas located on public land create a need for a plan that considers BLM agency land management guidance and integrates BLM staff into planning debris disposal. BLM preliminary 4(e) condition 4 specifies that the Districts obtain and maintain a BLM-approved burn plan for any large woody debris stored and burned on BLM-administered lands. In addition, the condition would require the Districts to make all reasonable efforts to prevent large woody debris from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry. In its comments on the draft EIS, BLM clarified that it prepared the last burn plan, which is valid for 10 years, in December 2017. Therefore, a new plan would be required during the period of a new license. Modifying the Woody Debris Management Plan, filed on October 11, 2017, to include provisions requiring licensees to obtain and maintain a valid burn plan for any large woody debris stored and burned on BLM-administered lands, and requiring licensees to make all reasonable efforts to prevent large woody debris from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry would ensure public access and navigability are not impaired, reduce delays in disposal, and accomplish disposal consistent with BLM and other resource management requirements.

Recreation Management at Ward's Ferry Bridge

Ward's Ferry Bridge, located at the upstream end of Don Pedro Reservoir, serves as the take-out location for the Meral's Pool whitewater boating run on the Tuolumne River. In the amended license application, the Districts propose to design and construct

improvements at Ward's Ferry Bridge to improve public safety during river-egress[221] but would not be responsible for the long-term operation or maintenance of the facility because it would not be a project recreational facility.

High use in this topographically constrained and undeveloped location generated several preliminary agency conditions and recommendations and recommendations from others, including BLM Don Pedro revised 4(e) condition 13; Forest Service preliminary 10(a) recommendation 1, California DFW preliminary 10(j) recommendation M7-3.2; Tuolumne County; Conservation Groups recommendation 8; and whitewater boating interests including All-Outdoors Whitewater, Oars West, Inc., Sierra Mac River Trips, Inc., American River Touring Association, ECHO: The Wilderness Company, and numerous individuals.

Although the content of measures provided by each of these entities is slightly different in terms of specific capacity and types of amenities, each of these preliminary conditions and recommendations describes extensive construction to provide vehicular access for extracting watercraft at all water levels, restrooms, trails, parking, and day-use facilities and indicates the Districts would also be responsible for operating and maintaining the facility.

BLM 10(a) recommendation 1 also recommends that the Districts conduct geotechnical studies to assist in the design and layout of the boating take-out facility specified in BLM Don Pedro revised 4(e) condition 13.

Our Analysis

Reservoir fluctuation affects whitewater boating use at Ward's Ferry Bridge, because whitewater boaters have an increasing distance to carry boats and equipment up to the road as the reservoir lowers. The steep canyon is rocky and having trails with appropriate slope, width, and tread to access the shoreline would improve footing for boaters taking out at Ward's Ferry Bridge and reduce erosion potential.

The existing restroom was installed to address sanitation concerns near this point of public access to Don Pedro Reservoir. Occurrences of recurrent and destructive vandalism call into question the benefit of the restroom because it is often inoperable or unsuitable for visitor use, which is only provided to commercial whitewater boaters who are issued a key. Considering these circumstances, continuing to require the Districts to

[221] Exhibit E, page 3-292 states: "the Districts are proposing to enhance river recreation and help ameliorate bridge and road safety concerns by improving the take-out." However, the Districts' November 27, 2017, AIR response states: "the Districts are not proposing the Ward's Ferry rafting take-out improvement as a project facility, but as an off-license enhancement."

expend burdensome time and funding to maintain this restroom would not likely provide a safe, functional, suitable restroom at this location.

The Forest Service authorizes commercial and private whitewater boating on the Meral's Pool run of the Tuolumne River by issuing permits. As such, the agency is responsible for managing this activity and can specify logistical elements such as the number of whitewater boaters and the types of water craft permitted, as well as the timing and places of use on public land. As evidenced by the documented problems, it appears the agency has authorized a level of use that exceeds the carrying capacity of the take-out at Ward's Ferry Bridge. BLM's Don Pedro revised 4(e) condition 13 and recommendations for this location from all other entities, seek to remedy this situation by increasing capacity at the take-out by constructing facilities to improve boat extraction efficiency, safety, and user experience.

In the draft EIS, we determined that congestion at Ward's Ferry Bridge was a result of peaking flows from the (non-project) Holm Powerhouse concentrating whitewater boating use in a short period and the large number of boating permits issued by the Forest Service and concluded that this congestion was not a project effect. In their comments on the draft EIS, Sierra Mac River Trips, Inc., and American River Touring Association, Inc., point out that they pay an annual fee to the Districts for permits that allow them to egress the reservoir at Ward's Ferry and that fluctuating reservoir levels have adversely affected the Ward's Ferry area. In addition, comments from 42 individuals state that Don Pedro Reservoir level fluctuations cause erosion in the Ward's Ferry area. BLM commented that since the inundation of the original take-out site by Don Pedro Reservoir, the Ward's Ferry take-out point has become the best and, essentially, the only take-out point when boating the Lumsden to Ward's Ferry segment of the Tuolumne Wild and Scenic River. BLM further states that the Commission recognized the effect of the project on the Ward's Ferry site in 1987, when it amended the current license, requiring in License Article 53 that the Districts provide a restroom, and in Article 52 that the Districts remove the woody debris jam that would otherwise form in the upper arm of the reservoir and block whitewater boaters from reaching the take-outs. BLM notes that Ward's Ferry is within the project boundary and meets the Commission's guidance on what constitutes nexus, citing two other Commission projects where the Commission required mitigation for loss of an access point and important whitewater run. BLM also states that Don Pedro 4(e) condition 13 is consistent with the 1995 Settlement Agreement between BLM and the Districts, and BLM expects that this mandatory condition will be included in the license.

Commission staff visited the Ward's Ferry site during an environmental site review held on March 27, 2019, and observed little evidence of erosion associated with reservoir level fluctuations. It was apparent, however, that water level fluctuations affect the level of effort that is required to hand-carry rafts from the river, and the narrowness and uneven footing of the trails on both sides of the river make manual egress more difficult. We maintain that improving these trails and prohibiting the use of boom trucks for lifting rafts from the river is the most appropriate approach to reduce congestion while

improving public safety. We see the following safety issues associated with the lifting platform that would be constructed under BLM's Don Pedro revised 4(e) condition 13:

1. Hoisting heavy rafts in a canyon with strong up-canyon afternoon winds creates a concern that rafts aligned parallel to the channel and in line with the up-canyon winds—as would be the case with the hoisting facility design—could be blown into each other while being hoisted.

2. The proposed platform would not address the concern of boats falling on or swinging into recreationists, because the proposed platform measure does not exclude campers or day users from the platform or the area below the platform; the lack of flat ground is the biggest site constraint, so it is likely that a constructed platform and the associated shoreline would become an attractive place for dispersed recreation; and with no separation between rafts and dispersed recreationists using the reservoir, public safety concerns identified by the commenters would just be expanded to the area near the platform.

3. The platform measure would also not curtail the existing practice of hoisting rafts from the bridge; as commenters explain, boats usually arrive within a short time of each other, so multiple companies are trying to hoist rafts at the same time. Unlike a fully occupied boat ramp at a reservoir where boaters must wait their turn to launch or retrieve boats, rafters who could not find a place to hoist their boats from the platform—either because the platform is occupied by recreationists or other boaters—would likely proceed to hoist from the bridge. Therefore, unless the county enforces its ordinance that prohibits blocking the road, the existing safety concerns of blocking the county road and having boats fall on dispersed recreationists using the reservoir would continue regardless of whether a platform was constructed.

4. The platform would provide access but would require costly excavation and pier construction. The staff alternative provides safe access at a much lower cost; however, it would be more labor intensive for boaters to retrieve boats. It is likely that even if the trails were constructed, rafting companies would likely continue using the bridge to hoist rafts unless the county enforces its ordinance that prohibits blocking county roads.

5. Although a platform would appear to reduce safety concerns, it may create new user conflicts or additional/different safety concerns.

With regard to public safety on Ward's Ferry Road and the bridge, Tuolumne County requests safety improvements and maintenance, including spot widening, turn outs, guard rails, paved shoulders, and parking stops. Tuolumne County owns and maintains Ward's Ferry Road, including the bridge, and because it is a county road used primarily for public purposes, it does not meet the Commission's definition of a project

road. The county, which has jurisdiction over public road use, has the ability to prevent road obstruction at Ward's Ferry Bridge by enforcing its county ordinances.

Non-motorized, Recreational River Boating

The Don Pedro project affects boating opportunities on the reach downstream of La Grange Diversion Dam because current operation alters flow in the reach, and minimum flow releases do not always provide sufficient flow for boating. The analysis of flow data provided by the Districts found that from 1997 through 2012 during the typical boating season of May through October, a flow of 200 cfs[222] was exceeded 95 percent of the time in May; 56 percent of the time in June, July, August and September; and 74 percent of the time in October.[223]

The Districts' proposed minimum flows and the slightly modified minimum flows included in the draft Voluntary Agreement, designed to benefit aquatic resources, would increase the flows available for boating opportunities in the lower Tuolumne River. The Districts also propose to provide weekend flow releases specifically to enhance non-motorized, recreational river boating on the lower Tuolumne River. In wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional flow to the river downstream of the proposed infiltration galleries (to be monitored below the proposed fish counting/barrier weir at RM 25.5). Then, in all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.5 for the 3-day July 4th holiday, the 3-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August. Park Service 10(a) recommendation 3 for the Don Pedro Project recommends scheduling the proposed 200-cfs boatable flow for the 3-day July 4th weekend that occurs closest to the actual holiday,[224] and to ensure that all measures to remove water hyacinth that would render the river non-navigable are conducted well before the summer recreational flow season.

Flow scenarios contained in conditions and recommendations made by the agencies and NGOs (see section 3.3.2, *Aquatic Resources*) and operation of the

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[222] Boater responses provided in *Lower Tuolumne River Lowest Boatable Flow Study Report*, indicate a flow of 200 cfs, as measured at the La Grange gage, provides the lowest boatable flow for canoes and hardshell and inflatable kayaks (HDR, 2013o).

[223] Note that these frequencies are not consistent with information presented in the *Lower Tuolumne River Lowest Boatable Flow Study Report* (HDR, 2013o), which reports a flow of 200 cfs was exceeded 94 percent of the time in May; 54 percent of the time in June; 56 percent of the time in July, August and September; and 74 percent of the time in October.

[224] The recommendation does not indicate a preference for providing flows on the preceding or succeeding weekend when the holiday occurs on a Wednesday.

infiltration galleries would also affect the frequency of flows suitable for boating in the lower Tuolumne River.

The Districts also propose to provide a new boat put-in/take-out at RM 25.5 at the location of the proposed fish counting/barrier weir.

Our Analysis

Our analysis of the effects of proposed and recommended flow regimes on non-motorized boating focuses on the reach downstream of the proposed infiltration galleries, where flows would be reduced during most of the boating season by the diversion of flow into the infiltration galleries. Operations modeling results indicate that flows would be sufficient for boating (at least 200 cfs) downstream of the infiltration galleries at least 87.5 percent of the time in wet and above normal water years under each of the proposed and recommended flow regimes (table 3.3.5-3). The Districts' proposed interim flow regime, which would be in effect until the infiltration galleries are operational, would also provide boatable flows 100 percent of the time in below normal water years and 84.8 percent of the time in dry and critical years. After the infiltration galleries are operational, the frequency of boatable flows would be reduced to 79.3 percent of the time in below normal water years, 39.0 percent of the time in dry years, and 29.1 percent of the time in critical water years. Boatable flows would occur slightly more frequently under the flow regime included in the draft Voluntary Agreement, with boatable flows occurring 84.8 percent of the time in below normal water years, 52.8 percent of the time in dry years, and 42.4 percent of the time in critical water years. The flow regimes recommended by the Water Board and ECHO would both provide boatable flows ranging between 45.3 and 50.8 percent of the time in below normal, dry, and critical water years, and the flow regimes recommended by NMFS, California DFW, and the Conservation Groups would provide boatable flows 100 percent of the time in all water year types. The flow regime recommended by The Bay Institute would provide boatable flows approximately 100 percent of the time in all but critically dry water years, when boating flows would be available 82.8 percent of the time.

Table 3.3.5-3. Percent of time simulated daily average flows are at least 200 cfs in the lower Tuolumne River below the infiltration galleries under existing conditions (base case) and flow regimes proposed by the Districts and recommended or prescribed by stakeholders (Source: Districts' modeling data from Districts, 2018b,d; 2020a,b).

	Percent of Time Flow is at Least 200 cfs at RM 25.5							
Month	**Base Case**	**Districts Interim**	**Districts with-IGs [a]**	**Draft Voluntary Agreement**	**NMFS, Calif. DFW, Conservation Groups[b]**	**Water Board**	**The Bay Institute**	**ECHO**
	All Water Year Types							
May	100	100	100	100	100	100	100	100
June	52	61	38	38	100	100	100	100
July	50	99	58	61	100	53	98	54
Aug	50	100	58	59	100	50	90	50
Sept	50	100	59	80	100	50	84	50
Oct	87	100	80	100	100	96	99	87
All	64.9	93.5	65.8	73.1	100.0	75.0	95.4	73.4
	Wet Water Years							
May	100	100	100	100	100	100	100	100
June	100	100	83	83	100	100	100	100
July	100	100	99	99	100	100	100	100
Aug	100	100	100	100	100	100	100	100
Sept	100	100	100	100	100	100	100	100
Oct	91	100	81	100	100	97	99	91
All	98.5	100.0	93.8	97.1	100.0	99.5	99.9	98.5
	Above Normal Water Years							
May	100	100	100	100	100	100	100	100
June	100	100	38	26	100	100	100	100
July	100	100	97	97	100	100	100	100
Aug	100	100	100	100	100	100	100	100
Sept	100	100	100	100	100	100	100	100
Oct	98	100	92	100	100	98	100	98
All	99.6	100.0	88.0	87.5	100.0	99.6	100.0	99.6

Month	Base Case	Districts Interim	Districts with-IGs [a]	Draft Voluntary Agreement	NMFS, Calif. DFW, Conservation Groups[b]	Water Board	The Bay Institute	ECHO
	Percent of Time Flow is at Least 200 cfs at RM 25.5							
	Below Normal Water Years							
May	100	100	100	100	100	100	100	100
June	7	100	13	13	100	100	100	100
July	0	100	94	94	100	10	100	10
Aug	0	100	100	100	100	0	100	0
Sept	0	100	100	100	100	0	100	0
Oct	96	100	67	100	100	96	100	96
All	33.9	100.0	79.3	84.8	100.0	50.8	100.0	50.8
	Dry Water Years							
May	100	100	100	100	100	100	100	100
June	5	10	6	10	100	100	100	100
July	0	97	16	30	100	6	100	7
Aug	0	100	6	14	100	0	100	0
Sept	0	100	10	62	100	0	100	0
Oct	97	100	93	100	100	97	100	97
All	34.1	84.8	39.0	52.8	100.0	50.7	100.0	50.8
	Critically Dry Water Years							
May	100	100	100	100	100	100	100	100
June	3	10	3	7	100	100	100	100
July	0	97	0	0	100	6	93	7
Aug	0	100	0	0	100	0	64	0
Sept	0	100	0	47	100	0	41	0
Oct	65	100	69	100	100	94	99	65
All	28.4	84.8	29.1	42.4	100.0	50.0	82.8	45.3

[a] Although values for the Districts with-IGs scenario are based on the Districts' March 17, 2020, filing (Districts, 2020a) to correct an inadvertent modeling error that was incorporated into the draft EIS, the largest change in values compared to the draft EIS is a decrease of 4 percent which occurred in June of below normal water years.

[b] Although values for the Conservation Groups scenario are based on the Districts' March 17, 2020, filing (Districts, 2020a) to correct an inadvertent modeling error that was incorporated into the draft EIS, these values remained the same as in the draft EIS.

Park Service 10(a) recommendation 3 to schedule flow releases for boating to occur on the weekend that is nearest to July 4th would align the event with a predictably higher recreational use period. This approach would enable more boaters to take advantage of suitable flows. Additionally, having information on scheduled releases and the minimum flow schedule available to the public would allow for flow-dependent recreation planning. Park Service does not specify when releases would take place when the holiday occurs on a Wednesday, and because predicting whether more use would occur on either of the two weekends surrounding the holiday, it would be appropriate for the Districts to use their discretion for scheduling the event. It would be necessary to consult with boating interests to select start and end days of releases to ensure they are timed to provide the maximum benefit to boaters.

The Park Service also recommends (as part of 10(a) recommendation 3) that all measures to remove water hyacinth that would render the river non-navigable are conducted well before the summer recreational flow season. Although the Districts proposed in their amended final license application to provide funding to California DFW to support water hyacinth removal, this measure was withdrawn when the Districts agreed to fund the LTRHIP, and no parties have recommended that water hyacinth removal be required as a license condition. Although this invasive plant species can adversely affect navigability of the river, it has proven difficult to control and its occurrence and abundance is not attributable to operation of the hydroelectric projects.

The Districts' proposed fish counting/barrier weir would obstruct boating in the lower Tuolumne River. The Districts' proposal to provide a new boat put-in and take-out facility at RM 25.5 would allow boaters to circumnavigate the barrier as well as provide a point of access for those who want to begin or end their boating trips at this location. If the proposed fish counting/barrier weir is constructed, this facility would address the project effect of impaired boating access and provide an enhancement for boating use.

It is likely that increased flows resulting from all the flow scenarios would periodically decrease wading suitability in lower Tuolumne River. However, wading was not identified as a frequent recreational activity and the low gradient of the reach likely provides opportunities for visitors to find alternative wading locations.

3.3.5.3 Cumulative Effects

Hydroelectric project operation and diversions for municipal water supply facilitated by four dams upstream of La Grange Diversion Dam have historically affected the timing and quantity of flow in the lower Tuolumne River, resulting in about 40 percent of the unimpaired flow passing to the lower Tuolumne River (CCSF, 2005). In addition, project construction and the filling of Don Pedro reservoir in 1972 inundated several miles of free-flowing river, including an area that is reported by Sierra Mac River

Trips, Inc.[225] to have afforded easy bank-side access as a take-out for whitewater rafters. If the project is operated as proposed by the Districts and recommended by staff, higher flows to be released downstream of La Grange Dam will provide increased opportunities for boating and improve fish habitat, thereby increasing angling opportunities.

3.3.6 Land Use and Aesthetics

Lands near the projects are within Tuolumne and Stanislaus Counties. Primary land uses in the vicinity are single-family residential, non-irrigated farmland, and irrigated farmland. Land use downstream of the projects consists mainly of irrigated agricultural land and related uses as well as urban, suburban, and rural residential uses. Privately owned lands in the vicinity of the projects are subject to the counties' general plans and zoning ordinances and public lands are managed under agency management plans, as discussed below. The downstream extent of the Don Pedro Project boundary coincides with the upstream extent of the proposed boundary of the La Grange Project.

The projects are located in the Sierra Nevada foothills region, an area characterized by rolling hills, rural landscapes, native grasslands, and blue oak woodland. Project features include Don Pedro Reservoir, Don Pedro Dam and spillway, Don Pedro Powerhouse, La Grange Diversion Dam and Reservoir, La Grange Powerhouse, and a number of recreational facilities at Don Pedro Reservoir. The Districts own all facilities and lands within the existing Don Pedro Project boundary, except for 4,802 acres of federal land that BLM administers. BLM's visual resource objective for these lands is to protect and enhance the scenic and visual integrity of the characteristic landscape by maintaining the existing visual quality of the (1) Don Pedro Reservoir/Highway 49 viewshed (Visual Resource Management Class III) and (2) Red Hills ACEC (Visual Resource Management Class II) (BLM, 2008b).[226]

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[225] Comments on draft EIS, accession no. 20190412-5016.

[226] The Class I Visual Resource Management objective is to preserve the natural character of the landscape, and minimal visual change from human activities is allowed. Class II and III allow progressively greater amounts of visual change to the existing landscape, while Class IV allows management activities that require major modification of the existing character of the landscape, and the level of change to the characteristic landscape can be high. Once the class is determined for a tract of BLM-administered land in the Sierra Resource Management Plan, BLM policy requires that proposed management activities on that tract, such as constructing and operating energy facilities, must meet the requirements of the designated classification.

3.3.6.1 Affected Environment

Don Pedro Project

The existing project boundary encompasses approximately 18,370 acres of which 4,802 acres are federal lands within BLM's Sierra Resource Management Area (figure 3.3.6-1), including land within the Red Hills ACEC, which was designated to protect the rare plant species found in this area. Ninety percent of the 160-mile Don Pedro Reservoir shoreline is undeveloped and the Districts' land use policies include rules and regulations that strictly limit the use of lands outside the developed recreational areas. These policies are designed to protect and preserve the natural character and integrity of the area by prohibiting shoreline development and disturbances such as dredging, docks, moorings, and piers and prohibiting all vehicle use on lands, except at designated boat launches.

Lands upstream of the Don Pedro Project consist primarily of public land managed by BLM and the Forest Service (Stanislaus National Forest). Public land administered by BLM is managed under the Sierra Resource Management Plan (BLM, 2008a), the Visual Resource Inventory (BLM, 1986a), and the Visual Resource Contrast Rating (BLM, 1986b). National Forest System lands are managed under the Stanislaus National Forest Land and Resource Management Plan. The Don Pedro Project boundary also includes land within the management corridor of the Tuolumne River, a designated National Wild and Scenic River. In 1988, the Forest Service approved the Tuolumne Wild and Scenic River Management Plan, which established a 0.25-mile management corridor on each side of the designated river segment from its source to Don Pedro Reservoir for a distance of 83 miles. The aliquot[227] parcel description of the corridor overlaps the Don Pedro Project lands at the upstream end of Don Pedro Reservoir.[228]

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[227] A location descriptor used in the public land survey system in which the townships and sections are indexed based on: (1) the township's position relative to the initial point, (2) the section's location within the designated township, and (3) the principal meridian reference.

[228] The corridor description in the Tuolumne Wild and Scenic River Management Plan includes land within T.1N, R.16E, S1/2N1/2 and N1/2S1/2 of section 31. Project land overlapping the management corridor is within T.1N, R.16E, S1/2NW1/4 and N1/2SW1/4 of section 31.

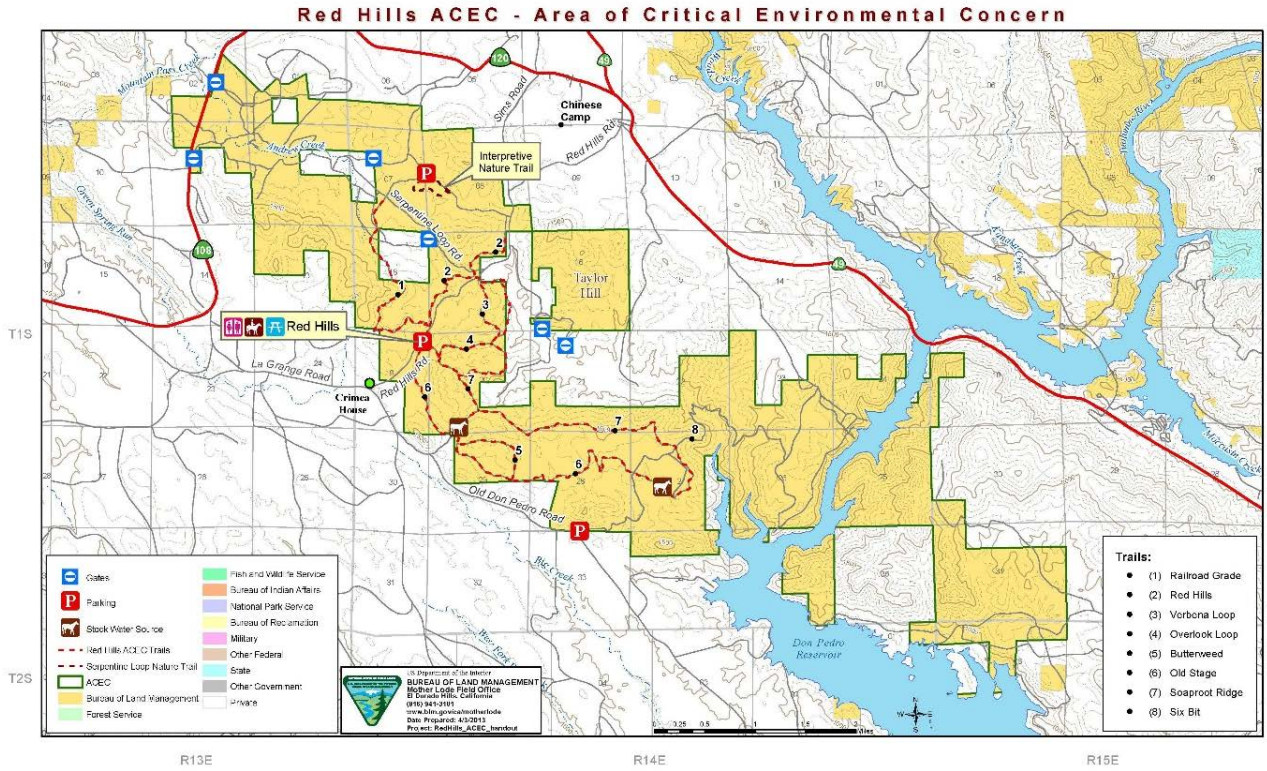

Figure 3.3.6-1. BLM-managed land in the vicinity of Don Pedro Reservoir, including Red Hills Area of Critical Environmental Concern (Source: BLM, 2013).

Other than the three developed recreation areas, two of which have facilities partially situated on BLM land, the Districts do not allow residential and commercial development within the Don Pedro Project boundary; however, project facilities are structural elements that visually contrast with the surrounding rural or natural landscape. The Districts conducted a Visual Quality Study to document current visual conditions of the Don Pedro Project as viewed from BLM-managed lands during various times of the year and identified the visual elements related to the project include the view of: the horizontal, unvegetated margin of the reservoir shoreline that is exposed as the water level lowers[229]; buildings and amenities associated with developed recreational areas (e.g., campgrounds, marina facilities); and the project roads, dam, spillway and powerhouse.

A small portion of the Blue Oak Recreation Area is situated within BLM-administered land. Project facilities that exist within this BLM land are a short, paved

[229] Since construction of the new Don Pedro Dam, the Districts report the Don Pedro Reservoir has operated between elevations 690 and 830 feet, depending on hydrologic, precipitation, and water management factors; however, current operating protocols permit reservoir drawdown to elevation 600 feet.

segment of Loop D campground road, a restroom building, and several campsites. A small portion of the Moccasin Point Recreation Area, along the Moccasin Arm section of Don Pedro Reservoir, is situated within BLM-administered land. Project facilities that exist within this BLM land are a short, paved segment of the MPC1 road, the marina store/office, and a portion of the floating marina dock.

The Districts use more than 63 miles of paved and unsurfaced or graveled roads and a 5.9-mile-long shoreline access trail to operate and maintain the project and provide recreational access. About 6 miles of these roads are located on BLM-managed land and the remainder are on privately owned land, District-owned land, or on road easements within Tuolumne County. The 5.9-mile-long shoreline trail is located on BLM-managed land. Several entities are responsible for maintaining the roads and trail used to access, operate and maintain the project, including the Districts, BLM, CCSF, private landowners, and Tuolumne County. The Districts have sole or shared responsibility for maintaining about 40 miles of roads and sole responsibility for maintaining the 5.9-mile-long shoreline access trail. About 38 miles of roads are in good condition with the remainder ranging from poor condition to passable with 4-wheel drive or high clearance vehicles. About 4 of the 6 miles of roads located on BLM-managed lands are in good condition with the remainder ranging from poor condition to passable with 4-wheel drive or high clearance vehicles.

Some roads used to access project infrastructure are gated to restrict public access for security or public safety reasons and to prohibit public access to the Districts' easements for operating and maintaining the project. Where appropriate, pedestrian travel on gated roads is allowed for recreational access. Bonds Flat Road, a county road that crosses the top of Don Pedro Dam and passes within about 600 feet downstream of the Don Pedro spillway, is a heavily traveled road that connects county road J-59 and state Highway 132. Bonds Flat Road is excluded from the project boundary. The project does not have an existing transportation system management plan.

La Grange Project

Land within the proposed project boundary for the La Grange Project consists of MID-owned land and public land managed by BLM and a single owner, Coleman Ranch (figure 3.3.6-2).[230] The 14 acres of public land within the proposed project boundary are managed by BLM under the Sierra Resource Management Plan (BLM, 2008a). The proposed project boundary follows an elevational contour of 300 feet around the reservoir and extends about 500 feet downstream of the dam and 700 feet downstream of the powerhouse (figure 2.1.1-2). The proposed project boundary encompasses the project infrastructure and a portion of La Grange Dam Road. The shoreline is undeveloped, and

[230] The license application does not report the acreage within the proposed project boundary by landowner.

no policies have been adopted by the Districts' Boards of Directors regarding shoreline development along the La Grange Reservoir (Districts, 2017e).

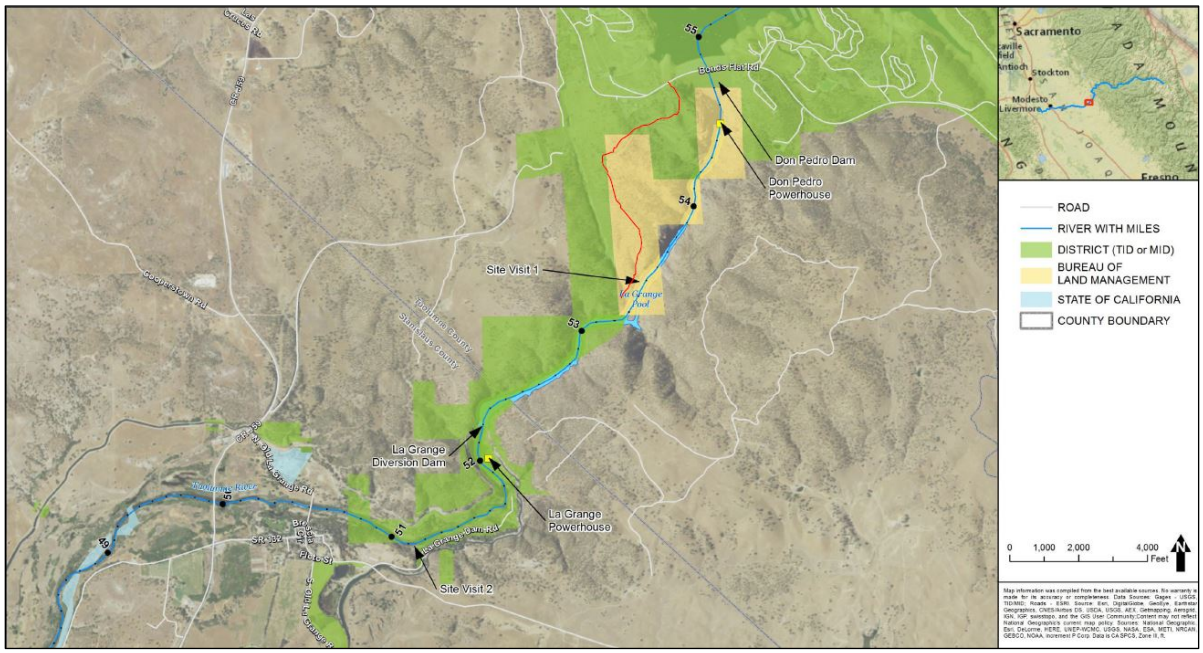

Figure 3.3.6-2. Landownership in the vicinity of the La Grange Project (Source: Districts, 2017b).

The 2-mile-long La Grange Reservoir is located in a narrow canyon between Don Pedro Powerhouse and La Grange Diversion Dam, and the upper two-thirds of the reservoir is riverine in nature and widens in the lower third to appear more reservoir-like with impounded water. The entire La Grange Reservoir shoreline is undeveloped. Project infrastructure and the reservoir are visual elements of the La Grange Project, but prominent views of the project by the public are not possible because of restricted road access and steep terrain that limits distant views.

The Districts use more than 2 miles of paved and unsurfaced or graveled roads to operate and maintain the project (figure 3.3.6-3). These roads are located on the Districts' or private land and public access is not allowed. The Districts are responsible for maintaining these roads.

Figure 3.3.6-3. Roads used for accessing the La Grange Project (Source: Districts, 2017e).

3.3.6.2 Environmental Effects

Elements of project operation and maintenance related to flow regulation, reservoir elevations, recreation and water surface use, public access, roads, visual resources, and fire and fuel management are often interrelated and need to be coordinated to ensure consistency with public land management policies and regulation, avoid conflicting activities, and provide for public safety.

Coordination with Resource Agencies and Stakeholders

Effects of project operation and maintenance related to flow regulation, reservoir elevations, recreation and water surface use, public access, roads, visual resources, and fire and fuel management are often interrelated and occur across jurisdictional boundaries. Public land management agencies, NGOs, and individuals actively participated in the pre-filing stage of this proceeding because project operation and features have the potential to affect land that agencies are responsible for managing or lands serving particular interests.

Tuolumne County recommendations include elements for consultation and administration support associated with the projects. The county also recommends the Districts coordinate with the county to explore options for coordinating patrol requirements for the Ward's Ferry Bridge among BLM, the Forest Service, and the Districts, including maintenance to manage the site's cleanliness, and to provide assistance to provide cellular telephone service at Ward's Ferry Bridge to improve visitor safety and emergency response.

Our Analysis

In its recommendations, Tuolumne County seeks support for services and improvements at Ward's Ferry Bridge. As discussed in section 3.3.5.2, *Recreation, Environmental Effects, Recreation Management at Ward's Ferry Bridge*, the county recommendations are intended to address non-project effects of whitewater recreation rather than effects of the project. Coordination among the various entities with interests and responsibilities at Ward's Ferry Bridge could improve management efficiencies. However, such coordination should be on a voluntary basis, because the Commission cannot require the participation of other entities. Further, coordination should exclude any supplemental funding from the Districts, because the county and BLM are responsible for law enforcement and emergency response in this area and the Commission has no way of ensuring any supplemental funds provided by the Districts would be used for project purposes. Providing cellular telephone service would improve public safety, but this service does not exist at countless other similar remote locations across the Sierra Nevada Mountains. Topography and economics determine whether cellular service is provided in any particular area and the Don Pedro Project does not affect or create a need for this costly development that would mostly benefit non-project users. The county's recommendation for funding for site maintenance at Ward's Ferry Bridge would be consistent with the Districts' proposed measure to routinely patrol and clean the area as it is currently developed (i.e., the restroom but no development for whitewater take-out facilities).

Transportation System Management

The Districts use roads and trails crossing public and private lands to operate and maintain the projects and for public recreational access. The Districts propose to continue implementing the existing License Article 17[231] and annually notify BLM of the location and type of any road maintenance projects on BLM-managed land and, if necessary, convene a meeting to discuss these projects. BLM Don Pedro revised 4(e) condition 16 specifies that the Districts develop a transportation system management plan for BLM approval. The Districts, upon Commission approval, would implement the plan. Tuolumne County recommends the Districts meet with the county to discuss assisting with improvements to Ward's Ferry Road and the intersection of County road J-59 and Bonds Flat Road.

[231] Standard article in Form L-2 states, "In the construction and maintenance of the project, the location and standards of roads and trail, and other land uses, including the location and condition of quarries, borrow pits, spoil disposal areas, and sanitary facilities, shall be subject to the approval of the department or agency of the United States having supervision over the lands involved."

Our Analysis

The Districts' existing manner of managing the roads and trails associated with the project has resulted in poor road conditions, and expectations about maintenance standards and responsibilities for project roads among the various landowners and managing agencies are uncertain. Because the Districts propose to continue their current practices, these same conditions would likely continue under the Districts' proposed measure.

Under BLM's Don Pedro revised 4(e) condition 16, roads and trails would be managed under a BLM-approved transportation system management plan. As discussed in its rationale for the preliminary condition, BLM states the plan would identify all roads crossing BLM-managed land, require road rehabilitation, and provide for scheduled condition assessments and maintenance activities. These provisions would likely reduce the number of roads that are in poor condition which, in turn, would improve the quality of public access and reduce any effects of poor road maintenance such as erosion. The Districts' maps and table provided in its November 27, 2017, response to staff's AIR contains much of the basic information needed to develop the plan. Additional plan content necessary to ensure proper annual and long-term maintenance of project roads and trails over the license term would include information about identified road and trail maintenance needs and implementation schedule for completing repairs; description of routine road and trail maintenance practices, including applicable BMPs, and frequency; condition assessment frequency; other management plans (i.e., vegetation, cultural resources) that contain guidance relevant to road maintenance activities; and process for consulting with BLM and any other entity that shares maintenance responsibilities for roads and trails used for project purposes.

Ward's Ferry Road is a county road that passes near the project and crosses the upper end of Don Pedro Reservoir. The Districts use Ward's Ferry Road on about a weekly basis, but because the road is primarily used for public purposes it does not meet the Commission's definition of a project road. The intersection of county-maintained roads J-59 and Bonds Flat Road about 1.5 miles northwest of Don Pedro spillway is also mainly used by the general public. The project use of these roads is considered incidental and project assistance to Tuolumne County to make road improvements would mainly serve non-project users.

Bonds Flat Road Crossing Downstream of Don Pedro Spillway

When Don Pedro Reservoir spills, the flow passes through a bedrock channel beneath Bonds Flat Road. Since the project was licensed in 1966, the Districts have removed the road crossing twice in advance of spill conditions—in 1997 and 2017. Tuolumne County recommends the road be engineered to operate independently of spillway operation to maintain public access during spill events. Tuolumne County states it is committed to working with the Districts to devise a solution, but it is not clear if the recommendation seeks funding from the Districts to construct a bridge over the spillway.

Our Analysis

The practice of removing the road crossing prevents this material from flowing into the Tuolumne River; however, public and emergency traffic are diverted around the spillway via State Highways 49 or 132 to cross Tuolumne River upstream or downstream, respectively, of Don Pedro Reservoir. During the 2017 spill event the road was impassable from about March 20 to June 28.

Having only occurred twice during the license term, high flow spill events that prevent traffic from crossing downstream of the spillway are extremely uncommon. Although other routes of travel are available, local residents would be inconvenienced and emergency response times would be delayed for about three months while the road is repaired. Because high-flow events rarely occur and have a short duration, alternative routes of travel around the spillway exist, and the Districts have restored access in as timely a manner as possible, the Districts' current approach of removing and restoring the roadbed represents a practical approach to addressing the effect of a high flow spill event.

Fire Prevention and Response

The Districts propose to implement their Fire Prevention and Response Management Plan for the Don Pedro Project, which identifies fire prevention procedures, reporting, and safe fire practices for Districts' personnel and contractors responsible for operating and maintaining the Don Pedro Project. The plan identifies the various agency plans and regulations that the Districts referenced to prepare the plan and identifies the state and federal laws and regulations with which it would comply when operating and maintaining the Don Pedro Project. Elements of the plan include descriptions of the Districts' actions, responsibilities, and access related to wildland fire preparedness and reporting, including equipment, vehicles, and tools for District staff and job sites; fire index monitoring and activity curtailment, as appropriate; debris burning; vegetation clearance; communication systems; access routes, water sources, and helicopter landing areas; fire investigation; emergency contact information; and fire safety signage at recreational facilities.

The plan would be reviewed and potentially revised in consultation with BLM and the California Department of Forestry and Fire Protection during the license term on an unspecified schedule. The Districts would provide the revised plan to the agencies for a minimum 60-day review period before filing it with the Commission for approval.

BLM Don Pedro revised 4(e) condition 17 specifies implementing a version of the Districts' plan that includes revisions to include information such as fire history, references, analysis descriptions, permits, and use and storing of explosives. BLM also specifies that the plan be approved by BLM before filing with the Commission for its approval.

Our Analysis

BLM Don Pedro revised 4(e) condition 17, which includes consultation with BLM to finalize and approve the plan, would likely meet BLM's objective for the plan to describe processes for obtaining authorizations and approvals and the requirements necessary to adhere to BLM fire restriction orders. Because fire-related circumstances would likely change over the term of a new license, it would be appropriate to periodically review the plan, as the Districts propose, to determine if the plan should be revised. Implementing BLM's version of the fire plan would likely improve planning for and management of wildfires and improve the coordination of wildfire protection and prevention measures that could reduce wildfire occurrence in the vicinity of the project and meet BLM requirements.

However, it would be difficult for the Commission to determine compliance with the BLM-revised version of the plan, because the revisions inaccurately refer to Merced Irrigation District as the licensee. Additionally, some of the revised text, for example, explosives and permitting, is duplicative of administrative conditions submitted by BLM, and this may create conflicting compliance requirements and multiple points of reporting compliance for a single action. Some of the BLM-inserted text to the Districts' fire plan, such as adding information to the plan about fire history, references, and analysis descriptions, would not add value to the plan effectiveness because they document past investigations rather than describe future actions the Districts should take to prevent, suppress, and report fires.

Although the Districts' plan indicates it would be implemented within the Don Pedro Project boundary, the threat of wildland fire also exists at the La Grange Project. For this reason, it would be appropriate to provide separate plans for each project.

Visual Resource Management

The amended license application for the Don Pedro Project does not include proposed measures related to visual resources, although it states the Districts would implement BMPs and consult with BLM during planning and construction for two proposed construction projects. BLM Don Pedro revised 4(e) condition 18 specifies the Districts prepare and implement a visual resources management plan for BLM-managed land within the project boundary. The plan would be approved by BLM before submittal to the Commission for its approval.

Our Analysis

The Districts' visual quality report adequately characterizes the visual elements associated with the Don Pedro Project. Existing project facilities situated on BLM-administered land occur on BLM land classified by the BLM Visual Resource Management System (VRMS) as Class III. The objective of Class III is to partially retain existing characteristics of the landscape and to guide management activities not to dominate the view of the casual observer (BLM, 1986a). The degree of contrast allowed

for Class III areas is moderate, wherein visual elements, presumably those not occurring naturally, attract attention and begin to dominate the existing landscape (BLM, 1986b). When compared to the BLM VRMS Class III objective and the degree of allowable contrast within the Class III area, the few project facilities at Blue Oak Recreation Area and Moccasin Point Recreation Area, situated within BLM land, are not inconsistent with these visual resource management parameters. In addition, there is no supporting evidence that shows this small number of project facilities are in unacceptable condition or do not conform to the BLM VRMS Class III objectives.

Proposed new construction, such as the whitewater boating take-out facility upstream of Ward's Ferry Bridge and the extension of riprap on the upstream face of Don Pedro Dam could affect the existing visual appearance at the project, including on BLM-administered land. However, the proposed extension of riprap, to limit the potential for erosion if the reservoir is drawn down lower than the current minimum elevation of 600 feet, would occur on the Districts' land. Additionally, the riprap extension would increase riprap on the upstream face of Don Pedro Dam from the current elevation of 585 feet down to elevation 535 feet. Furthermore, the Districts' proposed lower minimum pool elevation for the Don Pedro Reservoir of 550 feet would occur infrequently; therefore, the likelihood that the extension of riprap would have a significant impact on visual quality of the project is minimal, and any potential impacts would occur infrequently.

The Districts' proposal to construct a whitewater boating take-out facility upstream of Ward's Ferry Bridge would occur on BLM-administered land, and the BLM VRMS Class III objectives for this BLM land in the area would apply to the proposed take-out facility. Therefore, developing and implementing a visual resources management plan, consistent with BLM's VRMS Class III objectives for this site, would ensure the visual quality is not degraded by construction of the take-out facility. Beneficial elements of the plan would include describing desired project feature appearances (e.g., construction materials, color, and scale) relative to guidance contained in applicable plans, monitoring visual resources over the term of a new license to determine whether additional treatments would be necessary to achieve visual quality objectives, and consulting with BLM about new facilities on BLM-administered land. Providing for BLM approval of the plan before it is submitted to the Commission would ensure the plan contains agency guidance applicable to visual resources at the project and describes adequate consultation and approval processes for new construction. While we do not recommend the proposed whitewater boating take-out facility at Ward's Ferry Bridge, BLM revised 4(e) condition 13, which would be included as a mandatory condition in any license issued for the project, requires the Districts to implement a Ward's Ferry Take-Out Management Plan that includes the construction of: (1) an elevated hoisting platform; (2) an Americans with Disabilities Act-compliant vault restroom; (3) two access roads; and (4) two pedestrian access trails. To be consistent with the BLM VRMS Class III objectives for this site, the hoisting platform should be constructed of similar materials used in the existing Ward's Ferry Bridge, closely match

the colors of the bridge elements, and blend with the existing topography and environment to minimize effects on visual resources. The vault restroom should be constructed to match the materials and colors used in the construction of the hoisting platform and the bridge and should blend with the existing environment. Construction of the access roads and pedestrian access trails should blend with the existing environment and topography. The La Grange Project infrastructure is not visible from publicly accessible locations, so a plan is not necessary to address visual resources at this project.

Project Boundary

The Districts propose locating the project boundaries for the projects as shown in Exhibit G of each license application.

Our Analysis

Commission regulations require including only lands within the project boundary that are necessary for operating and maintaining the project and for other project purposes, such as recreation, shoreline control, or protection of environmental resources. For both projects, all project infrastructure, recreational facilities, and project roads are located within the proposed project boundaries, and the boundary locations appear consistent with the Commission's regulations providing a sufficient buffer of about 50 feet from project infrastructure and recreational facilities.

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Section 106 of the National Historic Preservation Act

Section 106 of the NHPA, as amended, and its implementing regulations found at 36 CFR 800 require the Commission, as lead federal agency, and the cooperating agencies to consider the effect of their undertakings on any historic properties and allow the Advisory Council an opportunity to comment.

Historic properties are defined as any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. In this document, we also use the term *cultural resources* to include properties that have not been evaluated for eligibility for listing in the National Register. Historic properties generally must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and must meet one or more of the criteria specified in 36 CFR 60.4. For example, dilapidated structures or heavily disturbed archaeological sites may not have enough contextual integrity to be considered eligible. Traditional cultural properties (TCPs) are a type of historic property eligible for listing in the National Register because of their association with cultural practices or beliefs of a living community that: (1) are rooted in that community's history; or (2) are important in maintaining the continuing cultural identity of the community (Parker and King, 1998). In most cases, cultural resources less

than 50 years old are not considered eligible for listing in the National Register. However, properties that are less than 50 years old may be considered eligible for the National Register if they have achieved significance within the past 50 years and are of exceptional importance or if they are a contributing part of a National Register-eligible district.

Section 106 also requires that the Commission seek concurrence with the California State Historic Preservation Officer (California SHPO) on any finding involving effects or no effects on historic properties and allow the Advisory Council an opportunity to comment. If Native American properties have been identified, section 106 requires that the Commission consult with interested Indian tribes that might attach religious or cultural significance to such properties (i.e., TCPs).

The Districts provided the Commission with cultural resources information, analyses, and recommendations, in accordance with the Advisory Council's regulations for implementing section 106 at 36 CFR 800.2(a)(3) and the Commission's regulation at 18 CFR 380(f). The federal land managing agencies have obligations regarding cultural resources under other federal laws and regulations, including the Federal Land Policy and Management Act, the Antiquities Act of 1906, section 110 of the NHPA, the Archaeological and Historic Preservation Act of 1974, the Archaeological Resources Protection Act of 1970, and the Native American Graves Protection and Repatriation Act.

Construction activities, maintenance, and operation of the projects could adversely affect historic properties (i.e., cultural resources listed or eligible for listing in the National Register). These historic properties could include prehistoric or historic archaeological sites, districts, buildings, structures, and objects, as well as locations with traditional value to Native Americans or other groups. Direct effects could include destruction or damage to all, or a portion, of an historic property. Indirect effects could include the introduction of visual, atmospheric, or audible elements that affect the setting or character of a historic property.

If existing or potential adverse effects to historic properties have been identified at the projects, the Districts must develop an HPMP for each project, providing measures to avoid, minimize, or mitigate the effects. During development of the HPMPs, the Districts should consult with the Commission, Advisory Council, California SHPO, BLM, and Native American tribes to obtain their views on the management of historic properties. In most cases, the HPMPs would be implemented by execution of PAs that would be signed by the Commission, Advisory Council (if it chooses to participate), California SHPO, BLM, and other consulting parties as appropriate.

On February 23, 2011, the Commission sent letters to six federally recognized Indian tribes for the Don Pedro Project. Federally recognized Indian tribes who received letters from the Commission included the Tuolumne Band of Me-Wuk Indians, Picayune Rancheria of Chukchansi Indians, Buena Vista Rancheria, California Valley Miwok Tribe, Chicken Ranch Rancheria of Me-Wuk Indians, and the North Fork Rancheria of Mono Indians. These letters invited the tribes to meet with Commission staff to discuss

their participation in the process and to establish communication procedures. On May 12, 2011, Commission staff met with representatives from the Picayune Rancheria of Chukchansi Indians, Chicken Ranch Rancheria of Me-Wuk Indians, California Valley Miwok Tribe, and Tuolumne Band of Me-Wuk Indians at the Tuolumne Band Headquarters in California. On May 15, 2014, Commission sent letters to the same federally recognized Indian tribes for the La Grange Project. No follow-up meetings with Indian tribes were organized for the La Grange Project.

In its April 8, 2011 Notice of Intent for the Don Pedro Project and its May 23, 2014 Notice of Filing of Pre-Application Document for the La Grange Project, the Commission designated the Districts as the Commission's non-federal representatives for carrying out day-to-day consultation with regard to the projects' licensing efforts, pursuant to section 106 of the NHPA; however, the Commission remains ultimately responsible for all findings and determinations regarding the effects of the projects on any historic property. The Districts also established Cultural Resources Working Groups for each project and provided the Commission with documentation of regular consultation with group participants regarding study status, results, and the development of HPMPs for each project.

On January 27, 2012, and December 16, 2015, respectively, the Commission issued a Notice of Proposed Restricted Service List for the Don Pedro Project and the La Grange Project. The Commission proposed to include the following entities on the list: Central Sierra Me-Wuk Cultural and Historic Preservation Committee, Tuolumne Band of Me-Wuk Indians, Chicken Ranch Rancheria of Me-Wuk Indians, Buena Vista Rancheria, California Valley Miwok Tribe, Advisory Council, Park Service, California SHPO, and the Districts. The notices also stated that the Commission would be consulting with the California SHPO and Advisory Council to prepare and execute PAs for the two projects. In a letter filed on April 3, 2017, the Buena Vista Rancheria of Me-Wuk Indians responded that they deferred to the Tuolumne Band of Me-Wuk Indians regarding the La Grange Project (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from R.C. Columbro, Tribal Historic Preservation Officer, Buena Vista Rancheria of Me-Wuk Indians, Sacramento, California, dated February 8, 2017).

Areas of Potential Effect

Pursuant to section 106, the Commission must take into account whether any historic property within a project's APE could be affected by the issuance of a license. The APE is determined in consultation with the California SHPO and is defined as "the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties," including TCPs (36 CFR 800.16[d]).

The Districts filed revised cultural resources study plans for the Don Pedro Project on November 22, 2011. The Historic Properties Study Plan for archaeological and

historic-era properties defined the APE for the Don Pedro Project as follows (Districts, 2011b):

> …all lands within the FERC boundary that are (1) within 100 ft. beyond the normal maximum water surface elevation (830 ft.), (2) within designated Project facilities and formal recreation use areas, (3) within informal recreation use areas identified by the Don Pedro Recreation Agency, (4) within the Red Hills Area of Critical Environmental Concern (ACEC), or (5) along the reservoir edges, especially the reservoir reaches, where there are portions of intermittent and perennial flowing streams. It is possible that the studies implemented as part of the relicensing process may identify Project-related activities that have the potential to affect historic properties outside this APE. It is also possible that during relicensing, Project improvements may be proposed that are outside the APE. If such areas are identified, the APE will expand in accordance with 36 CFR 800.4(a)(1) in consultation with the SHPO, BLM, Tribes, and other interested parties, as appropriate. Additional cultural resource inventories will be completed as part of this study if the APE is expanded. If unforeseen Project-related activities are planned to be undertaken outside of the APE in the future, the Section 106 process will again be complied with, prior to implementation of the activities.

The Districts' Traditional Cultural Properties Study Plan for potential TCPs at the Don Pedro Project states that the Districts would submit maps depicting the APE to the California SHPO for formal review, comment, and concurrence (Districts, 2011c). The study plan also states that the Districts might request California SHPO concurrence on a modified APE during the study if the Districts determine that the project affects historic properties outside the previously approved APE. In its December 22, 2011, Study Plan Determination, the Commission concurred with the two cultural resources study plans and thereby also concurred with the definition of the APE. In a subsequent letter filed on October 11, 2017, with the amended final license application, the California SHPO concurred with the Districts' redefinition of an APE for the Don Pedro Project that had been expanded by an additional 376 acres (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from C. Roland-Nawi, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated February 23, 2015). This expansion incorporated several additional areas where project-related operations and maintenance activities could affect historic properties.

The Districts filed a revised cultural resources study plan for archaeological and historic-era properties (CR-01, Cultural Resources Study) associated with the La Grange Project on January 5, 2015. The Commission's February 2, 2015, Study Plan Determination modified the APE and defined it as follows:

> Lands immediately downstream of the La Grange Diversion Dam and the La Grange impoundment upstream of the La Grange Diversion Dam. For

the downstream portion, the APE includes the La Grange Project powerhouse, tailrace, and La Grange Project access roads. For the upstream portion, the APE includes a 100-foot buffer zone beyond the normal maximum water surface elevation (reservoir spillway elevation of 296.46 feet msl) of the La Grange impoundment, starting at the La Grange Diversion Dam and extending upriver to the Don Pedro Dam. The APE may be modified after consultation with interested parties if the consultation results in the identification of additional lands that may be affected by La Grange Hydroelectric Project-related activities outside of these areas.

In a letter filed with their final license application for the La Grange Project, the Districts provided the Commission with documentation of consultation with the California SHPO regarding the APE and included a copy of the California SHPO's July 8, 2016 letter concurring with the boundaries of the APE.

Cultural History Overview

The Districts conducted archival research to obtain background information relevant to understanding past lifeways, cultural sequences, and historic period developments within and adjacent to the Don Pedro and La Grange Projects. Based on this gathered background information, a cultural context was prepared and is summarized below (as provided in Districts, 2019d; 2018h).

Prehistory

The cultural history of the region near the Don Pedro and La Grange Projects can be divided into five major archaeological periods—the Early Archaic period (11,500–7000 Before Present [B.P.]), Middle Archaic period (7000–3000 B.P), Late Archaic period (3000–1100 B.P.), Recent Prehistoric I period (1100–610 B.P.), and Recent Prehistoric II period (610–100 B.P). These periods reflect changes in tool technology through time as reflected in artifact assemblages recovered from a number of archaeological sites.

During the Early Archaic period (11,500–7000 B.P.) generalist hunter-gatherers subsisted on a variety of plant and animal resources. Early Archaic sites in the foothills of the Sierra Nevada Mountains are rare, but artifacts recovered from two sites located upstream of New Melones Reservoir (CA-CAL-342, CA-CAL-629/630) contain a large number of wide-stem and large-stemmed dart points and a small number of other stemmed and notched projectile points. Toolstone used for bifaces and projectile points is primarily traced to local sources and may indicate that land use by Early Archaic populations near the projects was not the highly mobile strategy used elsewhere by other people of the same period. However, some obsidian from eastern Sierra Nevada sources has been recovered from the two sites discussed above. Groundstone implements are also present at these sites. Numerous handstones and milling slabs were recovered from CA-CAL-629/630 and botanical remains reflect the processing of pine nuts and acorns.

Evidence also indicates that lands near the projects were occupied during the Middle Archaic period (7000–3000 B.P.). Although hunting and gathering remained the primary subsistence strategy, evidence dating to the Middle Archaic indicates a shift from larger stemmed projectile points to smaller Corner-notched dart points. Milling slabs, handstones, and various cobble-based processing tools are also commonly found at sites dating to this period. The archaeological record suggests that during the summer, populations gathered seasonal plant resources including berries, seeds, fruits, bulbs and roots at higher elevations. Lower elevation villages were inhabited during the cooler fall and winter seasons. Underground granaries at sites dating to this period indicate that pine nuts and acorns were important plant resources and were stored for future use.

Life during the Late Archaic period (3000–1000 B.P.) was very similar to that of the Middle Archaic period. Seasonal movement between the foothills and higher elevation conifer forests continued to be the primary subsistence strategy and Corner-notched dart points remain the predominant projectile form. However, an increase in the use of obsidian and the recovery of obsidian flaked stone implements from high elevation archaeological sites of the western Sierra Nevada indicates that populations now traversed the range from the east where obsidian was the primary toolstone.

The Recent Prehistoric I period (1100–610 B.P.) is marked by the introduction of the bow and arrow as reflected by the abundance of small-stemmed and corner-notched arrow points in archaeological deposits, but archaeological assemblages from this period do not provide adequate information about life during this time. Sites dating to the Recent Prehistoric II period (610–100 B.P.) are common. An abundance of bedrock milling features found throughout the area, both isolated and associated with midden deposits, indicates that the importance of acorns intensified at this time. Further, residential sites frequently contain both structural remains and house depressions. Populations continued to hunt large mammals, including sheep and deer found at elevations above 6,000 feet. Tools including Desert Side-notched projectile points and shaft straighteners associated with bow and arrow technology are frequently found at Recent Prehistoric II period sites.

Ethnography

The Don Pedro and La Grange Projects lie in the traditional territory of the Central Sierra Miwok who inhabited the mountains and foothills of the upper drainages of the Tuolumne and Stanislaus Rivers. The Central Sierra Miwok were politically independent but were one of five Miwok groups. Tribelets of approximately 25 persons controlled several semi-permanent settlements and seasonal campsites. Structures within settlements were primarily conical in shape with posts or frameworks that supported bark slabs. Sierra Miwok subsistence was focused on gathering local plant resources and hunting following a seasonal round. During the summer, groups traveled to higher elevations to take deer and visited lower elevations to procure elk and antelope. Acorns were a dietary staple but were supplemented with greens and pine nuts. In addition to the

manufacture of lithic projectile points, scrapers, choppers, and knives, Sierra Miwok technology also included basketry and ground stone implements used to process acorns.

European contact with the Eastern Miwok first occurred during the second part of the eighteenth century. At this time, Spanish explorers traversed the Sacramento and San Joaquin Valleys. This contact resulted in drastic changes in Miwok lifeways with tribelets cooperating to resist missionization, forced labor, and displacement. Many Miwok were lost to Spanish violence and introduced diseases. The subsequent arrival of European fur trappers, followed by gold miners and settlers, further caused Miwok cultural disruption. While the United States government entered into treaties with several tribelets, these treaties were never ratified, and several groups of Miwok were removed to the vicinity of Fresno. However, most of the Miwok remained on rancherias and a dependence on wage labor resulted in a decrease in the importance of traditional hunting and gathering as primary economic and subsistence endeavors.

Today, the Chicken Ranch Rancheria of Jamestown and the Tuolumne Band of Me-Wuk Indians are the two federally recognized Sierra Miwok tribes near the Don Pedro and La Grange Projects. However, several other tribes also retain ties to lands near the projects.

History

The historic context of the Don Pedro and La Grange Projects focus on several main themes—mining, agriculture, transportation, and water development.

Following the discovery of gold at Sutter's Mill in 1848, four primary methods of gold retrieval were developed in the Sierra Nevada foothills. Placer mining practices used water to erode "free" gold from stream sediments. This method quickly depleted the lower elevation streambeds and drainages and miners began to explore gravels associated with old rivers at higher elevations. Hydraulic mining replaced placer mining in the 1860s. This method used gravity-fed water to erode lands thought to hold gold. By 1880, the La Grange Hydraulic Mining Company held a mining field that encompassed approximately 1,200 acres. For the most part, hydraulic mining ended in 1884 when the United States Circuit Court made it illegal to discharge mining sediments into streams and rivers. Hard rock mining began near the projects in the 1850s. This method used the construction of mine shafts, adits, tunnels, and other features to access subsurface gold deposits. In the late 1880s, many of the mines were closed due to the advent of World War I, but many in Tuolumne County were subsequently reopened, and by 1915, mining was the main industry in the county. While the dredging of placer-bearing gravels in Tuolumne County began in earnest the 1930s, the La Grange Gold Dredging Company purchased a 9-mile field of land on the Tuolumne River in 1905 with the intent to mine it by dredging. These lands were dredged between 1907 and 1942 and between 1945 and 1951. Tailings from the dredge mining were used during construction of the new Don Pedro Dam.

Farming and ranching have been the primary economic endeavors in Tuolumne and Stanislaus Counties since about 1870. Hay, wheat, alfalfa, and orchard fruits were the main crops. Hay and alfalfa were particularly important because they served to feed livestock. By 1909, large-scale cattle ranches in Tuolumne County resulted in an economic boon to the region. Sheep, hogs, goats, llamas, and poultry were also raised. However, competition for land with crop farmers resulted in some animosity. Laws passed in 1870 and 1872 required ranchers to pay for any damage to adjacent crops as a result of livestock intrusion, resulting in a decrease in cattle ranching in the region. Hog farming, which required less land than that used by cattle and sheep, increased at this time. However, an 1878 law required hogs to be tied up, and this too resulted in a decline in animal husbandry in the region. This decline led to an increase in crop cultivation, particularly wheat, and water-intensive orchard crops. The increase in crop farming resulted in a need for transportation, irrigation, and water development projects.

The first roads in Tuolumne and Stanislaus Counties followed trails established by the Miwok that were later used by Euro-Americans. Several wagon roads dating to the late nineteenth century have been documented on General Land Office plats and USGS topographic maps. Bridges, ferries, and fords are located near both the Don Pedro and La Grange Projects. Construction of the Southern Pacific San Joaquin Valley railroad to Los Angeles began in December of 1869 and was completed in 1876. The railroad resulted in the founding of several major towns in Stanislaus County, including Modesto, Merced, and Turlock, and allowed for the easy transportation of people between the central valley, Southern California, and eastern cities. The farming and ranching economies also benefited from the railroad, which was used to move agricultural products. A railroad in Tuolumne County was not established until 1901 when the Sierra Railway built a railroad between Angels Camp in Calaveras County and Oakdale, on the Southern Pacific line.

Gold mining near the Don Pedro and La Grange Projects required water. Between 1851 and 1927, when it was purchased by Pacific Gas and Electric Company, the Tuolumne County Water Company constructed an elaborate system of ditches and flumes that carried water from dams and reservoirs to large mining camps in the region. Two other water companies were established in 1854, the Franklin Water Company and the French Bar Water Company, but the rights of these two companies were absorbed by the Stanislaus Water Company in 1855. A dam was constructed near the current location of the La Grange Diversion Dam, but it was washed out by flooding in 1861. The mining camp at La Grange was established in the early 1850s and for a time, was one of the most important camps on the river. Between 1871 and 1872, the La Grange Ditch and Hydraulic Mining Company constructed a 17-mile-long ditch along the Tuolumne River between a low diversion dam at Indian Bar and La Grange. By the 1880s, the La Grange Ditch was in poor condition but continued to be used for dredging into the earlier twentieth century. With construction of old Don Pedro Dam, the ditch was abandoned.

Water was also desperately needed near the Don Pedro and La Grange Projects for irrigation and other purposes. In 1871, J.M. Thompson, Charles Elliott, and M.A.

Wheaton obtained the rights to the location of the original mining dam that had been constructed by the Tuolumne Water Company. A new timber dam (the Wheaton Dam) was built, and water from this site was used to irrigate orchards and gardens in the area. The Wright Act of 1887 allowed for the development of irrigation districts and for the acquisition of water and property rights. TID was the first irrigation district to be established in California. The Districts purchased Wheaton Dam and associated property in 1890 and the stone La Grange Diversion Dam was completed in 1893. When the dam was finished, the Districts were still constructing associated irrigation canals. MID's main canal was excavated between 1891 and 1894 and contained a wooden flume connecting it to the dam headworks. The first full season of irrigation from this canal was in 1904. TID also completed a main canal by 1895 but continued work on the associated irrigation system. Irrigation began in 1900 when the system was completed. In 1906 and 1907, the La Grange Water and Power Company obtained the assets of the La Grange Ditch and Hydraulic Mining Company and installed a hydropower plant about 1 mile downstream from the La Grange Diversion Dam. The plant provided power to river dredgers and, later, to the city of Turlock and other nearby communities. In 1911, the La Grange Water and Power Company was combined with two other companies to form the Yosemite Power Company, which sold the La Grange system to the Sierra and San Francisco Power Company in 1917. In 1920, Pacific Gas and Electric Company acquired the Sierra and San Francisco Power Company. However, in 1923, TID purchased the former decommissioned La Grange Water and Power Company power plant. The plant was reopened in 1924 but only contributed to TID's generation when water was in excess of what was needed for irrigation purposes.

In 1915, the Districts agreed to construct a water storage dam at the Don Pedro site, and by 1923, the old Don Pedro Dam and Reservoir had been completed. However, to ensure continued water rights, the Districts planned to construct a larger, new Don Pedro Dam and Reservoir. In 1944, the California Legislature authorized the construction of a 1,200,000-acre-foot reservoir and the California DWR issued water rights in 1953. Construction of a diversion tunnel associated with the new Don Pedro Dam was completed in 1969 and construction of the dam itself was completed in 1971. The facility included a powerhouse, switchyard, power intake tunnel, outlet/diversion tunnel, spillway, and dikes.

Previous Investigations

To determine the extent of previous studies and to identify previously recorded cultural resource sites documented within 0.25 mile of the project APEs, between 2010 and 2012, the Districts reviewed existing records housed at the Central California Information Center, BLM Mother Lode Field Office, California State Library, California State University Stanislaus Special Collections, other county museums, and other state and local repositories. The Districts and their consultants also contacted Indian tribes to inquire about existing information that they might have with regard to known cultural resources.

The record search indicated that 62 cultural resource investigations have previously been conducted in the immediate vicinity of the Don Pedro Project (Districts, 2019d). Of these, 32 studies were located within the Don Pedro Project APE. These previous studies resulted in the documentation of 160 prehistoric, historic, and multi-component archaeological sites within the record search study area. Ninety-seven of these resources are located within project APE, consisting of 48 prehistoric sites, 35 historic-period sites, 9 sites containing both prehistoric and historic components, 1 protohistoric site, 1 site containing both prehistoric and protohistoric components, and 3 unknown site types. A review of historic General Land Office plats and USGS topographic quadrangles also suggested that an additional 50 previously unrecorded historic period sites could be located within the APE.

The record search indicated that nine cultural resource investigations have previously been conducted in the vicinity of the La Grange Project (Districts, 2018h). Of these, six studies were located within the La Grange Project APE. These previous studies resulted in the documentation of 18 prehistoric, historic, and multi-component archaeological sites within the record search study area. Four of these resources are located within the project APE. All of these resources are associated with water transportation and/or hydroelectric generation including the La Grange Diversion Dam (P-50-550), the Don Pedro outlet works/diversion tunnel (P-55-8887), the La Grange Ditch (P-55-8888), and the gated dam spillway (P-55-8889). A review of historic General Land Office plats and USGS topographic quadrangles also suggested that an additional 10 previously unrecorded historic period sites could be located within the APE of each of these projects.

Archaeological and Historic Resources

Following completion of the record searches, the Districts conducted intensive archaeological and built environment field investigations within the Don Pedro and La Grange Project APEs in accordance with the study plans filed for the Don Pedro Project on November 22, 2011, and the La Grange Project on January 5, 2015. Information gathered during the record searches was used to identify and relocate previously recorded sites within the APEs and to ensure that all previous site forms were accurate and met current standards. All newly discovered resources, including isolated finds (three or less artifacts per 50 square meters), were documented on California Department of Parks and Recreation site forms. Recordation included taking digital photographs of each site and preparing site sketch maps. GPS units were used to record all resource locations.

During field recordation of archaeological sites, the condition of each site was assessed to aid in the identification of project-related effects. National Register evaluations of affected sites were undertaken based on background research, documented remains, and other factors. A recommendation was made for the potential National Register eligibility of each site based on the criteria specified in 36 CFR 60.4, and the guidance provided in National Register Bulletin 15 (Park Service, 1997) and National

Register Bulletin 36 (Park Service, 1993). These criteria provide that the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

- **Criterion A.** That are associated with events that have made a significant contribution to the broad patterns of our history;
- **Criterion B.** That are associated with the lives of persons significant in our past;
- **Criterion C.** That embody the distinctive characteristics of a type, period, method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- **Criterion D.** That have yielded or may be likely to yield, information important in prehistory or history.

Typically, the National Register does not include properties that are less than 50 years old. However, properties that are less than 50 years old may be eligible for listing in the National Register if they are of exceptional importance (*See* 36 CFR 60.4, Criteria considerations, **Criterion G)**.

During the field investigations, the research potential of each site was also assessed based on site condition, integrity, location, and other factors.

Don Pedro Project Archaeological Resources

The initial results of archaeological survey at the Don Pedro Project were presented in a draft historic properties study report (HDR and FWARG, 2014) submitted to the California SHPO on October 28, 2014. A final report was filed with the Commission on May 22, 2015 (HDR and FWARG, 2015). A supplemental report that addressed lands subject to erosion was also filed on April 26, 2016 (HDR, 2014). These historic properties studies resulted in the documentation of 264 archaeological sites and 172 isolated finds within the within the project APE (Districts, 2019d).

The 85 prehistoric sites at the Don Pedro Project consist primarily of lithic scatters (30) that contain flaked stone debitage and/or tools. Short-term habitation sites (17 sites), long-term habitation sites (13 sites), and quarries (13 sites) are also prevalent. Short term-habitation sites contain both flaked and groundstone tools and other artifacts and may also contain bedrock milling stations. Long-term habitation sites include sites that contain prominent midden development, housepits, or extensive milling features. Other sites include solitary milling features (7 sites), rock shelters (2 sites), a possible tool cache and a possible hunting blind. Additionally, a historic district, the Tuolumne River Prehistoric Archaeological District, was also documented.

Many historic-period sites were also identified at the Don Pedro Project, including transportation sites (53 sites), mining-related sites (45 sites), sites related to water control/hydroelectric generation (23 sites), utility sites (6 sites), habitation sites (3 sites), and refuse scatters (2 sites). Classification of an additional 8 historic-period sites could not be ascertained.

Multi-component sites (39 sites) contain a varied combination of both prehistoric and historic site artifacts and features as described above.

In their reports filed with the Commission, the Districts recommended that 29 sites were eligible for listing in the National Register and 146 sites were ineligible for listing. The remaining 90 sites remained unevaluated pending further investigation.

By letter filed on October 11, 2017, the California SHPO concurred with the Districts' recommendation that all isolated finds identified at the Don Pedro Project are ineligible for listing in the National Register (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from C. Roland-Nawi, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated February 23, 2015). In its letter, the California SHPO also concurred with all of the Districts' other recommendations of National Register eligibility for archaeological resources. Additionally, the California SHPO concurred that 33 of the archaeological resources contribute to the eligibility of the Tuolumne River Prehistoric Archaeological District and 43 do not contribute to the district's eligibility.

In letters filed on September 19 and October 25, 2018, the California SHPO referred to subsequent reports that it had received from the Districts providing National Register evaluations of 47 of the 90 unevaluated archaeological sites that are potentially affected by the project[232] (letters to S. Boyd, TID, and J. Davids, MID, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated September 19, 2018, and October 24, 2018). In its letters, the California SHPO concurred that 13 of the sites are ineligible for listing in the National Register and one site is eligible. However, the California SHPO did not concur with the remaining 33 evaluations and stated that additional information for each site was needed to better understand site composition and whether any of the sites contribute to any of the historic districts at the project. In a letter from the California SHPO filed with the Districts' revised HPMP on February 14, 2019, the California SHPO stated that its comments had been addressed. Additionally, in their comments on the draft EIS filed on April 12, 2019, the Districts provided additional information regarding the current National Register status of sites located within the Don Pedro APE (Districts, 2019a).

[232] HDR (2018) *Cultural Resources Evaluation Report, Don Pedro Hydroelectric Project, FERC No. 2299* as referenced in the California SHPO's letters has not been filed with the Commission.

Table 3.3.7-1 provides a summary of current National Register status of archaeological sites documented within the APE at the Don Pedro Project. Of the 105 eligible or unevaluated archaeological resources, 48 are prehistoric sites, 29 are historic-period sites, and 28 are multi-component sites.

Table 3.3.7-1. National Register status of Don Pedro Project archaeological sites documented within the project APE (Source: Districts, 2019d).

Site Type	Eligible	Unevaluated	Ineligible	Total
Prehistoric	12	36	37	85
Historic	6	23	111	140
Multi-Component	11	17	11	39
Total	**29**	**76**	**159**	**264**

La Grange Project Archaeological Resources

The results of archaeological survey of lands contained within the La Grange Project APE were presented in a historic properties study report (HDR, 2017g). The historic properties survey resulted in the documentation of 5 archaeological sites and 2 isolated finds within the within the project APE (table 3.3.7-2).

Table 3.3.7-2. National Register status of La Grange Project archaeological resources within the project APE (Source: Districts, 2018h).

Site Number	Site Type	Description	National Register Eligibility
CA-STA-439H	Historic	Historic habitation (residential building)	Ineligible
CA-STA-440	Prehistoric	Bedrock milling features	Ineligible
CA-STA-441H	Historic	Historic habitation and powerhouse support facilities	Ineligible
CA-TUO-5992H	Historic	Two abandoned road segments	Ineligible
CA-TUO-6004H	Historic	Historic placer mining tailings	Ineligible

In their report, the Districts recommended that none of the 5 sites or 2 isolated finds are eligible for listing in the National Register. In a letter filed on October 11, 2017, the California SHPO concurred with these recommendations (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated September 18, 2017).

Built Environment Resources

During field studies for the Don Pedro and La Grange Projects, built environment resources were inspected and documented by individuals meeting the Secretary of the Interior's Standards for Architecture and Engineering Documentation.

Don Pedro Project Built Environment Survey Results

The results of the Don Pedro Project built environment survey were presented in the Districts' historic properties study report (HDR and FWARG, 2014). This study resulted in the documentation of 37 built environment resources within the project APE. Most of these include resources associated with the Don Pedro Project, including the dam system resources (15 resources), operations support resources (8 resources), recreation-related resources (4 resources), Districts' transmission lines (2 resources), construction-related resources (1 resource), and two historic districts—the Don Pedro Project Historic District and the Don Pedro Recreation Agency Historic District. Additionally, 5 other built resources not associated with the project were also documented. Table 3.3.7-3 describes these built environment resources.

The Districts evaluated each of the resources for their current and potential future National Register eligibility. Future eligibility was evaluated on both an individual basis and on each resource's potential to contribute to the eligibility one of the two identified historic districts. Currently, only one of the resources, the La Grange Ditch (P-55-8888), was recommended as eligible for listing in the National Register at the current time. In its February 23, 2015 letter, the California SHPO concurred with this recommendation. The California SHPO also concurred that the two transmission lines (P-55-8884, P-55-8885), the Guy F. Atkinson Company Construction Camp Powder House (P-55-8898), and all of the Don Pedro Project Operations Support Resources (P-55-8899 through P-55-8906) are also not eligible for listing. In its letter, the California SHPO stated that evaluation of the Hetch Hetchy Moccasin-Network Transmission Line (P-55-8693) was outside the scope of the project relicensing but that the Districts should assume that it is eligible. Additionally, the California SHPO stated that the Moccasin Creek Stone Building (P-55-1346), the Red Mountain Bar Siphon (P-55-3913), and the Kanaka Creek Cabin (P-55-8874) should be evaluated for their eligibility to the National Register.

Table 3.3.7-3. National Register Evaluations of Don Pedro Project built environment resources within the project APE (Source: Districts, 2019d, as modified by staff).

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
Historic Districts					
P-55-8880	Don Pedro Project Historic District	Ineligible	Eligible	NA	NA
P-55-8881	Don Pedro Recreation Agency Historic District	Ineligible	Eligible	NA	NA
Don Pedro Project Dam System Resources[a]					
P-55-8871	Don Pedro Dam (1970)	Unevaluated	Eligible	Contributing	NA
P-55-8872	Powerhouse (1968–1970)	Unevaluated	Eligible	Contributing	NA
P-55–8882	Don Pedro Reservoir (1970)	Unevaluated	Undetermined	Contributing	NA
P-55-8883	Switchyard (1971)	Unevaluated	Undetermined	Contributing	NA
P-55-8886	Power Tunnel (1968–1970)	Unevaluated	Eligible	Contributing	NA
P-55-8887	Outlet Works (1968)	Unevaluated	Eligible	Contributing	NA
P-55-8889	Gated Dam Spillway (1969)	Unevaluated	Eligible	Contributing	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
P-55-8890	Ungated Dam Spillway (1969)	Unevaluated	Eligible	Contributing	NA
P-55-8891	Dike A (1969–1970)	Unevaluated	Undetermined	Contributing	NA
P-55-8892	Dike B (1969–1970)	Unevaluated	Undetermined	Contributing	NA
P-55-8893	Dike C (1969–1970)	Unevaluated	Undetermined	Contributing	NA
P-55-8894	Gasburg Creek Dike (1970)	Unevaluated	Undetermined	Contributing	NA
P-55-8895	Unit 1 Substation (1970)	Unevaluated	Undetermined	Non-contributing	NA
P-55-8896	Unit 2 Substation (ca 1972)	Unevaluated	Undetermined	Non-contributing	NA
P-55-8897	Cable Hoist/Incline Track (1969–1971)	Unevaluated	Eligible	Contributing	NA
TID and MID Transmission Lines					
P-55-8884	TID (east) Transmission Line	Ineligible	Ineligible	NA	NA
P-55-8885	MID (west) Transmission Line	Ineligible	Ineligible	NA	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
Don Pedro Dam Construction-related Resources					
P-55-8898	Guy F. Atkinson Construction Camp Powder House	Ineligible	Ineligible	NA	NA
Don Pedro Project Operations Support Resources					
P-55-8899	Dam Storage Yard Warehouse (1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8900	Riley Ridge Microwave Building and two towers (1970–1971; 1986)	Ineligible	Ineligible	Non-contributing	NA
P-55-8901	Riley Ridge Employee Housing House 1 (1970–1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8902	Riley Ridge Employee Housing House 2 (1970–1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8903	Riley Ridge Employee Housing House 3 (1970–1971)	Ineligible	Ineligible	Non-contributing	NA
P-55-8904	Riley Ridge Employee Housing House 4 (1972)	Ineligible	Ineligible	Non-contributing	NA

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
P-55-8905	Riley Ridge Employee Housing House 5 (1972)	Ineligible	Ineligible	Non-contributing	NA
P-55-8906	Riley Ridge Water Tank (1971)	Ineligible	Ineligible	Non-contributing	NA
Don Pedro Project Recreation-Related Resources					
P-55-8574	Moccasin Point Recreation Area	Ineligible	Eligible	NA	Contributing
P-55-8803	Fleming Meadows Recreation Area	Ineligible	Eligible	NA	Contributing
P-55-8907	Headquarters and Visitor Center[233]	Ineligible	Eligible	NA	Contributing
P-55-8908	Blue Oaks Recreation Area	Ineligible	Eligible	NA	Contributing
Other Non-Project Resources					
P-55-1346	Moccasin Creek Stone Building	Unevaluated	NA	NA	NA

[233] This structure was completely destroyed by a fire in 2016.

Primary Number	Resource	National Register Eligibility	Potential Future Eligibility in 50 Years	Potential Future Eligibility as Element of the Don Pedro Project Historic District	Potential Future Eligibility as Element of the Don Pedro Project Recreation Agency Historic District
P-55-3913	Red Mountain Bar Siphon	Unevaluated	NA	NA	NA
P-55-8693	Hetch Hetchy Moccasin-Newark Transmission Line	Unevaluated	Undetermined	+	NA
P-55-8874	Kanaka Creek Cabin	Unevaluated	NA	NA	NA
P-55-8888	La Grange Ditch	Eligible	NA	NA	NA
Totals		Eligible = 1 Ineligible = 17 Unevaluated = 19 Total = 37	Eligible = 13 Ineligible = 11 Undetermined = 9 NA = 4 Total = 37	Contributing = 13 Non-contributing = 10 NA = 14 Total = 23	Contributing = 4 Non-contributing = 0 NA = 33 Total = 4

Notes: NA—not applicable

[a] The Districts recommended that the 15 structures that comprise the Don Pedro System resources are not currently eligible for listing in the National Register. By letter dated February 23, 2015, the California SHPO did not concur and recommended that their eligibility be re-evaluated. These resources remain unevaluated and their potential eligibility is undetermined.

With regard to the Don Pedro Project system resources (15 structures), the Districts recommended that these resources are not eligible for listing in the National Register because they do not yet meet the 50-year threshold for eligibility and are not considered to be exceptionally significant under Criterion G. However, in its February 23, 2015, letter the California SHPO stated that it could not concur with the Districts' recommendations. The California SHPO's position is that it is common practice to evaluate properties that are 45 years and older. When the Districts submitted their recommendations, these structures were 46 years old. For this reason, the California SHPO recommended that the eligibility of these structures (which would include the two historic districts) be re-examined. In their November 27, 2017, response to staff's October 27, 2017, AIR and in their February 2019 proposed HPMP, the Districts propose to reevaluate all these structures when they reach 50 years of age, except for the Don Pedro Recreation Agency Headquarters and Visitors Center building [P-55-8907], which burned down and no longer exists. Until that time, the National Register eligibility of these resources remains undetermined.

La Grange Project Built Environment Survey Results

The results of the La Grange Project built environment survey were presented in the Districts' Historic Properties Study Report (HDR, 2017g). This study resulted in the documentation of 14 built environment resources within the project APE. Most of these include resources associated with the La Grange Project Diversion Dam (P-50-0550) and irrigation system (eight resources) or the La Grange Project hydroelectric system (four resources). One resource is a garage associated with a residential property and one is the La Grange Ditch (P-55-8888). Table 3.3.7-4 describes all 14 built environment resources.

Table 3.3.7-4. National Register status of La Grange Project built environment resources within the project APE (Source: Districts, 2018h, as modified by staff).

Primary Number	Resource	National Register Eligibility (criteria)
La Grange Diversion Dam and Irrigation System Resources		
P-50-0550	La Grange Diversion Dam (1893)	Eligible
None	La Grange Forebay Bypass Spillway (1910)	Ineligible
None	La Grange Headpond (1893)	Ineligible
None	La Grange Irrigation Canal Forebay (1910)	Ineligible
None	La Grange MID Old Canal Intake Structure (1893)	Ineligible

Primary Number	Resource	National Register Eligibility (criteria)
None	La Grange TID Diversion Tunnel Intake Structure (1910)	Ineligible
None	La Grange MID Old Canal Discharge Structure (1910)	Ineligible
None	La Grange MID Old Canal Segment (1904)	Ineligible
La Grange Project Hydroelectric System Resources		
None	La Grange Powerhouse (1924)	Ineligible
None	La Grange Powerhouse Penstocks (1924)	Ineligible
None	La Grange Powerhouse Tailrace (1924)	Ineligible
None	La Grange Powerhouse Access Road (ca. 1922)	Ineligible
Residential Properties		
None	Garage on La Grange Powerhouse Access Road (ca. 1930)	Ineligible
Historic Mining Resources		
P-55-8888	La Grange Ditch (1872)	Eligible

In their report, the Districts recommended that the La Grange Diversion Dam (P-50-0550) is eligible for listing in the National Register under Criteria A and C for its role in the development and growth of irrigation in the Central Valley and for its association with the 1887 Wright Act. Additionally, it is unique because of its integrated spillway and materials and its height. The La Grange Ditch (P-55-8888) was previously determined to be eligible for listing. All other structures were recommended as ineligible for listing in the National Register due to alterations made over the years, resulting in a lack of any individual integrity for these structures. In a letter filed with the license application, the California SHPO concurred with these recommendations (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, dated September 18, 2017).

Traditional Cultural Properties

The Districts consulted with participating Indian tribes and implemented studies to identify potential TCPs within the project APEs.

Don Pedro Project Traditional Cultural Properties Results

To identify potential TCPs within the Don Pedro Project APE, the Districts implemented the 2011 Study Plan (CR-2), conducted archival research, interviewed tribal elders, visited archaeological sites, conducted National Register evaluations of identified locations, and assessed project-related effects on eligible TCPs. Representatives of the Central Sierra Me-Wuk Cultural and Historic program at Tuolumne, Chicken Ranch Rancheria of Me-Wuk, Southern Sierra Miwuk Nation, and Tuolumne Band of Me-Wuk Indians and an individual Yokuts/Me-Wuk elder not affiliated with a federally recognized tribe, participated in study interviews. The results of this work were presented a report filed with the Commission on May 22, 2015 (Applied Earthworks, 2015).

The study resulted in the identification of several locations that could qualify as TCPs; these locations included a cultural location encompassing a number of archaeological sites also known as a traditional fishing and plant-gathering location, auriferous streams, four separate archaeological sites, and two traditional plant gathering locations. All these locations were evaluated for listing in the National Register following the guidance provided in National Register Bulletin 38 (Parker and King, 1998).

The Districts determined that only one of these areas meets the criteria for National Register eligibility. The cultural location containing archaeological sites and plant-gathering and fishing areas (P-55-8925) was recommended to be eligible as a historic district. In a letter filed with the amended license application, the California SHPO determined that this district is eligible under National Register Criterion A for its association with a "pattern of events or a historic trend that made a significant contribution to the development of a community" and for its association with the cultural practices of the community that are important in maintaining and continuing its cultural identify (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from C. Roland-Nawi, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California, undated). While the area has been affected by mining activity, it has retained its integrity of location, feeling, and association.

La Grange Project Traditional Cultural Properties Results

Unlike the Don Pedro Project, no specific study plan was developed for TCPs at the La Grange Project. However, the Cultural Resources Study plan (CR-01) called for the Districts to consult with local Indian Tribes, invite them to attend a field visit, and allow them the opportunity to provide information regarding locations of cultural importance. To accomplish this task, the Districts contacted all organizations identified on the Districts' tribal list via email and by telephone, interviewed nine individuals, and provided a tour of the study area. Additionally, the Districts spoke with residents of La Grange and discussed the project with staff at the La Grange Museum. The results of the study were filed with the final license application (King et al., 2017).

The Districts' study did not result in the identification of any places at the La Grange Project that could be classified as TCPs. However, the report recommends that further study should take place if any changes in the structure or operation of the project are planned in the future.

3.3.7.2 Environmental Effects

Project-related effects on cultural resources within the Don Pedro and La Grange Project APEs are likely to occur from operation and maintenance activities. Project effects are considered adverse when an activity may alter—directly or indirectly—the characteristics of a historic property that qualify the property for inclusion in the National Register. If adverse effects are found, consultation with the California SHPO and other parties would be required to develop alternatives or modifications to avoid, minimize, or mitigate such adverse effects.

Over the license term, various project-related actions may affect historic properties at the project and include routine operation and maintenance of buildings and structures, reservoir inundation and fluctuation, vegetation management, grazing, road maintenance, construction and use, recreation, emergency repairs, and artifact collection/management. The Districts have identified project effects on all eligible or unevaluated resources that may occur as a result of these activities

Don Pedro Project

In its letters filed on October 11, 2017, September 19, 2018, and October 25, 2018, the California SHPO determined that 159 archaeological sites within the project APE are ineligible for listing in the National Register. Under section 106, no further assessment of effects or continued management of these resources is required. However, during their field investigations, the Districts evaluated project-related effects at the remaining 105 eligible and unevaluated sites documented within the APE. Ongoing project-related effects were identified at 88 archaeological resources—26 eligible sites and 62 unevaluated sites (table 3.3.7-5). No effects were observed at 3 eligible sites and 14 ineligible sites.

Sites within drawdown or seasonal fluctuation zones of a reservoir may be subject to erosion, scouring, deflation, hydrologic sorting, and the horizontal and vertical movement of artifacts. Reservoir fluctuation and/or drawdowns may also result in the exposure of previously submerged cultural resources making them more susceptible to artifact collection and vandalism. Table 3.3.7-6 demonstrates the number of sites affected solely by fluctuating water levels, recreational activities, looting, cattle grazing and/or combinations of multiple disturbances.

Of the 88 eligible and unevaluated archaeological sites that are experiencing project-related effects, almost all (78 sites) are experiencing effects as a result of fluctuating water levels.

Table 3.3.7-5. Summary of ongoing project-related effects for eligible and unevaluated archaeological sites at the Don Pedro Project (Source: Districts, 2019d, as modified by staff).

Ongoing Project-related Effects	Prehistoric Sites	Historic Sites	Multicomponent Sites	Total
Eligible Archaeological Resources				
Effects	12	5	9	26
No Effects	0	1	2	3
Subtotal	**12**	**6**	**11**	**29**
Unevaluated Archaeological Resources				
Effects	32	16	14	62
No Effects	4	7	3	14
Subtotal	**36**	**23**	**17**	**76**
Effects Total				**88 sites**
No Effects Total				**17 sites**

Table 3.3.7-6. Types of project-related effects observed at eligible and unevaluated archaeological sites at the Don Pedro Project (Source: Districts, 2019d, as modified by staff).

Identified Project-related Effect	Number of Sites Affected
Fluctuating water levels only	41
Recreation only	2
Cattle grazing only	8
Fluctuation water levels and recreation	25
Fluctuating water levels and looting	3
Fluctuating water levels and cattle grazing	1
Fluctuating water levels, recreation, and looting	5
Fluctuating water levels, recreation, and cattle grazing	1
Fluctuating water levels, looting and cattle grazing	1
Fluctuating water levels, recreation, cattle grazing, and looting	1
Total Number of Affected Sites	**88**

Recreational activities, such as camping, fishing, picnicking, boating, and hiking, may also affect cultural resources through increased public access and traffic. These

activities may cause soil erosion and artifact collection and/or vandalism at sites. Additionally, maintenance and improvement of formal recreation facilities can also result in site disturbances. Ongoing effects resulting from recreational use were observed at 34 eligible or unevaluated sites within the Don Pedro Project APE. Intentional looting was observed at 10 eligible or unevaluated sites. Finally, the issuance of cattle grazing leases can deplete vegetation cover and result in trampling and erosion of sensitive cultural resource sites. Within the Don Pedro Project APE, disturbances as a result of cattle grazing were observed at 12 eligible or unevaluated archaeological sites.

Project-related Effects to Built Environment Resources

Eligible hydroelectric facilities may require maintenance to ensure that they remain in good condition. Planned and unplanned maintenance and operation activities could affect the qualities of these structures that make them eligible for inclusion in the National Register. These activities may include but are not limited to structural or mechanical upgrades and the repair or replacement of existing building components. Additionally, changes in viewscape may also affect the setting, association, and feel of eligible structures.

Of the 37 built environment resources documented within the Don Pedro Project APE, only one has been previously determined to be eligible for listing in the National Register (the historic La Grange Ditch). In their amended license application, the Districts recommended a finding that project operations and maintenance activities were not affecting this structure. Effects on four unevaluated structures were assessed, and the Districts recommended a finding that they were also not being affected by project operations and maintenance. The Districts recommended a finding that the remaining 32 structures are ineligible for listing in the National Register because at they are not yet 50 years old. The Districts report that one of these structures (P-55-8907) was destroyed by a fire in 2016. For this reason, the Districts did not assess project effects on these resources. However, as mentioned in section 3.3.7.1, *Cultural Resources, Affected Environment, Don Pedro Project Built Environment Survey Results*, the California SHPO did not concur with the Districts' recommendation that the 15 structures associated with the Don Pedro Project dam system are not eligible.

Project-related Effects to Traditional Cultural Properties

The Districts identified a single TCP within the Don Pedro Project APE. This location, a traditional plant gathering area (P-55-8925), is accessible by a public road. For the most part, the location is located above the high-water line, although a small area of the site may be periodically inundated by Don Pedro Reservoir. No other potential effects were identified.

La Grange Project

The Districts identified five archaeological sites and two isolated finds during archaeological surveys conducted within the La Grange Project APE. The California

SHPO determined that all these resources are ineligible for listing in the National Register. For this reason, project-related effects were not assessed, and no further consideration of these properties is required under section 106.

The Districts identified 14 built environment resources within the La Grange Project APE. The California SHPO determined that all but two of these resources are ineligible for listing in the National Register. The Districts own and operate the La Grange Diversion Dam (P-50-0550). The La Grange Ditch (P-55-8888; also located within the Don Pedro Project APE) is located close to the project but is not a project facility. This structure is currently abandoned. The Districts did not identify any current project-related effects on these two resources. However, the Districts acknowledge that continued operations and maintenance activities and any future project-related construction activities have the potential to affect both structures.

The Districts did not identify any locations that may qualify as TCPs within the project APE.

Historic Properties Management Plans

Continued project operation and enhancements, recreational use, and new construction could affect cultural resources listed or eligible for inclusion in the National Register. The Districts propose to manage effects on historic properties through the implementation of separate HPMPs for the projects. The purpose of the HPMPs is to resolve (i.e., avoid, minimize, or mitigate) existing or potential project-related adverse effects on historic properties within the Don Pedro and La Grange Project APEs throughout the term of each license.

The Districts filed separate draft HPMPs with the license applications for the Don Pedro and La Grange Projects. The draft HPMPs were prepared in accordance with the Advisory Council and Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects* (Advisory Council and Commission, 2002). An updated HPMP for the Don Pedro Project was filed on February 14, 2019.

In both HPMPs, the Districts propose both general and specific management measures. General measures include but are not limited to: (1) plans for the curation of recovered archaeological materials; (2) a list of activities that are exempt from section 106 consideration; (3) a program for future cultural resources inventories on unsurveyed lands as conditions allow; (4) a public education and information program, including interpretive opportunities; (5) training for project personnel and contractors; (6) procedures for unanticipated discoveries of cultural materials and human remains; (7) protocols for emergency situations, (8) roles and responsibilities for the Districts' staff, Commission, BLM, California SHPO, Indian tribes, and other agencies; (9) reporting requirements, including the submittal of HPMP status reports every other year; and (10) procedures for HPMP review, updates, and amendments.

Additionally, each HPMP discusses specific project effects identified at each resource and provides measures to avoid, minimize, or mitigate adverse effects on those that are eligible or potentially eligible for listing in the National Register. These measures include programs for additional cultural resource evaluations, avoidance measures for known cultural resources, and a program for mitigating adverse effects on historic properties.

In their HPMP for the Don Pedro Project, the Districts propose various specific measures for each of the 105 eligible or unevaluated archeological sites. The Districts state that 17 of these sites are not be affected by the project (see table 3.3.7-7). The Districts propose to avoid these resources during operation and maintenance activities and to implement a monitoring program.

Table 3.3.7-7. HPMP measures for identified archaeological sites at the Don Pedro Project (Source: Districts, 2019d, as modified by staff).

Management Measure	**Number of Sites Affected**
Ineligible—no management required	159
No identified effects—monitoring	17
National Register evaluations	55
Inclusion in a mitigation plan	25
Eliminate cattle grazing and monitor	8
Total Number of Sites	**264**

The HPMP for the Don Pedro Project calls for formal National Register evaluation of the 55 sites experiencing project-related effects that cannot be eliminated. If any of these sites were determined eligible for listing in the National Register, appropriate measures to avoid, minimize, or mitigate effects would then be determined in consultation with the California SHPO, BLM, and others, as appropriate.

Twenty-five sites are eligible for listing on the National Register and are subject to unavoidable project-related effects. In the HPMP, the Districts propose to include these sites in a mitigation plan to be developed in consultation with the Commission, the California SHPO, BLM (as appropriate), and potentially affected Indian tribes. Approximately 50 percent of these sites would be mitigated through traditional data recovery excavations, artifact collection, and analysis of recovered materials to provide relevant scientific data. The remaining sites would be mitigated through implementation of a public education and interpretation program that would focus on previous information and information collected during the proposed data recovery efforts.

Cattle grazing is affecting eight sites located on Districts' lands that are leased to neighboring property owners.[234] In the HPMP for the Don Pedro Project, the Districts state that grazing in these areas will be discontinued and that these sites would be monitored at three- or seven-year intervals thereafter.

The Districts identified 37 built environment resources in the Don Pedro Project APE. One of these structures has since been destroyed by fire and therefore requires no further cultural resources management consideration. Four of these resources are eligible for listing in the National Register, but the Districts state that they are not currently being affected by the project. However, the draft HPMP calls for these structures to be avoided and monitored. In the HPMP, the Districts state that one of the remaining 32 unevaluated structures would also be avoided and monitored, while the remaining 31 structures would be evaluated in 2023 when they are all 50 years in age. The Districts suggest that 13 of these resources are likely to be determined to be eligible. To resolve potential adverse effects on eligible built environment resources, the HPMP calls for the development of a mitigation plan in the future to resolve any unavoidable project-related adverse effects. This plan would be developed in consultation with the Commission, California SHPO, and BLM (as appropriate).

A single TCP that is eligible for listing in the National Register was identified within the Don Pedro Project APE. No ongoing project-related effects were identified at this location and no specific management is proposed. However, the draft HPMP calls for a treatment plan to be negotiated among the California SHPO, Commission, Districts, BLM (as appropriate) and potentially affected Indian tribes in the future if any project-related adverse effects are identified at this site, or any as yet unidentified potential TCP located within the APE.

No archaeological sites or TCPs that are eligible for listing in the National Register were documented within the La Grange Project APE. For this reason, the La Grange Project HPMP does not include any specific measures for these resources. Fourteen built environment resources were identified, but only the La Grange Diversion Dam and the La Grange Ditch have been determined to be eligible for listing in the National Register. The Districts state that neither of these structures are being affected by project-related activities, but they could both be affected by future operations and maintenance activities. If the Districts propose any activity in the future that could affect the characteristics of the La Grange Diversion Dam or La Grange Ditch that qualify them for inclusion in the National Register, the HPMP calls for the Districts to consult with the California SHPO prior to commencing with the activity. Additionally, the HPMP calls

[234] Grazing was also identified at five additional sites; however, these sites are also experiencing other project-related effects that require implementation of other management measures.

for the Districts to reconsider the boundaries of the project APE within one year of any license issuance based on the Commission's final approval of a project boundary. If the project boundary includes lands outside the current APE, these lands will be included in the APE and the results of any additional surveys, evaluations, and assessments of effect included in a revised HPMP to be filed within two years of license issuance.

The Districts provided a draft of the Don Pedro Project HPMP to the California SHPO in August 2016 and received comments back on November 10, 2016 (letter to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, California, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California). However, the draft HPMP that was filed with the amended license application in October 2017 is the same version of the document that was submitted to the California SHPO in August 2016 and did not address the California SHPO's November 2016 comments. Consultation with the California SHPO, agencies, and Indian tribes regarding the La Grange Project HPMP had not yet been initiated when the draft HPMP was filed with the La Grange Project final license application.

In its October 27, 2017, AIRs for each project, staff requested that both HPMPs be revised to address any comments received (including the California SHPO's November 27, 2016 comments on the draft HPMP for the Don Pedro Project). The HPMPs would also present a discussion of the extent to which comments were addressed and provide copies of all correspondence. Additionally, for the Don Pedro Project, the Commission requested that the Districts reconcile discrepancies between the counts of archaeological sites identified in the cultural resources reports, amended license application, and draft HPMP. In their responses to the AIRs filed on November 27, 2017, the Districts stated that the final HPMPs to be filed for each project would include the requested consultation documentation. Additionally, the Districts stated that the counts of archaeological sites at the Don Pedro Project had been corrected. The Districts stated that a final HPMP for the Don Pedro Project would be filed with the Commission by May 2018 and a final HPMP for the La Grange Project would be filed by May 30, 2018. In separate letters to the Districts filed on December 5, 2017, the Commission requested that the final HPMPs for both the Don Pedro Project and the La Grange Project be filed no later than April 27, 2018.

On May 7, 2018, for the Don Pedro Project, and on April 6, 2018, for the La Grange Project, the California SHPO filed comments on the Don Pedro Project HPMP and the La Grange Project draft HPMP (letters to D. Risse, Senior Cultural Resources Specialist, HDR, Sacramento, from J. Polanco, California SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, California). These letters contained several editorial or corrective comments in addition to some substantive comments.

On May 3, 2018, the Districts filed a request to postpone submitting a final HPMP for the La Grange Project to the Commission until July 15, 2018, to allow for additional

time to address the California SHPO's comments. The Commission granted this request on May 9, 2018, and on July 10, 2018, the Districts filed the final HPMP. In a letter dated July 9, 2018, and attached to the HPMP, the California SHPO stated that it had no further comments.

A similar request to postpone until October 30, 2018, the submittal of the final HPMP for the Don Pedro Project was filed on May 8, 2018. On October 24, 2018, the Districts filed a second request to postpone the submittal of the final HPMP until January 31, 2019. On October 30, 2018, the Commission granted the Districts' request to postpone the submittal of the HPMP for the Don Pedro Project until January 31, 2019. On January 31, 2019, the Districts requested postponement of the submittal of the HPMP for the Don Pedro Project until February 21, 2019. The Districts filed the revised final HPMP with the Commission on February 14, 2019. In a letter dated January 31, 2019, and attached to the HPMP, the California SHPO stated the revised HPMP adequately addressed its previous comments.

BLM Don Pedro revised 4(e) condition 15 and La Grange preliminary 4(e) condition 7 would require the Districts' to implement each HPMP upon approval by the Commission.

Our Analysis

The Districts' revised HPMPs for the Don Pedro Project, filed on February 14, 2019, and the La Grange Project, filed on July 10, 2018, address the comments of the California SHPO and provide measures that are consistent with the Advisory Council and Commission's 2002 guidelines. We agree that these HPMPs are now adequate to address the potential effects of the projects on historic properties over any license terms. However, in the draft EIS, we requested that the HPMPs be revised to clarify that all parties involved in any dispute regarding the HPMPs would follow the process provided in the dispute resolution stipulation of the PAs. It should be noted that the dispute resolution process provided in the HPMPs still differs from the process provided in the Commission's September 30, 2019, draft PAs for both projects. Given that the HPMPs have been adequately revised to reflect the California SHPO's previous comments, and the process provided in the PAs is the one to which the Commission, California SHPO, and concurring parties (including the licensee) would be required to adhere regardless of the wording in the HPMPs, we no longer believe that additional revisions to the HPMPs are necessary.

To meet section 106 requirements, the Commission issued individual draft PAs on September 30, 2019, for review and comment among the involved parties associated with the PAs. On March 2, 2020, the California SHPO filed additional comments on the draft PAs. The Commission intends to issue final PAs for execution with the California SHPO for each project for the protection of historic properties that would be affected by project maintenance and operation. The terms of each PA would require the Districts to implement the HPMPs.

3.3.8 Socioeconomics

The Don Pedro Project is located within Tuolumne County, and the La Grange Project is located within Stanislaus and Tuolumne Counties. Waters released from the Don Pedro Project flow into La Grange Reservoir where water is diverted by the Districts to meet consumptive needs or passes the La Grange Diversion Dam and flows into the lower Tuolumne River.

The Don Pedro Project receives inflow from CCSF's upstream Hetch Hetchy System, a series of reservoirs, diversion conduits, and powerhouses located on the upper Tuolumne River. Consistent with the requirements of the Raker Act and agreements between the Districts and CCSF, the project provides a "water bank" of up to 570,000 acre-feet of storage. The water bank allows CCSF to meet its need to satisfy the Districts' senior water rights by using the Don Pedro Reservoir to store water released from its upstream facilities. By using the allotted reservoir storage, CCSF can then divert water when releases are required to satisfy the Districts' water rights.

The Districts supply water for municipal and industrial uses to Stanislaus, Merced, and Tuolumne Counties. The SFPUC, a department of CCSF, owns and operates the Hetch Hetchy System and diverts water to support municipal and industrial water use in Alameda, San Francisco, San Mateo, and Santa Clara Counties, and the Groveland Community Services District in Tuolumne County. The study area for this analysis is composed of all seven counties grouped into two service areas: (1) economic benefits from agricultural uses are concentrated within the Districts' service area, and (2) more generalized economic benefits are concentrated in the SFPUC service area, resulting from the water banking agreement between CCSF and the Districts.

3.3.8.1 Affected Environment

Population, Housing, and Income

The population of the seven counties in the vicinity of the project (Tuolumne, Merced, Stanislaus, Alameda, San Francisco, San Mateo, and Santa Clara Counties) was 5.9 million in 2016, an increase of more than 600,000 people from the year 2000. Of the three counties adjacent to the proposed project, Merced County grew the fastest with a 1.4 percent annual growth rate between 2000 and 2016. All three of the counties adjacent to the project have experienced slower growth between 2010 and 2016. Tuolumne County is the only county in the seven-county area where the population declined during the last 16 years. The four counties in the SFPUC service area—Alameda, San Francisco, San Mateo, and Santa Clara Counties—experienced a population growth between 0.4 percent and 0.8 percent during the past 16 years, increasingly slightly in the last 6 years. The three counties in proximity to the Don Pedro and La Grange Projects—Stanislaus, Merced, and Tuolumne Counties—make up 14 percent of the population of the study area. In recent years, the study area's population has grown slightly faster than the population of the state of California. Between 2010 and 2016, the population of the study area increased by a 0.9 percent compound annual growth rate compared to 0.6

percent for the state of California. The number of households also increased at a higher rate in the study area compared to the state in more recent years (U.S. Census Bureau, 2000, 2010, and 2016).

Important population centers in the study area include the towns of Modesto (population of 208,512), located 30 miles west of the La Grange Diversion Dam; Turlock (population of 71,166), located 25 miles west of the La Grange Diversion Dam; and Merced (population of 81,461), located 25 miles south of the La Grange Diversion Dam. The city of San Francisco (population: 850,282) is located 108 miles west of La Grange Diversion Dam (U.S. Census Bureau, 2016). The population within the study area is expected to grow to 8.5 million people by 2060, with a combined annual growth rate of 0.7 percent between 2020 and 2060. Among all the counties in the study area, Merced County is expected to lead this growth with a 1.1 percent combined annual growth rate, followed by Stanislaus County at 0.8 percent. This growth rate will exceed the forecasted growth rate for the state by 0.1 percentage points. Most of this growth is forecasted to occur in the near-term, tapering off in later decades (table 3.3.8-1).

Approximately 2.2 million housing units were located in the study area in 2016, and 13 percent of these housing units were concentrated in the three-county region—Merced, Stanislaus, and Tuolumne Counties—located in proximity to the projects. Five percent of these housing units were vacant in 2016. Of the seven counties in the study area, Tuolumne County had the highest rate of vacancy at 30 percent of all housing in 2016. The next highest vacancy rates were in San Francisco and Merced Counties at 8 and 7 percent vacancy, respectively.

Table 3.3.8-1. Population projections in the study area, 2020 to 2060 (Source: California Department of Finance, 2018).

Area	2020	2030	2040	2050	2060	M&I Water Source
California	40,639,392	43,939,250	46,804,202	49,077,801	50,975,904	--
Alameda County	1,703,660	1,873,622	2,027,328	2,154,848	2,260,737	SFPUC
Merced County	286,746	326,923	369,542	410,444	452,868	MID
San Francisco County	905,637	982,639	1,048,803	1,118,562	1,197,009	SFPUC
San Mateo County	792,271	844,778	884,198	913,131	936,154	SFPUC
Santa Clara County	2,011,436	2,223,743	2,436,897	2,633,652	2,804,044	SFPUC
Stanislaus County	572,000	638,840	699,022	747,188	787,145	SFPUC / Districts
Tuolumne County	53,976	54,801	55,400	55,534	56,595	SFPUC / Districts

Area	2020	2030	2040	2050	2060	M&I Water Source
California 10-year combined annual growth rate	0.9%	0.8%	0.6%	0.5%	0.4%	--
Study area 10-year combined annual growth rate	1.1%	0.9%	0.8%	0.7%	0.6%	--

Note: M&I – municipal and industrial

In 2016, the median household income in the study area ranged from $45,343 in Merced County to $103,328 in Santa Clara County. The median household income declined in Merced, Stanislaus, and Tuolumne Counties between 2010 and 2016. In Alameda, San Francisco, San Mateo, and Santa Clara Counties, the median household income increased slightly over the same period. The median household income declined in the state of California by -0.8 percent; within the study area, only in Merced and Stanislaus Counties did median household income decline by a larger amount (table 3.3.8-2). Total employee compensation from wages and salaries in the study area was $389.1 billion in 2016, representing 28 percent of all wages and salaries in the state of California (USBEA, 2017a).

Table 3.3.8-2. Median household income and employee compensation for the study area and California in 2010 and 2016 (adjusted to 2017 dollars) (Source: U.S. Census Bureau, 2010, 2016; USBEA, 2017a).

	Median Household Income			
Area	**2010**	**2016**	**Compound Annual Growth Rate 2010–2016**	**Compensation of Employees 2016 (thousands of dollars)**
Alameda County	$77,996	$81,532	0.7%	$72,346,040
Merced County	$49,286	$45,343	-1.4%	$4,531,208
San Francisco County	$80,154	$89,569	1.9%	$92,817,291
San Mateo County	$96,278	$100,645	0.7%	$53,073,817
Santa Clara County	$97,629	$103,328	1.0%	$153,658,553
Stanislaus County	$57,436	$52,690	-1.4%	$11,611,170
Tuolumne County	$53,353	$51,812	-0.5%	$1,062,505
California	$68,439	$65,142	-0.8%	$1,407,535,663

California DWR defines a *disadvantaged community* as a community with an annual median household income less than 80 percent of the statewide annual median household income. Census geographies with an annual median household income less than 60 percent of the annual statewide average are considered *severely disadvantaged communities*. Also, Water Code § 79702.(k) defines an *economically distressed area* as a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 20,000 persons or less and has an annual median household income less than 85 percent of the statewide median household income with one or more of the following conditions as determined by California DWR: (1) financial hardship, (2) an unemployment rate at least 2 percent higher than the statewide average, or (3) a low population density (California DWR, n.d.). Sixty-three percent of the Turlock and Modesto sub-basin includes communities designated as *disadvantaged communities* or *severely disadvantaged communitie*s by the State of California, and sixty-seven percent are considered economically distressed areas (WTSGSA and ETSGSA, 2018).

Employment

Both projects are located at the southern end of California's Mother Lode region, which shaped the region's economy during the California gold rush of the mid- to late-1800s. The three counties in the Districts' service area had unemployment rates between 11.6 and 15.7 percent in 2016, higher than state unemployment estimates over the same period. County unemployment rates in the SFPUC service area were lower than statewide unemployment levels in California in 2016, from 5.6 percent in San Mateo County to 7.1 percent in Alameda County (table 3.3.8-3) (U.S. Census Bureau, 2016).

The largest industry by total employment in the three counties in the Districts' service area is health care and social assistance, which had approximately 46,700 full- and part-time employees in 2016. This service area is most highly specialized in farm employment with a location quotient of 5.44, indicating the area is 5.44 times more specialized in farming as compared to the state level. The area is also highly specialized in forestry, fishing, and related industries as well as in manufacturing. Large sectors, in terms of total employment, include local government, retail trade, and manufacturing (USBEA, 2017c). Much of the employment in the Districts' service area relies directly and indirectly on water from the projects, made available for agricultural purposes because of agreements with the Districts. The Districts' water supply directly supports many jobs in agriculture production (particularly vineyards), jobs that indirectly rely on farming operations (e.g., farm machinery and fertilizers), and industries that rely on agricultural commodities (e.g., wineries and food processing plants). In Stanislaus County, 11 of the 14 largest employers are in agricultural production or food processing; in Merced County, 4 of the 11 largest employers are in agricultural production or food processing. In Tuolumne County, 2 of the 6 largest employers are in hydroelectric power production (California Employment Development Department, 2018).

Table 3.3.8-3. Labor force characteristics in the study area with gross domestic product, 2016 (Source: U.S. Census Bureau, 2016; National Association of Counties, 2017; USBEA, 2017b).

Location	Civilians in Labor Force	Employed (population employed)	Unemployment (unemployment rate)	Gross Domestic Product (billions in 2017 dollars)
Alameda County	864,007	801,026 (92.7%)	61,327 (7.1%)	$121.9
Merced County	115,412	97,146 (84.2%)	18,143 (15.7%)	$9.1
San Francisco County	521,164	488,560 (93.7%)	32,234 (6.2%)	$153.9
San Mateo County	419,603	395,999 (94.4%)	23,439 (5.6%)	$93.3
Santa Clara County	1,005,037	938,545 (93.4%)	65,981 (6.6%)	$244.7
Stanislaus County	246,661	212,544 (86.2%)	33,913 (13.7%)	$21.3
Tuolumne County	22,167	19,597 (88.4%)	2,570 (11.6%)	$2.1
California	19,391,320	17,577,142 (90.6%)	1,683,726 (8.7%)	$2,619.6

For counties in the SFPUC service area, the largest industry by employment was professional, scientific, and technical services with 573,025 employees in 2016. The area is most highly specialized in the information industry and has a location quotient of 1.76. Other large sectors, in terms of total employment, include health care and social assistance, manufacturing, and accommodation and food services (USBEA, 2017c). The four counties in the SFPUC service area have fewer companies specializing in agricultural production and food processing than the three counties in the Districts' service area. Municipal and industrial water supplies are used across this four-county area to support all the businesses in this area. The gross domestic product (GDP) produced in the San Francisco-Oakland-Hayward metropolitan statistical area, which includes Alameda, San Francisco, and San Mateo Counties, was $470.5 billion in 2016. In 2016, the GDP of the San Jose-Sunnyvale-Santa Clara metropolitan statistical area, which includes Santa Clara County, was $252.5 billion (USBEA, 2017d).

Municipal and Industrial Use

The Tuolumne Watershed, where the Don Pedro and La Grange Projects are located, is an important source of water for municipal and industrial users located in the SFPUC RWS. As previously described, water released from the Don Pedro Project enters La Grange Reservoir created by the La Grange Diversion Dam. At the La Grange Project, the Districts convey water from the river for irrigation and municipal and industrial water supply. Water released from the Don Pedro Project, and not diverted by the Districts at the La Grange Project, passes through La Grange Reservoir to the lower Tuolumne River.

SFPUC supplies retail drinking water and wastewater services to San Francisco County and wholesale water to Alameda, San Mateo, and Santa Clara Counties. SFPUC's customers include 27 water agencies and water companies and approximately 2.7 million people in its service area (SFPUC, 2018). SFPUC's wholesale customers receive more than 66 percent of the water delivered by the RWS, 16 wholesale customers (BAWSCA Member Agencies) rely on SFPUC for 100 percent of their total water supply. Of the remaining 10 wholesale customers, 8 rely on the RWS to meet 50 percent or more of their potable water supply. SFPUC is the third largest supplier of water for domestic and municipal users in California, and approximately 85 percent of San Francisco's total water needs is satisfied by water delivered from the Tuolumne River. The remaining 15 percent of the water supply that CCSF needs is diverted from the combined Alameda and Peninsula Watersheds.

During fiscal year 2018–2019, SFPUC delivered an average of approximately 192 mgd to wholesale and retail customers. Wholesale customers received 125 mgd, San Francisco retail customers received approximately 63 mgd, and retail customers outside the SFPUC service area received 4 mgd (SFPUC, 2019).

CCSF's water rights on the Hetch Hetchy System on the Tuolumne are junior to the most senior rights held by the Districts. The Hetch Hetchy System was authorized

under the Raker Act, which has been supplemented by a series of agreements between CCSF and the Districts to reduce the effects of storage and diversion constraints imposed under the Raker Act and allowing CCSF to obtain storage credits in the new Don Pedro Reservoir. These storage credits currently equal up to 570,000 acre-feet. CCSF does not divert water out of Don Pedro Reservoir, but rather diverts water upstream based on credits in the water bank established in the Fourth Agreement with the Districts. Carryover storage from wet and normal to dry years in the water bank helps to ensure the reliability of the Hetch Hetchy System in sequential dry years under the operating constraints imposed in Raker Act sections 9(b) and (c). As part of the 1996 amendment to the Don Pedro Project license, CCSF and the Districts entered into the 1995 side agreement that required CCSF to make annual payments to the Districts in return for the Districts meeting all the minimum flow requirements. These agreements are critical in reducing dry-year supply shortfalls and rationing levels to CCSF's retail and wholesale customers.

The Districts also supply about 67,500 acre-feet of water to meet consumptive water demands in the counties in the vicinity of the projects, including water for municipal, industrial, and agricultural uses. In addition to those currently served, several municipalities in Stanislaus County are currently interested in using Don Pedro Project water as a substitute for groundwater supplies.

Agricultural Use

According to the 2012 Census of Agriculture, the number of irrigated acres of harvested cropland in Merced County grew by almost 5 percent between 1997 and 2012 (USDA, 2014a). During this period, several businesses operating irrigated cropland consolidated, reducing the number of such businesses by approximately 20 percent. In addition, the amount of pastureland increased in size by almost 30 percent. The most notable change in cropland and pastureland occurred in Stanislaus County where the total number of irrigated acres decreased by nearly 7 percent between 1997 and 2012, matching an increase in the number of acres that were turned into pastureland over this same period (table 3.3.8-4). In 2012, approximately 5 percent of the pastureland in Stanislaus and Merced Counties was irrigated (USDA, 2014a).

Much of the harvested cropland (irrigated and non-irrigated) is dedicated to supporting the area's livestock production. In 2012, the main crops grown to support livestock were corn and alfalfa. In 2012, farmers irrigated 107,331 acres of corn in Merced County and 62,971 acres of corn in Stanislaus County for use as grain or silage. Additionally, farmers irrigated 78,019 acres of alfalfa in Merced County and 22,538 acres of alfalfa in Stanislaus County for use as hay and haylage. Much of the irrigated land is also dedicated to almond production. In 2012, 115,599 acres and 138,162 acres of almonds were cultivated in Merced and Stanislaus Counties, respectively (USDA, 2014c). Other important crops in the two counties include cotton and wheat (USDA, 2014d).

Table 3.3.8-4. Acres of irrigated harvested cropland and pastureland (with number of operations) (Source: USDA, 2004a,b; 2014a,b).

	Merced County		Stanislaus County	
Year	**Irrigated Harvested Cropland**	**Pastureland (Excluding Cropland and Woodland)**	**Irrigated Harvested Cropland**	**Pastureland (Excluding Cropland and Woodland)**
1997	429,715 (2,340)	317,856 (421)	320,282 (3,316)	352,075 (633)
2002	461,311 (2,169)	359,896 (591)	334,705 (2,946)	342,125 (969)
2007	458,017 (1,810)	456,195 (553)	297,053 (2,526)	403,786 (1,156)
2012	449,569 (1,769)	411,166 (556)	299,331 (2,763)	380,662 (1,210)
Net change, 1997–2012 (acres)	**4.6%**	**29.4%**	**-6.5%**	**8.1%**

Farmers in the Districts' service area annually contribute an estimated $1.232 billion directly into the local economy, including $527.9 million from crop production and $665.5 million from livestock operations. These agricultural operations support about 7,230 on-farm, full-time and part-time jobs, generating an estimated $202.5 million in labor income. The estimated $1.232 billion in annual gross agricultural production supports an additional $2.9 billion in annual output from backward-linked industries such as those that supply goods and services to agricultural operations that depend on project water for irrigation, and those forward-linked industries, such as dairies, that use grains as inputs into their operations. These forward- and backward-linked industries create another 11,670 jobs, generating $532.3 million in labor income. In 2011, Merced and Stanislaus Counties were the fifth and sixth largest counties in California as measured by gross value of agricultural production. Together, they contributed $6.5 billion, or 12.3 percent, of total gross value for the state; a significant portion of this production comes from land irrigated with water that the Districts supply. Half of the major employers in Stanislaus and Merced Counties are agriculture-related businesses.

The Don Pedro Project provides irrigation water to more than 230,000 acres of farmland in both Merced and Stanislaus Counties (Districts, 2018a). The project also indirectly supports the larger agricultural sector in and around these counties and includes suppliers that provide goods and services to farms, dairy plants, food processing facilities, creameries, food transportation companies, and point-of-sale operations, such as grocery stores. Agricultural operations support many more jobs and provide more income than the farms and their suppliers alone. For example, once a cow produces milk at a dairy, that milk can be sent to a creamery where is it further processed into yogurt, cheese, or some other milk product adding value and supporting additional jobs and income. These products are then sold to regional or national vendors that transport these goods to final points of sale, such as local specialty shops or grocery stores, thereby supporting additional jobs and income. The Districts estimated that water from the Don Pedro Project supports approximately 18,900 total jobs and $734.8 million in total annual labor income when considering both directly supported activities and forward-linked sectors. In total, the Districts provide irrigation supplies that contribute an estimated annual average of $4.1 billion in total economic output to the local economy through agricultural production and processing (Districts, 2018a).

Of the approximately 233,000 acres that are irrigated with water from the project, approximately 122,000, acres are dedicated to feed, 88,300 acres are dedicated to fruit and nuts, 20,300 acres are dedicated to field crops, and 2,600 acres are dedicated to vegetables. Milk composes the largest share of total commodity value, estimated at $537 million (annual average from 2007 to 2011), and cattle and calves produce another $128 million. Combined animal production makes up 55 percent of the commodity value supported by crops grown with project water. Fruit and nut production accounts for approximately $360 million of the total commodity value. The magnitude of agricultural production output in the region has given rise to a large agricultural processing sector in the region. The agricultural processing sector is conservatively estimated to create 6,540 jobs (Districts, 2018a).

Land Value

In 2012, the estimated market value of all land and buildings on average per farm was estimated to be $3.3 million in Merced County, $1.9 million in Stanislaus County, and $1.1 million in Tuolumne County (adjusted for inflation to 2017 dollars). Overall, after adjusting for inflation, average agricultural land values decreased by 9 percent in Merced County, 11 percent in Stanislaus County and 8 percent in Tuolumne County between 2007 and 2012.

Land values in the Districts' service area have been relatively stable despite the national economic recession that lasted from December 2007 to June 2009, the effects of which have been offset by high crop prices, low interest rates, and available water supplies (NBER, 2018). Additionally, cropland in the Districts' service area is valued between 30 to 50 percent higher than similar cropland in other districts served by both surface water and groundwater.

3.3.8.2 Environmental Effects

Don Pedro Project

Effects of Proposed Capital Infrastructure Improvements on Socioeconomic Resources

The Districts' proposal includes the construction of a fish exclusion barrier at the TID sluice channel entrance, a foot trail, a fish counting/barrier weir, and a new boat take-out/put-in. Construction of these facilities would require employing construction personnel for one year. Because of the limited size of the proposed facilities, the number of construction workers is not anticipated to exceed 10 workers at any time during the construction period.

The Districts' proposed measures include the implementation of their Don Pedro RRMP. The Districts also propose to construct one facility that would not be part of the licensed projects an improved boater take-out facility at the Ward's Ferry Bridge to relieve congestion caused by numerous whitewater boaters who want to take advantage of peaking flows at the CCSF's Holm Powerhouse.

Our Analysis

Construction of the proposed facilities are unlikely to have any measurable effect on population, housing, or income in the immediate area of the projects or the study area. The temporary increase in employment associated with the construction of the proposed facilities would not be noticeable, because it would consist of only specialized construction workers who may temporarily relocate to the study area for the duration of the construction of these facilities. Most of the employees associated with project operation already live and work in the study area and the project would continue to support their existing jobs. As a result, the construction of the proposed facilities and continued operation of the projects would not generate increases in demand for local housing, strain public services, or contribute to social disruption that might be observed in other settings where larger scale or longer-term capital improvement projects have occurred.

Recreational sites would continue to provide public access to the projects, and improved recreational facilities could attract increased recreational use, and new recreational facilities would have sufficient capacity to accommodate existing and future use. The Districts' proposal to enhance certain recreational facilities would have minor, beneficial effects on the three counties in its service area—Stanislaus, Merced, and Tuolumne Counties. Initially these beneficial effects would be associated with direct and indirect spending for construction, while over time, the beneficial effects would stem from spending that would result from the marginal growth of visitors to the sites.

Effects of Proposed and Recommended Flow Regimes on Municipal and Industrial Use

The analysis of economic effects of the proposed and recommended flow regimes for municipal and industrial use is based on two documents: (1) *Socioeconomic Impacts of Water Shortages within the Hetch Hetchy Regional Water System Service Area*, prepared by Dr. David Sunding (2018) for the SFPUC, and (2) the *Supplemental Reply Comments of the Bay Area Water Supply and Conservation Agency* (BAWSCA, 2018). In its analysis, BAWSCA provides the results of the CCSF water systems operations model that shows changes in water supply under each of the proposed and recommended flow regimes. The water supply shortages forecast in that model were used to predict economic impacts calculated within the Sunding study.

As described in section 3.3.8.1, *Socioeconomics*, *Affected Environment*, and Sunding (2018), SFPUC withdraws water from the Hetch Hetchy Project to serve its RWS, which includes all or part of Santa Clara, San Mateo, Alameda, and San Francisco Counties. In March 2014, CCSF filed a draft report of potential socioeconomic impacts of reduced water supply within the SFPUC service area with FERC, such as the result of proposed and recommended instream flow measures included in a new Don Pedro license (Sunding, 2018). The Sunding (2018) report, filed by CCSF in January 2018, provides estimates of welfare losses, job losses, and business losses resulting from assumed shortages in the RWS supply.

The report does not attempt to predict any actions SFPUC might take to acquire new sources of water to replace water supply loss from Don Pedro Reservoir. Also, the report does not analyze the Districts' proposed instream flow recommendation or any of the recently filed alternative instream flow recommendations submitted in response to the Commission's November 30, 2017, REA notice.

The Sunding (2018) report estimates economic impacts based on shortages in RWS supply. The report presents information based on a single dry year and escalates economic losses from year to year consistent with the historical hydrology of the Tuolumne River. It also assumes the Districts' proposed infiltration galleries on the Tuolumne River are functional, and that any increased minimum instream flow requirements would require SFPUC to contribute 51.7 percent of the increase in required flow, the contribution towards minimum instream flows by CCSF as stated in the Fourth Agreement.

Because of several recent dry water years in California, the report calculates a "base year" starting with the 220 mgd demand for July 2010 to July 2011 (fiscal year) and adjusts this demand to a value considered to be more typical for weather, population, and employment. This adjusted value of 238 mgd is then increased to 243 mgd to account for the reduced non-RWS water supply availability in dry years.

The report also forecasts water demand for the year 2040 using a model that estimates growth for residential households, household income, water price, employment, and conservation. The demand forecast model uses statistics to relate the estimated growth in the demand factors to generate a water demand and predicts a water demand growth of about 1 percent per year during the 30-year analysis period.

Table 3.3.8-5 shows the Sunding (2018) study results for welfare loss for the 238 mgd adjusted base year water demand and defines RWS welfare losses by consumers as an increased cost to consumers who are unable to receive water supply under current water rates, requiring the rationing of water at an estimated level. The report considers the economic welfare changes, shown in table 3.3.8-5, as the amount of money individual consumers would be willing to pay to avoid the water shortages. The welfare analysis, which is based on water prices derived from a survey of RWS users, represents a customer's willingness to pay to avoid rationed water. Those survey results suggest residential prices range from $875 to $2,975 per acre-foot, and non-residential prices range from $1,119 to $3,132 per acre-foot.

Table 3.3.8-5. Annual welfare losses—base year demand of 238 mgd (Source: Sunding, 2018).

Percent Reduction of RWS Supply	Base Year Demand of 238 mgd (in millions of dollars)
10%	$33
20%	$93
30%	$188
40%	$322
50%	$471
60%	$703

Sunding (2018) states that the area served by the RWS is one of the largest centers of employment and economic activity in the United States. About 1.4 million jobs are located in the SFPUC service area, and firms located in this service area produce more than $366 billion in goods and services each year.

San Francisco depends on water that is imported from other areas. For this reason, Sunding (2018) states that it is important to analyze the sales and employment impacts resulting from a water shortage in the commercial and industrial sector and estimates how the estimated water shortages could affect business and job losses. Table 3.3.8-6 presents the estimated effects of each percent reduction in water supply on businesses, and table 3.3.8-7 presents potential job losses.

Table 3.3.8-6. Annual estimated business losses by county (in millions) for the base year demand of 238 mgd (Source: Sunding, 2018).

Percent Reduction of RWS Supply	Alameda	San Francisco	San Mateo	Santa Clara	Total
10%	$0	$0	$314	$212	$526
20%	$307	$0	$668	$405	$1,380
30%	$1,456	$0	$3,676	$771	$5,904
40%	$3,143	$5,338	$5,709	$1,050	$15,240
50%	$4,098	$5,338	$8,561	$2,899	$20,896
60%	$5,704	$11,817	$11,081	$8,371	$36,973

Table 3.3.8-7. Annual potential job losses by county for the base year demand of 238 mgd (Source: Sunding, 2018).

Percent Reduction of RWS Supply	Alameda	San Francisco	San Mateo	Santa Clara	Total
10%	0	0	2,311	782	3,093
20%	465	0	4,296	2,253	7,014
30%	5,224	0	10,911	6,199	22,334
40%	6,559	24,489	15,278	9,768	56,094
50%	8,686	24,489	23,748	14,744	71,667
60%	12,262	54,439	29,903	23,377	119,981

In addition to informing the Districts' water supply operations modeling, SFPUC, a department of CCSF, also simulated the proposed and recommended flow proposals using the SFPUC water system operations model (HHLSM). The HHLSM model has been developed to include additional years from the hydrologic record that are useful for SFPUC to consider in its water supply planning; those results are included in SFPUC's analysis.

Using the HHLSM, SFPUC evaluated the proposed and alternative flow schedules at three different levels of service area demand: 238 mgd, 265 mgd, and 287 mgd. The results of SFPUC's study were presented as the amount of water rationing needed in the service area under each alternative for the three levels of service area demands.

In the report, SFPUC says that, if any of these alternative instream flow proposals were established on the Tuolumne River, it would be required to find or develop substantial amounts of new sources of water supply. Although SFPUC did not evaluate new sources of water supply in its response to instream flow recommendations, it says that the water supply rationing estimates are provided so that the effects of the proposed and alternative instream flow schedules on the amount of Tuolumne River water supply available to SFPUC can be compared.

In response to CCSF and BAWSCA's comments on the draft EIS, the Conservation Groups[235] and TRT et al.[236] submitted comments in April and December 2019, respectively, to assert that the SFPUC water demand projections included in the Sunding (2014; 2018) analysis of economic effects to Bay Area water users may critically overstate the area's true water demand.[237] TRT et al. asserts that the normalized 238 mgd demand scenario relies on a design drought with no historical basis, the belief that SFPUC and BAWSCA cannot respond to and manage droughts better today than during the 1987–1992 drought period, and the idea that CCSF customers would return to

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[235] Includes comments submitted by California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, Central Sierra Environmental Resource Center, Tuolumne River Conservancy, American River Touring Association, Inc., Sierra Mac River Trips, Inc., O.A.R.S. West, Inc., and All-Outdoors California Whitewater Rafting, Inc. (collectively, Conservation Groups) on April 12, 2019.

[236] Includes comments submitted by Tuolumne River Trust, California Sportfishing Protection Alliance, Golden West Women Flyfishers, Mr. William L. Martin, and Mr. David Warner (collectively, TRT et al.) on December 30, 2019.

[237] See 20180129-5254, especially *Socioeconomic Impacts of Water Shortages within the Hetch Hetchy Regional Water System Service Area (2014)* and *Socioeconomic Impacts of Water Shortages within the Hetch Hetchy Regional Water System Service Area (2018).*

higher water usage practices after a series of non-drought years. TRT et al. notes the 265 mgd demand scenario was adopted by SFPUC and BAWSCA based on the maximum contractual obligations of demand (i.e., 184 mgd for BAWSCA and 81 mgd for San Francisco) for water users in each service area and is not a realistic estimate of water demand in 2040 (TRT et al., 2019).

Instead, TRT et al. suggests the final EIS should evaluate a 200 mgd demand scenario for CCSF and BAWSCA because it is a conservative value for the most recent usage (i.e., 192 mgd) reported by SFPUC in its 2019 annual report. TRT et al. also notes a 200 mgd demand scenario is "normalized" to the urban water customer attitudes of today (i.e., water users in general are more water conservation focused) and captures the improvement of SFPUC and BAWSCA's ability to respond to and manage drought since the 1987–1992 drought period (e.g., after 1994, SFPUC prioritized water supply over power generation, and San Francisco invested about $4.8 billion in the Water System Improvement Program). In addition, TRT et al. comments the final EIS should evaluate a demand scenario of 220 mgd, as was done in the draft EIS.

Both SFPUC and BAWSCA disagree with using a 200 or 220 mgd demand scenario for CCSF and BAWSCA to analyze effects on Bay Area water supply. In its September 2019 reply comments, CCSF notes the basis for the 200 mgd demand scenario appears to represent the highest levels of historical use reductions achieved by San Francisco when the RWS was recovering from extreme drought. CCSF contends the 200 and 220 mgd demand scenarios do not account for the variability of California water systems during drought management, as well as the population, housing, and commercial growth expected to occur in the San Francisco water service area. CCSF continues to recommend using a "normalized" base-year demand of 238 mgd to represent current or near-term conditions, which avoids relying on a lower than average, single-year snapshot of a highly dynamic water system. Likewise, CCSF continues to recommend using a demand of 265 mgd to evaluate future conditions because the value addresses potential cumulative effects adequately.

In their comment letter, TRT et al. includes a figure that they obtained from SFPUC showing SFPUC's average total system delivery per year for fiscal years 1971–2019. We have included this figure as figure 3.3.8-1, below.

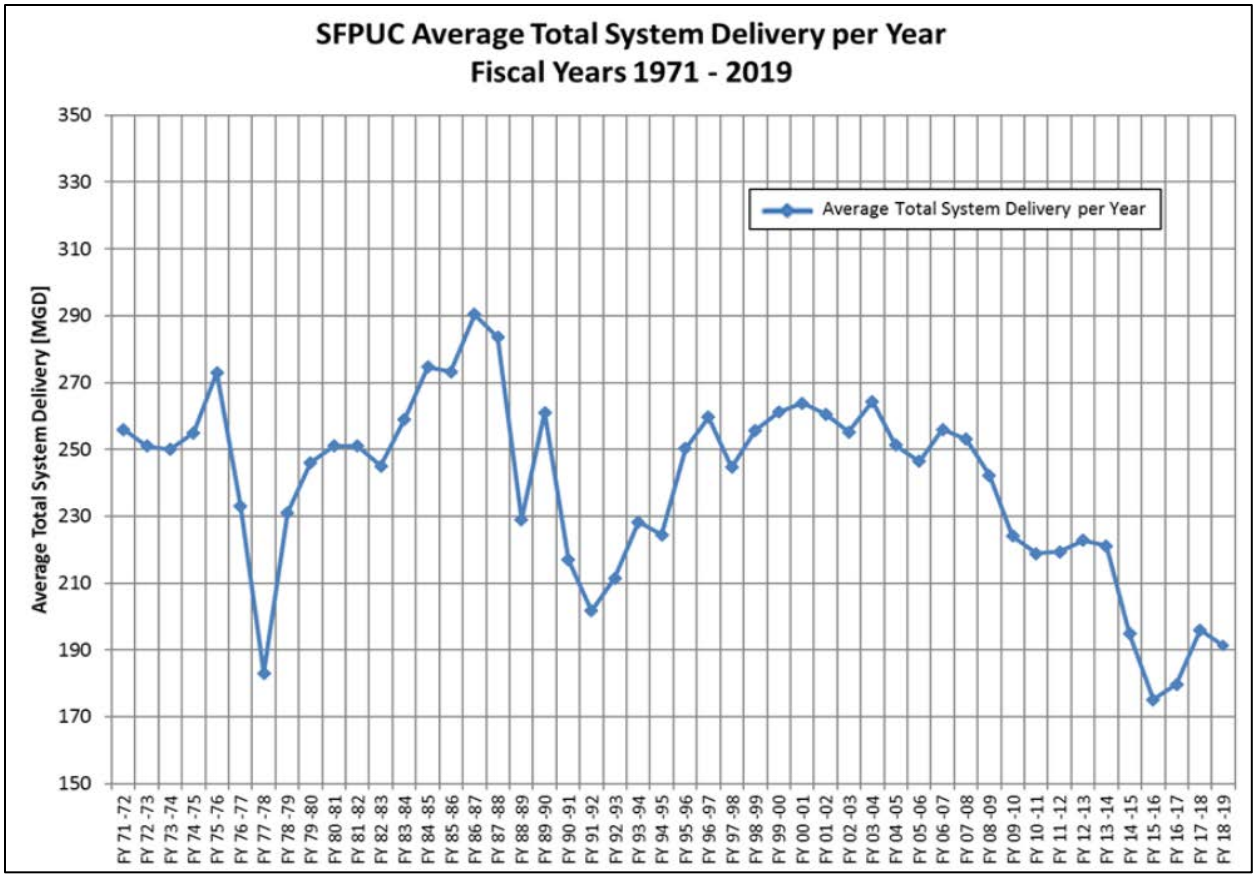

Figure 3.3.8-1. SFPUC average total system delivery per year, fiscal years 1971–2019 (Source: TRT et al., 2019).

This figure indicates an overall downward trend in Bay Area water demand since 1972. This trend correlates with the goals identified in SFPUC's 2019 annual report, including a standard for indoor residential water use of 55 gallons per person per day, dropping incrementally to 50 gallons by 2030; a standard for outdoor water use based on the amount of irrigable landscaped area for residential and dedicated irrigation commercial accounts and the community's climate; and a standard for water loss due to leaks in a water utility's pipe infrastructure. In addition, the report outlines SFPUC's Local Water Program that provides conservation assistance, promotes recycled water to meet the Bay Area's most significant irrigation needs, mandates non-potable supplies for toilet flushing and irrigation in new developments, and identifies local groundwater to enhance the Bay Area's drinking water supply sustainably now and into the future (SFPUC, 2019).

However, as indicated by TRT et al. in their comment letter, SFPUC and BAWSCA have done little to reduce their dependence on the Tuolumne River. A review of the Local Water Program outlined in SFPUC's annual report suggests the program would only supply about 8 to 10 mgd of supplemental water supply by 2040 (SFPUC, 2019). Both SFPUC and BAWSCA have not constructed new treatment plants to treat

water that they might secure on a temporary basis through transfer or purchase and still have limited conveyance capacity to move water from alternative sources into or within the Bay Area service area. As such, while not entirely representative of current or future demand, the use of the 238 and 265 mgd demand scenarios captures the cumulative effects (e.g., increased population, workforce modification, and shifts to local weather patterns) that the Bay Area could experience over the next 20 years. In addition, a demand scenario of 238 mgd is the base year demand that was used for the Districts' Don Pedro operations model, which serves as the first model in a series of models to compare the effects of alternative flow schedules with the base conditions on the Tuolumne River and the water supply effects analyzed.

Each of the instream flow alternatives would result in greater and more frequent water supply rationing in the SFPUC service area compared to the Districts' proposal. In each case, the estimated rationing is consistent with the SFPUC water supply planning methodology, which considers a water balance based on water supply available to SFPUC, the use of the SFPUC water supply storage facilities, and the assumed level of demand. SFPUC says that within each level of demand, the only differences between the model simulations are the proposed and alternative instream flow requirements. Table 3.3.8-8 summarizes the effects of the Districts' proposed instream flow and the seven alternative recommendations (Districts, 2019c).

Under the current normal-year water demands of 238 mgd, the Districts' proposed flow regime with operational infiltration galleries would result in the same number of years of rationing as the base case, but because of the loss in water supply from greater instream flow requirements, the rationing levels would be higher under the Districts' proposed flow regime with infiltration galleries (Districts, 2019c). However, in extended drought conditions, the staff-recommended drought management plan would create a process for the Districts to identify any temporary operational changes that could reduce adverse socioeconomic impacts to water users in the SFPUC RWS service area.

Modesto—Effects on the City of Modesto would also be substantial in terms of shortages of municipal and industrial water (table 3.3.8-9). The City of Modesto receives water from MID, and by purchasing water from MID, it avoids costs associated with pumping groundwater, which is the least-cost alternative to purchasing from MID. Based on an avoided cost of $143 per acre-foot for pumping groundwater, the estimated economic losses to the City of Modesto is anticipated to begin at $478,127 under baseline conditions (current operations) and increase to $956,253 for a 10 percent shortage and reach nearly $2.4 million for a 40 percent shortage (Cardno ENTRIX, 2014).

Table 3.3.8-8. Summary of effects of Tuolumne River instream flow alternatives on SFPUC water supply delivery at an annual demand of 238 mgd (Source: Districts, 2019c).

	Relative Effect of the Flow Proposal and Alternatives								
	Current Operations	**Districts - with infiltration galleries**	**Draft Voluntary Agreement**	**California DFW**	**NMFS**	**Water Board 40%**	**Conservation Groups**	**The Bay Institute**	**ECHO**
Total years of operation simulated	42	42	42	42	42	42	42	42	42
Years in simulations in which full supply is delivered	36	36	32	33	28	32	28	0	18
Total number of years in simulation with some level of supply rationing	6	6	10	9	14	10	14	42	24
Years with 10% rationing	6	3	0	0	0	0	0	0	0
Years with 11% to 20% rationing	0	3	10	0	0	0	0	0	0
Years with 21% to 30% rationing	0	0	0	0	0	0	9	1	0
Years with 31% to 40% rationing	0	0	0	0	9	0	5	41	0

	Relative Effect of the Flow Proposal and Alternatives								
	Current Operations	**Districts - with infiltration galleries**	**Draft Voluntary Agreement**	**California DFW**	**NMFS**	**Water Board 40%**	**Conservation Groups**	**The Bay Institute**	**ECHO**
Years with 41% to 50% rationing	0	0	0	3	5	0	0	0	19
Years with 51% to 60% rationing	0	0	0	6	0	3	0	0	0
Years with 61% to 70% rationing	0	0	0	0	0	7	0	0	0
Years with 71% to 80% rationing	0	0	0	0	0	0	0	0	0
Years with 81% to 90% rationing	0	0	0	0	0	0	0	0	5

Table 3.3.8-9. Estimated economic losses to the City of Modesto resulting from municipal and industrial water supply shortages (Source: Cardno ENTRIX, 2014).

	Water Supply (percentage of full supply)				
Impact	**90%**	**80%**	**70%**	**60%**	**50%**
Reductions in surface water supplies from MID (acre-feet/year)	-3,131	-6,262	-9,392	-12,523	-15,654
Loss in economic value (2018 dollars)	-$478,127	-$956,253	-$1,434,380	-$1,912,507	-$2,390,634

Our Analysis

CCSF Study—As SFPUC states in its May 2018 response, if the Commission includes any of the alternative instream flow proposals in a new project license, SFPUC would be required to find and develop substantial new sources of replacement water supply. Alternative water supplies could include imported water, desalination of brackish water, local groundwater, local surface water, banked groundwater, and recycled water.

Although CCSF's study of economic effects from a decreased water supply and its water supply rationing estimates of the proposed and alterative instream flows provide a way to compare the effects of each proposal, neither approach estimates the likely amount and cost of water supply that SFPUC would need to replace if any of these new instream flow schedules are included in a new Don Pedro Project license. As SFPUC states, as the agency responsible for providing a long-term water supply to the RWS, SFPUC would respond to any new license requirement that reduces supply from the Tuolumne River by acquiring new water resources to avoid sustaining major economic losses to jobs and businesses in the supply area.

To estimate how proposed instream flow alternatives would reduce the current RWS water supply, we used the results of SFPUC's water simulation model filed in December 2019 to calculate the maximum reduction in RWS water supply for each water year type. We examined the effects on water supply at what we assume to be a representative RWS base year demand of 238 mgd and at a future demand level of 265 mgd, which we think corresponds to what we consider to be SFPUC's full use of the existing Tuolumne River's water supply in dry years based on its HHLSM simulations.

Tables 3.3.8-10 and 3.3.8-11 present the maximum deficits in water supply deliveries to SFPUC for each instream flow requirement.

Table 3.3.8-10. Increase in maximum supply deficit in water deliveries to SFPUC by water year type under the 238 mgd demand scenario for each alternative instream flow proposal (million gallons per day/year) (Source: Districts, 2019c).[a]

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts with infiltration galleries[b]	0	0	0	0	12
Draft Voluntary Agreement	0	0	0	0	36
NMFS	0	0	95	95	95
California DFW	0	0	0	0	143
Water Board	0	0	0	0	155
Conservation Groups	0	0	60	60	71
The Bay Institute	85	81	82	81	83
ECHO	107	107	107	107	107

[a] Water delivery data based on December 2019 model flows filed by the Districts' on December 11, 2019.

[b] Deficits would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

Table 3.3.8-11. Increase in maximum supply deficit in water deliveries to SFPUC by water year type under the 265 mgd demand scenario for each alternative instream flow proposal (million gallons per day/year) (Source: Districts, 2019c).[a]

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts - with infiltration galleries[b]	0	0	0	0	27
Draft Voluntary Agreement	0	0	0	0	53
NMFS	0	0	106	106	106
California DFW	0	0	0	0	146
Water Board	0	0	106	106	119
Conservation Groups[c]	-	-	-	-	-
The Bay Institute[c]	-	-	-	-	-
ECHO[c]	-	-	-	-	-

[a] Water delivery data based on December 2019 model flows filed by the Districts' on December 11, 2019.

[b] Deficits would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

[c] Scenario of 265 mgd not modeled for this instream flow alternative.

To estimate SFPUC's cost to replace the maximum storage deficit under each instream flow schedule, we calculated the replacement cost for the range of deficits at SFPUC's current stated demand of 238 mgd through the maximum deficits estimated under future demand of 265 mgd in critical water years. We based the cost of replacement water on the cost of water produced by the Carlsbad Desalination Project, which became operational in December of 2015 after nearly 20 years of development (SDCWA, 2020a). Cost for water provided by that plant is approximately $2,500/AF, including costs for debt service, equity returns, capital expenses incurred to upgrade existing facilities in order to use the water, new capital costs, and operating costs (SDCWA, 2020b).

Tables 3.3.8-12 and 3.3.8-13 present our estimate of the cost to either supplement or replace the maximum water supply deficit to SFPUC for each water year type.

Table 3.3.8-12. Annual cost (in 2019 dollars) to replace maximum supply deficit in water deliveries to SFPUC by water year type under the 238 mgd demand scenario under each alternative instream flow proposal (in millions of dollars).[a]

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts - with infiltration galleries[b]	0	0	0	0	$33.5
Draft Voluntary Agreement	0	0	0	0	$100.5
NMFS	0	0	$265.3	$265.3	$265.3
California DFW	0	0	0	0	$399.3
Water Board	0	0	0	0	$432.8
Conservation Groups	0	0	$167.5	$167.5	$198.2
The Bay Institute	$237.3	$226.2	$229.0	$226.2	$231.8
ECHO	$298.8	$298.8	$298.8	$298.8	$298.8

[a] Water delivery data based on December 2019 model flows filed by the Districts' on December 11, 2019.

[b] Costs would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

Table 3.3.8-13. Annual cost (in 2019 dollars) to replace maximum supply deficit in water deliveries to SFPUC by water year type under the 265 mgd demand scenario under each alternative instream flow proposal (in millions of dollars).[a]

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts - with infiltration galleries[b]	0	0	0	0	$75.4
Draft Voluntary Agreement	0	0	0	0	$148.0
NMFS	0	0	$296.0	$296.0	$296.0
California DFW	0	0	0	0	$407.7
Water Board	0	0	$296.0	$296.0	$332.3
Conservation Groups[c]	-	-	-	-	-
The Bay Institute[c]	-	-	-	-	-
ECHO[c]	-	-	-	-	-

[a] Water delivery data based on December 2019 model flows filed by the Districts' on December 11, 2019.

[b] Costs would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

[c] Scenario of 265 mgd not modeled for instream flow alternative.

As shown in tables 3.3.8-12 and 3.3.8-13, the Districts' proposed with-infiltration galleries flow regime and the flow regime included in the draft Voluntary Agreement would not incur any cost to replace water lost for municipal and industrial uses in wet, above normal, below normal, or dry water years under the existing RWS water demand of 238 mgd or the projected future water demand of 265 mgd. In critical water years, the estimated cost to replace water under the Districts' proposed with-infiltration galleries flow regime is $33.5 million under the existing water demand of 238 mgd and $75.4 million under the projected future water demand of 265 mgd. For the draft Voluntary Agreement flow regime, the cost of replacement water in critical water years would be $100.5 million under the existing 238 mgd water demand and $148 million under the projected future water demand of 265 mgd.

Comparatively, most of the flow regimes recommended by the agencies and NGOs would incur costs to replace water for municipal and industrial uses in wet, above normal, below normal, and dry water years. All of their recommended flow regimes would incur higher costs in critical water years under the existing 238 mgd water demand, approximately 6 to 13 times the costs under the Districts proposed flow regime and 2 to 4 times the cost to replace water under the draft Voluntary Agreement flow regime. Although we were not able to calculate costs under the estimated future water demand of 265 mgd for the flow regimes recommended by several of the NGOs, the relative increase in costs for flow regimes recommended by the agencies, compared to the costs of the Districts' proposed and draft Voluntary Agreement flow regimes, are similar to the increases estimated at the 238 mgd demand level.

We recognize that using the cost of water produced at the Carlsbad Desalination Project to estimate the cost of water supply deficits is simplistic, and that SFPUC would likely accommodate these deficits using a combination of approaches and water sources including increased conservation efforts, imported water supplies, local groundwater, other local surface water, banked groundwater, and recycled water. Although some water may be available at costs less than our assumed cost of $2,500/AF, the cost of water tends to escalate rapidly when large amounts of water need to be acquired. While there is uncertainty as to what combination of water supply alternatives would ultimately be implemented by SFPUC, we consider $2,500/AF to be a reasonable value to use for evaluating the relative magnitude of potential costs to SFPUC water users.

The cost of municipal water may also increase under the proposed and recommended flow regimes, raising the cost of living in the study area. The increased cost of water is one small factor contributing to the increased cost of living and it is unlikely, under any of the alternative flow regimes, to result in such adverse conditions as to negatively affect population growth in the study area.

Modesto—The cost of the various reductions in water supply to the city of Modesto was not estimated for the instream flow alternatives but as a reduction in surface water supplies. Although not specific to the recommended instream flow alternatives, the Districts' economic analysis provides a reasonable approach for estimating potential effects of reduced water supplies with groundwater, including the groundwater pumping cost.

Effects of Proposed and Recommend Flow Regimes on Agriculture

As described in the Affected Environment section, the Districts provide irrigation water from Don Pedro Reservoir for 230,000 acres of fruit and nut, feed, vegetable, and row crops. In 2014, the Districts filed a study with the Commission on the economic contribution of regional agriculture to show the potential socioeconomic effects of a reduced water supply on agricultural operations in the study area as the result of proposed and recommended instream flow measures for Don Pedro. The study titled *Regional Economic Impact Caused by a Reduction in Irrigation Water Supplied to Turlock*

Irrigation District and Modesto Irrigation District, amended in December 2019, provides estimated changes in output, labor income, and employment associated with the proposed and recommended flow regimes (Districts, 2019c).

The Districts' analysis assumed that irrigation contributes directly to agricultural production, which subsequently supports other industries such as animal production, fruit and meat processing and dairy production. The Districts further assumed that historical pumping volumes of groundwater would be available and would continue to meet up to 15 percent of total annual demand for irrigation water supply.

The Districts' economic model estimated changes in annual economic output based on annual changes in available irrigation water for proposed and recommended flow regimes. Potential effects were based on modeled on-farm irrigated crop revenue, modeled dairy and livestock production, and an IMPLAN®[238] analysis of changes in labor income, employment, and total economic output. The model did not account for cumulative effects of reduced agricultural production in years following water shortages and did not consider the long-term decline in yields from stress irrigation or structural shifts (e.g., installation of high-efficiency water systems and shifting to a different crop mix) in the local agricultural sector as a result of reduced irrigation supply. In general, the Districts noted that the potential adverse consequences of extended droughts combined with lower groundwater availability and greater instream flow requirements could cause farmers in the area to respond to long-term droughts by shifting farming patterns to more drought-tolerant crops to offset declines in the agricultural economy, diminishing the long-term adverse effects of a change in crop production.

The Districts' model also estimated the forward-linked effects of reduced local agricultural production, including effects on wineries, meat processors, and dairies. This analysis assesses two levels of effects on forward-linked industries:

- High impact estimate—assumes that output from animal producers and crop processors is affected immediately and proportionately to a change in crop production.

- Low impact estimate—assumes that animal producers and crop processors can find alternative crop sources to offset 100 percent of the reduction in Districts' crop production in reduced water years.

To estimate the average annual impacts to economic output from agricultural production from reductions in irrigation deliveries associated with the alternative flow

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[238] IMPLAN® is an input-output modeling software program that uses inter-industry relationships to estimate the change in economic activity that can be expected in the study area as a result of generated demand for goods and services associated with the directly affected industry (in this case, agricultural crop production).

regimes, the average of the high impact and the low impact is used. The analysis also assumes no intra- or inter-district water trading.

Water year type frequency[239] is a vital component in understanding the total impact of the various flow regimes on the regional economy. Currently, the total volume of water released to the lower Tuolumne River downstream of the La Grange Diversion Dam is 300,923 acre-feet in a wet year and as low as 94,000 acre-feet in a critically dry year. Table 3.3.8-14 shows the percent of full demand for consumptive water uses that would be supplied in an average year, by water year type, for the proposed and recommended flow regimes and for the base case. The base case represents existing operations, under which 92 percent of demand is met, even under critically dry water years. The Districts' proposed flow regime with infiltration galleries would be nearly identical to the base case and meet 91 percent of demand under a critical water year. Whereas, under The Bay Institute's recommended flow regime, only 88 percent of demand would be met in a wet water year, declining to 52 percent of demand in a critical water year.

Table 3.3.8-14 Percent of demand met for irrigation water delivered, by water year type for flow regime (Source: Districts, 2019c).[a]

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Base case[b]	100%	100%	100%	100%	92%
Districts - with infiltration galleries[c]	100%	100%	100%	100%	91%
Draft Voluntary Agreement	100%	100%	100%	100%	87%
NMFS	99%	100%	92%	85%	77%
California DFW	99%	100%	93%	87%	78%
Water Board	88%	94%	68%	92%	69%
Conservation Groups	98%	94%	90%	88%	77%
ECHO	87%	65%	63%	64%	62%
The Bay Institute	88%	75%	65%	66%	52%

[a] Some of the water year types occur with greater frequency, which ensures that the average percentage demand met for irrigation reflects a general trend for those years

[239] Over the course of the 42-year modeling term, wet, above normal, below normal, dry, and critical water years occurred 36 percent, 14 percent, 7 percent, 17 percent, and 26 percent of the time, respectively.

more than is true for other years. For all model years, 15 years are characterized as wet, 6 years are characterized as above normal, 3 years are characterized as below normal, 7 years are characterized as dry, and 11 years are characterized as critical. Some scenarios, such as for the Water Board, ECHO, and the Bay Institute, may show smaller demand met because of the small number of years included in the sample.

[b] Note that these values are based on average percentage of demand met over a period of years, and it takes some time for reservoir levels to be affected during periods of reduced water availability. The Don Pedro Reservoir maintains sufficient storage to provide 100 percent full, or close to full demand in single critical water year types following a wet or above normal water year. The reduction in water supply delivery under the base case reflects consecutive years of water shortages (i.e., a drought).

[c] Costs would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

Our Analysis

Table 3.3.8-14 shows that all the proposed and recommended flow regimes reduce the amount of water available for irrigation, ranging from 8 percent to more than 30 percent for certain water years. To estimate the economic effects on agricultural production resulting from changes to the project flow regimes, we prepared tables that combine operations data from the alternative flow regimes with economic data (tables 3.3.8-15, 3.3.8-16, and 3.3.8-17). These tables present the average annual economic impacts associated with each of the proposed and recommended flow regimes in wet, above normal, below normal, dry and critical water years. The modeling period corresponds with the Districts' hydrologic model and covers a 42-year period from 1971 to 2012. Several important assumptions inform the development of these tables. First, our baseline for estimating the economic effects of changes in agricultural production resulting from reduced irrigation deliveries is existing project operations. Second, we do not account for losses, such as evaporation or leakage, from the canals and we assume that water is not transferred into or out of the irrigation system. Finally, our analysis includes an estimated impact to other economic sectors that depend on agricultural products, such as dairies and wineries, which could face increased costs as a result of reduced availability of certain inputs.

The Districts' economic analysis estimates that water supplies provided by the project sustains 18,900 jobs in Stanislaus and Merced Counties (Districts, 2019c). As shown in table 3.3.8-15, effects on the economic output could be as great as $1.9 billion—approximately 6 percent of annual GDP in the three-county region—in a critical water year under The Bay Institute's flow regime. Base case results are presented in the tables below to provide a basis for comparing the proposed and recommended flow regimes. For the base case, economic impacts would only occur in a critical water year when full irrigation demand cannot be met. Under the Districts' high impact estimate (as

shown in table 3.3.8-16), up to 7,056 jobs could be lost under The Bay Institute's flow regime in a critical water year. This estimate would represent approximately one third of all jobs supported by irrigation water from the project and 1.9 percent of all jobs in the three-county region included in the Districts' service area. Additionally, as shown in table 3.3.8-17, labor income would be similarly affected; up to $393 million in labor income would be affected under the ECHO flow regime in a critical water year, representing more than 50 percent of all labor income supported by irrigation water from the Don Pedro Project and 2.3 percent of all labor income in the three-county region.

The Districts' low-impact estimate indicates that crop processors would be able to transition to alternate crops. Where reasonable alternative crop sources can be developed, the total job losses would be substantially lower, approximately 1,850 jobs, representing a decline of approximately 10 percent from baseline conditions, and a decrease of less than one percent of total employment in the three-county area. Using the low impact estimate, labor income would decline by approximately $141 million, and total output would decline by 6 percent. Total output would decline by approximately $240 million, or less than 1 percent of total GDP in the three-county area. In either the high or low impact estimate, this analysis indicates the economic effects on the three-county area would be substantial and would have meaningful and lasting adverse effects on socioeconomic resources, including loss of jobs and income that would impact the overall economic conditions in the area.

Table 3.3.8-15. Average annual effects on economic output from agricultural production from reductions in irrigation deliveries associated with the alternative flow regimes over the 42-year modeling term compared to the base case (millions of 2019 dollars)[a] (Source: Districts, 2019c; 2018g,i).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts - with infiltration galleries[b]	$0	$0	$0	$0	-$53
Draft Voluntary Agreement	$0	$0	$0	$0	-$195
NMFS	-$13	$0	-$260	-$558	-$603
California DFW	-$13	$0	$0	-$139	-$868
Water Board	-$456	-$229	-$1,222	-$307	-$902
Conservation Groups	-$80	-$232	-$392	-$476	-$570
The Bay Institute	-$430	-$943	-$1,373	-$1,315	-$1,563
ECHO[c]	-$551	-$1,339	-$1,373	-$1,373	-$1,222

[a] The Consumer Price Index was used to adjust the values in this table from 2012 dollars to 2019 dollars.

[b] Costs would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

[c] Based on model results filed August 29, 2018. Effects on economic output were not provided with the updated model results filed on December 11, 2019.

Table 3.3.8-16. Average annual employment losses (number of jobs) from agricultural production from reductions in irrigation deliveries associated with the alternative flow regimes over the 42-year modeling term compared to the base case (Source: Districts, 2019c; 2018g,i).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts - with infiltration galleries[b]	0	0	0	0	-199
Draft Voluntary Agreement	0	0	0	0	-719
NMFS	-47	0	-957	-2,050	-2,225
California DFW	-47	0	0	-513	-3,216
Water Board	-1,685	-836	-4,576	-1,128	-3,393
Conservation Groups	-284	-828	-1,427	-1,733	-2,108
The Bay Institute	-1,578	-3,473	-5,030	-4,821	-5,886
ECHO[a]	-2,008	-4,908	-5,030	-5,030	-4,507

[a] Based on model results filed August 29, 2018. Effects on economic output were not provided with the updated model results filed on December 11, 2019.

[b] Costs would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

Table 3.3.8-17. Average annual labor income losses from agricultural production from reductions in irrigation deliveries associated with the alternative flow regimes over the 42-year modeling term compared to the base case (millions of 2018 dollars)[a] (Source: Districts, 2019c; 2018g,i).

Flow Regime	Wet	Above Normal	Below Normal	Dry	Critical
Districts - with infiltration galleries[b]	$0	$0	$0	$0	-$11
Draft Voluntary Agreement	$0	$0	$0	$0	-$40
NMFS	-$3	$0	-$52	-$111	-$119
California DFW	-$3	$0	$0	-$28	-$173
Water Board	-$93	-$46	-$258	-$60	-$192
Conservation Groups	-$16	-$47	-$80	-$96	-$115
The Bay Institute	-$85	-$187	-$271	-$259	-$335
ECHO[c]	-$109	-$264	-$270	-$270	-$241

[a] The Consumer Price Index was used to adjust the values in this table from 2012 dollars to 2018 dollars.

[b] Costs would be slightly higher under the proposed interim flow regime that would be in effect until the irrigation galleries are operational. The Districts estimate that design, permitting and construction of the infiltration galleries would require approximately 6.5 years.

[c] Based on model results filed August 29, 2018. Effects on economic output were not provided with the updated model results filed on December 11, 2019.

As shown in table 3.3.8-15, the Districts' proposed with-infiltration galleries flow regime and the flow regime included in the draft Voluntary Agreement would not cause any reduction in economic output from agricultural production in wet, above normal, below normal, or dry water years. In critical water years, the estimated losses of economic output from agricultural production are estimated to be up to $53 million under the Districts' proposed with-infiltration galleries flow regime and $195 million under the flow regime included in the draft Voluntary Agreement. These values assume that some agricultural production would simply cease, as forward-linked industries would be negatively impacted (e.g., animal feed crops would not be imported from outside the

region to support beef production). However, the actual impacts may be lesser depending on the availability of suitable substitutes and would likely be reduced over time as agricultural practices adjust to changes in water availability under a new flow regime.

In critically dry water years, all of the agency and NGO-recommended flow regimes would increase the maximum annual loss in economic output from agricultural production at least 10-fold over the District's proposal and at least 3-fold over the flow regime included in the draft Voluntary Agreement. Most of the agency and NGO-recommended flow regimes also produce substantial impacts to economic output from agricultural production in wet, above normal, below normal and dry water years, compared to no impact in these water year types for the Districts' and draft Voluntary Agreement flow regimes.

Because the effects presented in tables 3.3.8-15, 3.3.8-16, and 3.3.8-17 do not show the economic impacts that could accumulate over multiple dry years of drought conditions, the effects could be greater during extended droughts. Agricultural production, animal production, and food processes may be able to withstand temporary effects of one dry year, whereas consecutively occurring dry water years could contribute to permanent losses in agriculture as farmers lay off labor, have fallow fields, and require agricultural processors and consumers to look for other vendors to provide agricultural products. Flow regimes that result in lengthy consecutive annual reductions in irrigation water supply are likely to shrink the regional agricultural sector.

Finally, the Districts state that the availability and reliability of affordable water and electricity from the Don Pedro Project would also affect land values, particularly agricultural land values. The Districts determined that the land values in their service area have a clear premium compared to land values in other nearby regions that do not have access to surface or groundwater supplies, and that there was a clear value differential when comparing irrigated cropland to rangeland without water supplies. Although other factors that drive land value are not attributable to water supply, reliable surface water supplies provided by the Don Pedro Project likely have a positive influence on land values. It is expected that the conversion of high-value cropland (such as almond orchards) to lower value cropland (such as annual silage crops) or pastureland would decrease the value of the land permanently. The exact decline in land value associated with agricultural and water supply losses is unknown but is expected to have a significant effect on the region under flow regimes that cause greater reductions in water supply.

The frequency of water shortages impacts the long-term viability of the agricultural economy. While crop-shifting is not easily accomplished in areas that are dominated by tree and vine crops, over time, individual farmers may react to shortages of water and increased cost of replacement water, if available, in a number of ways that may temper some of the socioeconomic impacts of the proposed and recommended flow regimes. For example, at their own expense, farmers may choose to switch to less water intensive crops or install more efficient irrigation systems. These business decisions would be made at the individual farm level and are not quantified in our analysis.

Nonetheless, the economic effects of the recommended flow regimes, in particular the recommendations by the the Water Board, California DFW, The Bay Institute, Conservation Groups, and ECHO, would have substantial socioeconomic effects on the region.

La Grange Project

The La Grange Project does not store water for consumptive use, provides no flood control benefits, and has no recreational facilities associated with the project or La Grange Reservoir. Therefore, the Districts' proposal would not result in any adverse effects on socioeconomic resources.

3.3.8.3 Cumulative Effects

The Districts play key roles in the agricultural economies of Stanislaus and Merced Counties and the entire San Joaquin Valley. Through the Don Pedro Project, the Districts provide highly reliable water supplies to their customers, including consistent annual deliveries of high-quality surface water to maintain crops during periods of drought. With the reliable water supply available, growers and producers have invested heavily in high-valued perennial crops, such as almonds and peaches, and dairy production, resulting in the development of a large complex of agricultural support industries in the area. Dry and drought conditions over multiple years would have cumulative impacts on agricultural production, including structural shifts in the local agricultural economy as livestock and dairy producers turn to alternate sources of feed and incur additional costs for feed, and almond growers move to more efficient methods of irrigation.

The Hetch Hetchy System supplies 85 percent of the water supply for CCSF and its 27 wholesale customers in the RWS. The outcome of the project licensing process could affect future water supply available to the Bay Area from the Hetch Hetchy System. Under certain circumstances, the Districts and CCSF share responsibility for meeting FERC license requirements in the lower Tuolumne River downstream of the Don Pedro Project. Additionally, demand for municipal and industrial water supply is expected to continue to increase, in part as a result of expected population growth in the study area. The projects would provide increasing value as a result of increased demand for reliable water sources. Because the proposed and recommended flow regimes would reduce the availability of municipal and industrial water supplies, the adverse effects of reductions in supply would also increase in the future as demand increases.

Don Pedro Reservoir provides 340,000 acre-feet of flood control storage, which provides flood control benefits along the Tuolumne and San Joaquin Rivers. Use of the Don Pedro Project spillway during flood conditions has occurred only twice since dam construction. Flood control provides financial security to homeowners, businesses, and landowners located along the rivers, and supports ongoing development downstream of the project. The La Grange Project provides no flood control benefits.

The projects would provide minor cumulative benefits to socioeconomic resources near them in the form of electricity generated and employment opportunities. These benefits have existed since hydroelectric generation began at the project in 1924 and would continue throughout the next 30 to 50 years if the Commission were to grant a license for the projects.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the projects would continue to operate as they have in the past. None of the Districts' proposed measures or the resource agencies' recommendations and mandatory conditions would be required. None of the staff-recommended measures would be implemented, including measures to enhance environmental conditions for fish and wildlife within the project and measures that would expand and improve recreation opportunities.

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4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Don Pedro and La Grange Projects' use of the Tuolumne River for hydropower purposes to see what effect various environmental measures would have on the projects' costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[240] the Commission compares current project costs to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower projects' power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EIS for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

As currently operated, the Don Pedro Project has an authorized installed capacity of 168.015 MW and generates an average of 612,967 MWh annually (based on operations model results); the La Grange Project has a capacity of 4.7 MW and generates an average of 18,077 MWh annually.

Tables 4.1-1 and 4.1-2 summarize the assumptions and economic information we use in our analyses. The Districts provided this information in their license applications. We conclude that the values provided by the Districts are reasonable for the purposes of our analyses. Cost items common to all alternatives include taxes and insurance costs, net investment (the total investment in power plant facilities remaining to be

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[240] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

depreciated), estimated future capital investment required to maintain and extend the life of plant equipment and facilities, relicensing costs, normal operation and maintenance cost, and Commission fees.

Table 4.1-1. Parameters for the economic analysis of the Don Pedro Project (Source: Districts, as modified by staff).

Parameter	Value
Period of analysis (years)	30
Period of financing (years)	20
Net investment, $[a]	63,014,000
Relicensing cost, $[b]	21,398,960
Current and proposed operation and maintenance, $/year[c]	9,629,530
Tax status	Exempt
Commission fees, $/year[d]	345,730
Composite energy rate ($/MWh)[e]	62.20
Capacity rate ($/MW-year)[f]	48.65
Interest rate[g]	3.5
Discount rate[h]	5.0

[a] Net investment is the depreciated project investment allocated to power purposes. The value provided by the Districts (2017f, in AIR response 5(d)) was depreciated to 2018 dollars.

[b] Relicensing costs include the administrative, legal/study, and other expenses to date. The value provided by the Districts (2017a) was escalated to 2018 dollars.

[c] Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license. The values provided by the Districts (2017a) were escalated to 2018 dollars.

[d] Commission fees are based on statements of annual charges from the Commission for use of federal lands and administrative charges based on authorized capacity.

[e] The Districts provided an on-peak energy rate of $67/MWh (60 percent of annual generation) and an off-peak energy rate of $55/MWh (40 percent), which results in a composite energy rate of $62.20/MWh (2017f, in AIR response 5(c)).

[f] Source: Districts (2017f, in AIR response 5(d)).

[g] Source: Districts (2017f, in AIR response 5(d)).

[h] Rate assumed by staff.

Table 4.1-2. Parameters for the economic analysis of the La Grange Project (Source: Districts, as amended by staff).

Parameter	Value
Period of analysis (years)	30
Period of financing (years)	20
Net investment, $[a]	4,370,800
Relicensing cost, $[b]	4,921,760
Current and proposed operation and maintenance, $/year[c]	482,550
Tax status	Exempt
Commission fees, $/year[d]	5,150
Composite energy rate ($/MWh)[e]	62.20
Capacity rate ($/MW-year)[f]	48.65
Interest rate[g]	3.5
Discount rate[h]	5.0

[a] Net investment is the depreciated project investment allocated to power purposes. The value provided by the Districts (2017e, in AIR response 2(a)) was depreciated to 2018 dollars.

[b] Relicensing costs include the administrative, legal/study, and other expenses to date. The value provided by the Districts (2017e, in AIR response 2(a)) was escalated to 2018 dollars.

[c] Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license. The values provided by the Districts (2017b, exhibit E, section 4.1.3) were escalated to 2018 dollars.

[d] Commission fees were estimated by staff for use of federal lands and administrative charges based on installed capacity.

[e] The Districts provided an on-peak energy rate of $67/MWh (assumed 60 percent of annual generation, same as Don Pedro) and an off-peak energy rate of $55/MWh (40 percent), which results in a composite energy rate of $62.20/MWh (Districts, 2017e, AIR response 2(d)).

[f] Source: Districts (2017e, AIR response 2(e)).

[g] Source: Districts (2017e, AIR response 2(c)).

[h] Rate assumed by staff.

4.2 COMPARISON OF ALTERNATIVES

4.2.1 Don Pedro Project

Table 4.2.1-1 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this final EIS for the Don Pedro Project: no action, Districts' proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 4.2.1-1. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Don Pedro Hydroelectric Project (Source: staff).

	No Action	Districts' Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity (MW)	168.015	220	220	220
Annual generation (MWh)	612,967	633,898	633,681	652,994
Dependable capacity (MW)	168	220	220	220
Annual cost of alternative power ($ and $/MWh)	46,297,400 75.53	50,128,650 79.08	50,117,830 79.09	51,318,800 78.59
Annual project cost ($ and $/MWh)	14,958,750 24.40	24,457,680 38.58	22,631,630 35.71	25,823,330 39.55
Difference between the cost of alternative power and project cost ($ and $/MWh)	31,338,650 51.13	25,670,970 40.50	27,486,200 43.38	25,495,470 39.04

4.2.1.1 No-action Alternative

Under the no-action alternative, the Don Pedro Project would continue to operate as it does now. The project has an installed capacity of 168.015 MW and a dependable capacity of 168 MW, and it generates an average of 612,967 MWh of electricity

annually. The average annual cost of alternative power (energy and capacity) would be $46,297,400, or about $75.53/MWh. The average annual project cost of operating the project would be $14,958,750, or about $24.40/MWh. Overall, the project would produce power at a cost that is $31,338,650, or $51.13/MWh, less than the cost of alternative power.

4.2.1.2 Districts' Proposal

The Districts' proposed environmental measures and recreational resource measures are presented in table 4.3-1 in section 4.3, *Cost of Environmental Measures*.

The Districts propose to upgrade Units 1, 2, and 3 at the Don Pedro Project, which would increase the hydropower capacity of the project from the currently authorized 168 MW to the proposed new authorized capacity of approximately 220 MW, with a maximum output of 244 MW compared to the current maximum of 203 MW at maximum head. The upgrades would increase the annual generation by approximately 20,000 MWh. The capital cost is projected to be $48,900,000 in 2016 dollars ($52,320,470 in 2018 dollars). The levelized annual cost of the construction would be $3,088,850.

As proposed by the Districts, the Don Pedro Project would have an installed and dependable capacity of 220 MW and generate an average of 633,898 MWh of electricity annually. The average annual cost of alternative power would be $50,128,650, or about $79.08/MWh. The average annual project cost of operating the project would be $24,457,680, or about $38.58/MWh. Overall, the project would produce power at a cost that is $25,670,970, or $40.50/MWh, less than the cost of alternative power.

4.2.1.3 Staff Alternative

Table 4.3-1 in section 4.3, *Cost of Environmental Measures*, also shows the staff-recommended measures, including additions, deletions, and modifications to the Districts' proposed environmental protection and enhancement measures along with the estimated cost of each.

As proposed by staff, the project would have an installed and dependable capacity of 220 MW as proposed and generate an average of 633,681 MWh of electricity annually. The average annual cost of alternative power would be $50,117,830, or about $79.09/MWh. The average annual project cost of operating the project would be $22,631,630, or about $35.71/MWh. Overall, the project would produce power at a cost that is $27,486,200, or $43.38/MWh, less than the cost of alternative power.

4.2.1.4 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative with the exception of the addition of mandatory conditions that were not adopted in the staff alternative, and the exclusion of staff-recommended measures that would conflict or be redundant with the mandatory conditions. This alternative would have an installed and dependable capacity of 220 MW

and generate an average of 652,994 MWh of electricity annually. The average annual cost of alternative power would be $51,318,800, or about $78.59/MWh. The average annual project cost of operating the project would be $25,823,330, or about $39.55/MWh. Overall, the project would produce power at a cost that is $25,495,470, or $39.04/MWh, less than the cost of alternative power.

4.2.2 La Grange Project

Table 4.2.2-1 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this final EIS for the La Grange Project: no action, Districts' proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 4.2.2-1. Summary of the annual cost of alternative power and annual project cost for the alternatives for the La Grange Hydroelectric Project (Source: staff).

	No Action	**Districts' Proposal**	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Installed capacity (MW)	4.7	4.7	4.7	4.7
Annual generation (MWh)	18,077	22,430	22,205	24,576
Dependable capacity (MW)	4.7	4.7	4.7	4.7
Annual cost of alternative power ($ and $/MWh)	1,353,060 74.85	1,623,710 72.39	1,609,860 72.50	1,757,180 71.50
Annual project cost ($ and $/MWh)	1,031,160 57.04	1,139,750 50.81	1,171,150 52.74	1,278,970 52.04
Difference between the cost of alternative power and project cost ($ and $/MWh)	321,900 17.81	483,960 21.58	438,710 19.76	478,210 19.46

4.2.2.1 No-action Alternative

Under the no-action alternative, the La Grange Project would continue to operate as it does now. The project has an installed and dependable capacity of 4.7 MW and

generates an average of 18,077 MWh of electricity annually. The average annual cost of alternative power (energy and capacity) would be $1,353,060, or about $74.85/MWh. The average annual project cost of operating the project would be $1,031,160, or about $57.04/MWh. Overall, the project would produce power at a cost that is $321,900, or $17.81/MWh, less than the cost of alternative power.

4.2.2.2 Districts' Proposal

The Districts' proposed environmental measures and recreational resource measures are presented in table 4.3-1 in section 4.3, *Cost of Environmental Measures*.

As proposed by the Districts, the project would have an installed and dependable capacity of 4.7 MW and generate an average of 22,430 MWh of electricity annually. The average annual cost of alternative power would be $1,623,710, or about $72.39/MWh. The average annual project cost of operating the project would be $1,139,750, or about $50.81/MWh. Overall, the project would produce power at a cost that is $483,960, or $21.58/MWh, less than the cost of alternative power.

4.2.2.3 Staff Alternative

Table 4.3-2 in section 4.3, *Cost of Environmental Measures*, also shows the staff-recommended measures, including additions, deletions, and modifications to the Districts' proposed environmental protection and enhancement measures along with the estimated cost of each.

As proposed by staff, the project would have an installed and dependable capacity of 4.7 MW and generate an average of 22,205 MWh of electricity annually. The average annual cost of alternative power would be $1,609,860, or about $72.50/MWh. The average annual project cost of operating the project would be $1,171,150, or about $52.74/MWh. Overall, the project would produce power at a cost that is $438,710, or $19.76/MWh, less than the cost of alternative power.

4.2.2.4 Staff Alternative with Mandatory Conditions

This alternative is similar to the staff alternative with the exception of the addition of mandatory conditions that were not adopted in the staff alternative, and the exclusion of staff-recommended measures that would conflict or be redundant with the mandatory conditions. This alternative would have an installed and dependable capacity of 4.7 MW and generate an average of 24,576 MWh of electricity annually. The average annual cost of alternative power would be $1,757,180, or about $71.50/MWh. The average annual project cost of operating the project would be $1,278,970, or about $52.04/MWh. Overall, the project would produce power at a cost that is $478,210, or $19.46/MWh, less than the cost of alternative power.

4.3 Cost of Environmental Measures

Table 4.3-1 gives the cost of each of the environmental enhancement measures considered in our analysis for the Don Pedro Project and table 4.3-2 gives the cost of each of the environmental enhancement measures considered in our analysis for the La Grange Project. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 4.3-1. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the Don Pedro Hydroelectric Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
General				
1. Reduce the minimum reservoir level from elevation 600 feet to 550 feet.	Districts, staff	$0	$0	$0
Geology and Soil Resources				
1. Develop a plan to minimize undesirable erosion or sedimentation conditions caused by the project near river reaches and reservoirs. (Water Board preliminary 401 condition 9)	Water Board	$10,000[d]	$4,000[d]	$4,590
2. Develop an erosion control plan for for project-related construction activities affecting BLM lands that are within or adjacent to the project boundary. (BLM Don Pedro revised 4(e) condition 3)	BLM, staff	$5,000[d]	$0[d]	$300
3. Develop a soil erosion and sediment control plan for project-related construction activities authorized by the new license.	Staff	$0[e]	$0[e]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
4. If the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Districts must consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity. (BLM Don Pedro revised 4(e) condition 35)	BLM	$0[d]	$0[d]	$0
Aquatic Resources				
1. Establish an ecological group and host annual meetings. (FWS Don Pedro 10(j) recommendation 12, California DFW 10(j) recommendation M3-1, Conservation Groups recommendation 3)	FWS, California DFW, Conservation Groups	$0[d]	$25,000[d]	$25,000
2. Create the TPAC. (FWS revised 10(j) recommendation 4)	Districts, FWS	$0[d]	$25,000[d]	$25,000
3. Develop a coordinated operations plan. (California DFW 10(j) recommendation M3-2)	California DFW	$20,000[d]	$10,000[d]	$11,180
4. Maintain the minimum streamflows identified in table 5.6-2 of Exhibit E in	Districts	$0[f]	$50,200 (energy loss 807 MWh)[f]	$50,200

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
the Don Pedro amended final license application, which provides two sets of flow requirements: (1) interim flows to be released until the infiltration galleries are operational and (2) flows to be provided after the infiltration galleries are operational.				
5. Provide the Districts' proposed minimum interim flows until the infiltration galleries are operational, and thereafter maintain the minimum streamflows included in the draft Voluntary Agreement filed with the Water Board on March 1, 2019. Compared to flows that the Districts' propose to be in effect after the infiltration galleries are operational, the Voluntary Agreement flow regime increases the minimum flow required downstream of the infiltration galleries from 75 to 125 cfs in dry and critical water years, and reduces the minimum flow required at the La Grange gage from 350 to 300 cfs in wet, above normal, and below normal water years.	Staff	$0[g]	$363,690 ($300,000 plus an energy loss of 1,024 MWh)[g]	$363,690
6. Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet)	Districts	$0[f]	-$9,330 (150 MWh energy gain –	-$9,330

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
on October 5, 6, and 7, with infiltration galleries shut off to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would be provided in wet, above normal, and below normal water years only.			$9,330 negative cost)[f,h]	
7. Develop a fall pulse flow release plan that includes provisions for: (1) the annual release of 5,950 acre-feet of water downstream of La Grange Diversion Dam to promote the upstream migration of Chinook salmon during favorable instream thermal conditions; (2) annual consultation with the fisheries agencies to determine the timing and magnitude of flow releases; (3) annual monitoring of upstream passage at the temporary fish counting weir to assist the determination on the timing of the fall pulse flow releases to coincide with the upstream migration; (4) notification of the selected pulse flow release timing and magnitude to the Commission; and (5) a summary report after 10 years of monitoring to	Staff	$0[f]	$90,670 ($100,000 cost plus 150 MWh energy gain – $9,330 negative cost)[f]	$90,670

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
evaluate effectiveness and any recommended changes to the fall pulse flow release plan. These flows would be provided in wet, above normal, and below normal water years only.				
8. Develop a spring pulse flow release plan to encourage salmonid smolt outmigration and increase survival to include the AMP provided by the Districts in appendix E-1, attachment F of their amended final license application.	Districts, staff	$5,000[d]	$32,260 ($100,000 cost plus 1,089 MWh energy gain – $67,740 negative cost)[f,h]	$32,560
9. Modify the proposed spring pulse flow release plan to include the floodplain rearing pulse flows in the draft Voluntary Agreement.	Staff	$0[d]	$0[i]	$0
10. Provide gravel mobilization flows of 6,000 to 7,000 cfs during years when sufficient spill is projected to occur.	Districts, staff	$0[f]	$32,830[f]	$32,830
11. Implement the FWS Spill Management Plan to maximize fisheries benefits from excess water during spill years. (FWS revised 10(j) recommendation 2)	FWS, Districts, staff	$10,000[j]	$9,060[j]	$9,650

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
12. Provide NMFS's recommended minimum instream flows downstream of La Grange Diversion Dam. (NMFS 10(j) recommendations 1.1 and 1.2)	NMFS	$0[k]	$90,310 (energy loss 1,452 MWh)[k]	$90,310
13. Provide NMFS's recommended seasonal pulse flows in the lower Tuolumne River. (NMFS 10(j) recommendation 1.3)	NMFS	$0[k]	-$262,920 (energy gain 4,227 MWh)[k]	-$262,920
14. Provide minimum instream flows to be specified by the Water Board. (Water Board preliminary 401 conditions 1 and 2)	Water Board	$0[l]	$13,250 (energy loss 213 MWh)[l]	$13,250
15. Provide California DFW's recommended minimum instream flows and minimum Don Pedro Reservoir storage requirements. (California DFW 10(j) recommendation M1-2 and M1-4)	California DFW	$0[k]	$674,560 (energy loss 10,845 MWh)[k]	$674,560
16. Provide California DFW's recommended spring floodplain activation flows. (California DFW 10(j) recommendation M1-5)	California DFW	$0[k]	$0 (energy effect is included in cost for Aquatics #14 above)[k]	$0
17. Provide California DFW's recommended geomorphic flood pulse flows. (California DFW 10(j) recommendation M1-9)	California DFW	$0[k]	-$680 (energy gain 11 MWh [negative cost])[k]	-$680

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
18. Provide California DFW's recommended adult Chinook salmon fall attraction pulse flows. (California DFW 10(j) recommendation M1-7)	California DFW	$0[k]	$0 (energy effect is included in cost for Aquatics #14 above)[k]	$0
19. Provide The Bay Institute's recommended minimum flows and pulse flows.	The Bay Institute	$0[f]	-$610,000 (energy gain 9,787 MWh [negative cost])[f]	-$610,000
20. Provide the Conservation Groups' recommended minimum flows and pulse flows. (Conservation Groups recommendation 1.C.1 and 3-6)	Conservation Groups	$0[k]	$1,279,520 (energy loss 20,571 MW MWh)[k]	$1,279,520
21. Provide 60% of the unimpaired flow from February to June to protect salmon. (ECHO recommendation 1)	ECHO	$0[f]	$638,610 (energy loss 10,267 MWh)[f]	$638,610
22. Develop a drought plan if three or more consecutively dry and/or critically dry water years occur. (NMFS 10(j) recommendation 1.6)	NMFS	$10,000[d]	$800[d]	$390
23. Develop a drought plan, in consultation with the Water Board, FWS, NMFS, BLM, and California DFW, that identifies the conditions under which license requirements would be temporarily modified during prolonged drought conditions and how	Staff	$5,000[d]	$0[d]	$300

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
the project would be operated when drought conditions occur.				
24. Develop a plan to monitor water temperatures at five sites in the lower Tuolumne River including real-time monitoring at the La Grange gage and a site near the temporary fish counting weir, plus periodic monitoring in Don Pedro Reservoir near the dam whenever the reservoir elevations are lower than 700 feet.	Staff	$10,000[m]	$36,770[m]	$37,360
25. Develop a stream flow and reservoir level compliance plan in consultation with the Water Board, FWS, NMFS, and California DFW. (Water Board preliminary 401 condition 3)	Water Board, staff	$5,000[d]	$1,000[d]	$1,300
26. Develop a streamflow and reservoir level compliance monitoring plan to include monitoring flow downstream of the infiltration galleries. (FWS Don Pedro 10(j) recommendation 1, California DFW 10(j) recommendation M1-1)	FWS, California DFW	$5,000[d]	$1,000[d]	$1,300

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
27. Install a flow gage near RM 25 that is capable of recording up to 8,000 cfs. (FWS Don Pedro 10(j) recommendation 1, NMFS 10(j) recommendation 1.4, California DFW 10(j) recommendation M1-1, Conservation Groups recommendation I.C.2)	FWS, NMFS, California DFW, Conservation Groups	$50,000[d]	$1,000[d]	$3,950
28. Implement the Spill Prevention Control and Countermeasure Management Plan for managing spill risks of hazardous materials associated with the Don Pedro Recreation Agency warehouse and fuel island filed with the Don Pedro amended final license application.	Districts	$0	$0	$0
29. Develop a hazardous substance plan. (BLM Don Pedro revised 4(e) condition 43)	BLM, staff	$0[n]	$0[n]	$0
30. Modify the Spill Prevention Control and Countermeasure Management Plan (filed as appendix E-3 of the Don Pedro amended final license application) to include measures for managing spill risks of hazardous materials at Don Pedro and La Grange Hydroelectric facilities in consultation with the Water	Water Board[o], staff	$10,000[d]	$0[d]	$590

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Board, California DFW, FWS, NMFS, and BLM. (Water Board preliminary 401 condition 10)				
31. Develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches. (Water Board preliminary 401 condition 6)	Water Board	$0[d]	$85,000[p]	$85,000
32. Develop a plan to monitor water temperature in Don Pedro Reservoir, La Grange Reservoir, and lower Tuolumne River. (Water Board preliminary 401 condition 7)	Water Board	$0[d]	$360,000[p]	$360,000
33. Establish temperature gages co-located with the recommended flow gage near RM 25 and a new temperature gage near Robert's Ferry Bridge crossing at RM 39.5 and file annual water temperature monitoring reports with resources agencies and the Commission that describe the magnitude and duration of any temperature exceedance events. (NMFS 10(j) recommendations 1.4 and 1.5)	NMFS	$11,600[d]	$10,000[d]	$10,690
34. Develop a water temperature monitoring/compliance plan. (FWS	FWS, California DFW	$0[d]	$360,000[p]	$360,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
Don Pedro 10(j) recommendation 6, California DFW 10(j) recommendation M2)				
35. Develop a salmonid protection and monitoring plan to provide for fish protection at project facilities. (California DFW 10(j) recommendation M8-1)	California DFW	$25,000[d]	$75,000[p]	$76,580
36. Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5 to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat. (Districts RPM-6)	Districts	$11,465,520	$620,570	$1,297,460
37. Install a fish counting weir and a temporary weir to capture and remove non-salmonid piscivorous fish in critically dry years. (Conservation Groups recommendation 7)	Conservation Groups	$0[d]	$633,300[p]	$633,300
38. Implement a predator control and suppression plan that would involve active control and suppression of striped bass and black bass upstream and	Districts	$152,850	$195,720	$204,740

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
downstream of the proposed fish counting/barrier weir.				
39. Modify the Predator Control and Suppression Plan to include recommendations for temperature requirements, floodplain activation and spring recession flows, sediment and LWM placement to favor native fish over non-native predators, performance measures, and monitoring and reporting. (California DFW 10(j) recommendation M6-1 and M6-2)	California DFW	$200,000[q]	$195,720[q]	$207,520
40. Implement a fall-run Chinook salmon spawning superimposition reduction program.	Districts	$2,840,080	$37,620	$205,290
41. Develop a fish passage program plan. (NMFS 10(j) recommendation 5)	NMFS	$2,500[r]	$205,960[r]	$206,110
42. Conduct a five-year program of experimental gravel cleaning.	Districts, staff	$1,222,800	$124,820	$197,010
43. Conduct coarse sediment augmentation in the Tuolumne River between RM 39 and RM 52 over a 10-year period, with a total of 75,000 tons of gravel, annual spawning surveys	Districts, staff	$6,196,400	$52,860	$418,670

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
for five years, and a spawning gravel evaluation in year 12.				
44. Modify the Districts' proposed coarse sediment augmentation measure above to include an implementation plan, an additional 25,000 tons of gravel and include one or more sites downstream of RM 39 to as far downstream as RM 24.5.	Staff	$2,044,800[d]	$17,440[d]	$138,160
45. Conduct sediment enhancement and management using the gravel quantities recommended by NMFS. (NMFS 10(j) recommendation 2)	NMFS	$51,982,460[s]	$63,440[s]	$3,132,330
46. Update the 2004 coarse sediment management plan, annual placement of sediment to minimize predation habitat (hot spots), and annual gravel augmentation using the gravel quantities recommended by California DFW. (California DFW 10(j) recommendation M4-1, M4-2, M4-3)	California DFW	$205,682,620[t]	$63,440[t]	$12,206,340
47. Gravel augmentation and rehabilitation and reduction of habitat for piscivorous fish. (Conservation Groups recommendation 6)	Conservation Groups	$205,682,620[t]	$63,440[t]	$12,206,340

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
48. Develop and implement a plan to facilitate coarse and fine sediment transport past La Grange Dam in the Tuolumne River. (Water Board preliminary 401 condition 5)	Water Board	$11,385,810[u]	$0[u]	$672,190
49. Revise the Woody Debris Management Plan for Don Pedro Reservoir to include rapid removal and supply specific sizes and amounts of LWM for restoration projects. (FWS Don Pedro 10(j) recommendation 9; California DFW 10(j) recommendation M4-4)	FWS, California DFW	$5,000[d]	$25,000[d]	$25,300
50. Collect, sort and place 80 to 100 pieces of LWM per year in the lower Tuolumne River to achieve and maintain 100 LWM pieces per mile in four restoration reaches. (NMFS 10(j) recommendation 3)	NMFS	$5,000[d]	$75,000[d]	$75,300
51. Design a large woody debris placement and management plan that includes specific targets for the number (maintain a total of 1,600 pieces) and size of LWM to be placed in the lower Tuolumne River. (California DFW 10(j) recommendation M4-4, 5 and 6;	California DFW, Conservation Groups	$5,000[d]	$75,000[d]	$75,300

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
Conservation Groups recommendation 5)				
52. Develop and implement a plan to address the reduction of LWM downstream of La Grange Dam. (Water Board preliminary 401 condition 4).	Water Board	$5,000[d]	$75,000[d]	$75,300
53. Increase floodplain rearing habitat for juvenile salmonids. (Conservation Groups recommendation 4)	Conservation Groups	$36,550,000[v]	$0[d]	$2,157,810
54. Develop a floodplain rearing habitat restoration plan. (California DFW 10(j) recommendation M5-1, Conservation Groups recommendation 4)	California DFW, Conservation Groups	$26,843,690[v]	$7,350[v]	$1,592,120
55. Restore and create floodplain rearing habitat. (California DFW 10(j) recommendation M5-2)	California DFW	$50,000,000[d]	$0[d]	$2,951,850
56. Develop a monitoring plan for floodplain habitat restoration projects. (California DFW 10(j) recommendation M5-3)	California DFW	$10,000[w]	$11,960[w]	$12,550
57. Remove construction damage caused during building of New Don Pedro Dam and related Tuolumne River restoration in the area of Buck Flat. (Tuolumne River Conservancy)	Tuolumne River Conservancy	$250,000[p]	$0[d]	$14,760

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
58. Implement the FWS LTRHIP. (FWS revised 10(j) recommendation 3)	FWS, Districts, staff	$28,927,920[x]	$1,000,000[x]	$2,707,820
59. Develop a salmonid monitoring plan. (NMFS 10(j) recommendation 4)	NMFS	$5,000[d]	$915,000[p]	$915,000
60. Develop a salmonid monitoring plan. (FWS Don Pedro 10(j) recommendation 5)	FWS	$5,000[d]	$885,000[p]	$885,000
61. Develop a salmonid monitoring plan. (California DFW 10(j) recommendations M11-1, 11-2, and 11-3)	California DFW	$5,000[d]	$800,000[p]	$800,000
62. Develop a fisheries genetic management plan and a conservation hatchery plan. (California DFW 10(j) recommendation M7-1)	California DFW	$5,000[d]	$1,090,000[p]	$1,090,000
63. Provide for reservoir fish stocking. (California DFW 10(j) recommendation M7-2)	California DFW	$0[d]	$140,000[p]	$140,000
64. Implement the Aquatic Invasive Species Management Plan filed with the Don Pedro amended final license application.	Districts	$0[d]	$25,000[d]	$25,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
65. Develop an Aquatic Invasive Species Management Plan that includes additional measures to address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil. (BLM Don Pedro revised 4(e) condition 6, California DFW 10(j) recommendation M10, Water Board preliminary 401 condition 8)	BLM, California DFW, Water Board[o], staff	$5,000[d]	$30,000[d]	$30,000
Terrestrial Resources				
1. Provide for annual environmental training for employees and contractors, rather than bi-annual as proposed. (BLM Don Pedro revised 4(e) condition 2, FWS Don Pedro 10(j) recommendation 10, California DFW 10(j) recommendation M9-1.6, M9-4.1)	BLM, FWS, California DFW	$0[d]	$2,000[d]	$2,000
2. Require the Districts to host an annual consultation meeting with the resource agencies and interested stakeholders to discuss management of special-status species. (BLM Don Pedro revised 4(e) condition 9, California DFW 10(j) recommendations M3-1 and M9-1.7)	BLM, California DFW	$0[d]	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
3. Annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM within the project boundary. (BLM Don Pedro revised 4(e) condition 9, FWS Don Pedro 10(j) recommendation 8, California DFW 10(j) Recommendation M9-1.9)	BLM, FWS, California DFW	$0[d]	$2,000[d]	$2,000
4. Make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years.	Districts, staff	$0[d]	$0[d]	$0
5. Shape the descending limb of the snowmelt runoff hydrograph to ensure that flows are not reduced by more than 7 to 10 percent (depending on flow volume) of the previous day's 24-hour average flow. (NMFS 10(j) recommendation 1.7)	NMFS	$0[y]	-$270,630 (energy gain 2,269 MWh plus energy gain 2,082 MWh)[y]	-$270,630
6. Follow a spring recession rate during the month of June each year following the flow rates specified in table 3.3.2-36 and 3.3.2-37. (California DFW 10(j) recommendation M1-6)	California DFW	$0[k]	-$96,220 (energy gain 1,547 MWh)[k]	-$96,220

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
7. Provide a riparian recession flow in above normal, below normal, and dry water years to allow a multi-day ramp-down at specified rates to base flow from the flow value on the final day of any water year ("Recession Initiation Flow Value") on which minimum flows are determined by a percent of unimpaired flow. (Conservation Groups recommendation 2.C.7)	Conservation Groups	$0[z]	$152,760 (energy loss 2,456 MWh)[z]	$152,760
8. Implement the TRMP filed as appendix E-6 of the Don Pedro amended final license application.	Districts	$0	$329,190	$329,190
9. Develop a revised TRMP for the Don Pedro Project that includes staff-recommneded measures 10, 11, 13, 15, 18, 19, 22, 24, 25, 27, 29, and 30 below. (BLM Don Pedro revised 4(e) condition 7, FWS 10(j) recommendation 11, California DFW 10(j) recommendation M9-4.1)	BLM, FWS, California DFW, staff	$10,700[d]	$0[d]	$630
10. Modify the Don Pedro TRMP to include pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior	Staff	$0[d]	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
to any project-related ground disturbance in areas with suitable habitat, and implement 50-foot buffers around special-status or threatened and endangered plants, marked with flagging or fencing, prior to the implementation of vegetation management, trail construction, or other ground-disturbing activities				
11. Modify the Don Pedro TRMP to include focusing future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; using manual control of noxious weeds in areas with sensitive resources; and control measures for the giant reed population on the Don Pedro Powerhouse access road. (BLM Don Pedro revised 4(e) condition 7)	BLM, staff	$0[d]	$1,100[aa]	$1,100
12. Modify the Don Pedro TRMP to include surveys every five years for special-status plants in several specified areas subject to project operations and maintenance activities or recreational use. (BLM Don Pedro revised 4(e)	BLM, California DFW	$0[d]	$4,400[bb]	$4,400

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
condition 7, California DFW 10(j) recommendation M9-4)				
13. Modify the Don Pedro TRMP to include surveys for special-status plants following California DFW protocols within the Red Hills ACEC every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, roads and trails that are predominately used for project-related purposes, and where project-related disturbance is reasonably expected to occur. (BLM Don Pedro revised 4(e) condition 7)	BLM, staff	$0[d]	$21,140[cc]	$21,140
14. Modify the Don Pedro TRMP to include: (1) pre-construction surveys for special-status plants prior to any ground disturbance, rather than the proposed 0.5-acre minimum threshold; (2) installation of interpretive signs about the unique plants of the Red Hills ACEC; (3) procedures for project staff to recognize and report occurrences of special-status plants; and (4) consultation with BLM to develop specific usage plans for areas around	BLM, California DFW	$10,000[d]	$3,000[d]	$3,590

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
known occurrences of special-status plants that could be affected by recreational use. (BLM Don Pedro revised 4(e) condition 7, California DFW 10(j) recommendation M9-4)				
15. Modify the Don Pedro TRMP to include: (1) pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat for special-status species (rather than the proposed 0.5-acre minimum threshold); (2) installation of interpretive signs about the unique plants of the Red Hills.	Staff	$8,000[d]	$3,000[d]	$3,470
16. Modify the Don Pedro TRMP, including: (1) protocols for collecting field signs of WNS during bat surveys; and (2) public education actions to avoid and minimize impacts at recreation facilities. (California DFW 10(j) recommendation M9-3.2)	California DFW	$0[d]	$2,000[d]	$2,000
17. Conduct annual surveys of project facilities to evaluate the need for bat exclusion devices and install exclusion	FWS	$0[d]	$10,000[d]	$10,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
devices as needed (FWS Don Pedro 10(j) recommendation 11).				
18. Conduct a single survey within 2 years of license issuance of all project facilities to evaluate the need for bat exclusion devices and install exclusion devices as needed.	Staff	$0[d]	$620[d]	$620
19. Modify the Don Pedro TRMP to provide for: (1) resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; (2) protection guidelines and BMPs to avoid and minimize impacts, including the installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting; and (3) reporting any sick or dead bat to California DFW and FWS as soon as possible, and following accepted decontamination protocols when entering areas with potential bat occurrence (as found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015). (FWS Don Pedro 10(j) recommendation	FWS, California DFW, staff	$0[d]	$1,380[dd]	$1,380

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
11, California DFW 10(j) recommendation M9-3.2)				
20. Modify the Don Pedro TRMP to include protective buffers for use of pesticides and avoiding pesticide use within suitable habitat for the San Joaquin kit fox, western burrowing owl, California red-legged frog, and California tiger salamander; and within 500 feet of any documented bat maternity colony. (FWS Don Pedro 10(j) recommendation 11)	FWS	$0[d]	$0[d]	$0
21. Modify the Don Pedro TRMP to include BMPs to avoid adverse effects from any pesticide use on BLM lands within 500 feet of suitable aquatic habitat for special-status or threatened and endangered amphibians and reptiles. (BLM Don Pedro revised 4(e) condition 32)	BLM	$0[d]	$0[d]	$0
22. Modify the Don Pedro TRMP to include BMPs to minimize potential for pesticides to affect non-target species and avoidance and minimization measures where project-related ground disturbance would occur within 300 feet	FWS, staff	$0[d]	$0[d]	$0

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
of wetlands and riparian areas. (FWS Don Pedro 10(j) recommendation 11)				
23. Revise the applicant-prepared BA for terrestrial species to (1) include procedures to minimize adverse effects on federally listed species; (2) ensure project-related activities meet restrictions included in site management plans for special-status species; and (3) develop implementation and effectiveness monitoring of measures taken or employed to reduce effects on listed species. (FWS Don Pedro 10(j) recommendation 8)	FWS	$2,000[d]	$0[d]	$120
24. Modify the Don Pedro TRMP to provide for protection of burrowing animals, including the federally listed California tiger salamander, San Joaquin kit fox by specifying locations where ground squirrel activity is problematic and where the Districts' rodent control activities would potentially occur, limiting use of burrow fumigants or rodenticides, conducting surveys for burrowing owl, San Joaquin kit fox, and California tiger salamander prior to fumigant use, and documenting	FWS, California DFW, staff	$0[d]	$4,000[d]	$4,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
incidental sightings of these species. (FWS Don Pedro 10(j) recommendation 11, California DFW 10(j) recommendation M9-2 and M9-3.1)				
25. Avoid pesticide use within 500 feet of suitable aquatic and upland habitat for California tiger salamander (BLM 4(e) 32, FWS Don Pedro 10(j) recommendation 11).	FWS, staff	$0[d]	$0[d]	$0
26. Modify the Don Pedro TRMP to include protective measures for the San Joaquin kit fox, including (1) discouraging raptor use of transmission line as perches and (2) habitat surveys. (FWS Don Pedro 10(j) recommendation 11)	FWS	$15,000[ee]	$4,300[ee]	$5,190
27. Modify the Don Pedro TRMP to provide protection of California red-legged frog and California tiger salamander by establishing decontamination protocols to prevent the spread of chytrid fungus. (FWS Don Pedro 10(j) recommendation 11)	FWS, staff	$0[d]	$500[d]	$500
28. Modify the Don Pedro TRMP to provide protection of San Joaquin kit fox, California red-legged frog and	California DFW, FWS	$110,000[ff]	$53,500[ff]	$60,000

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
California tiger salamander, and western burrowing owl, and special-status bats by including (1) control of bullfrog and crayfish populations; (2) surveys for chytrid fungus; (3) protocols for slash removal and storage; (4) provisions to minimize impacts from roads, including potential wildlife-friendly road crossings; and (5) species and habitat monitoring every three years. (California DFW 10(j) recommendation M9, FWS Don Pedro 10(j) recommendation 11)				
29. Implement the proposed protections for valley elderberry longhorn beetle in the Don Pedro TRMP, filed as appendix E-6 of the Don Pedro amended final license application to provide protections for valley elderberry longhorn beetle in accordance with the FWS (2017a) conservation guidelines for the species. (FWS Don Pedro 10(j) recommendation 8)	Districts, FWS, staff	$0[d]	$2,000[d]	$2,000
30. Modify the Don Pedro TRMP to provide protections for valley elderberry longhorn beetle by following the protocols from FWS (2017a) framework	FWS, staff	$0[d]	$0[d]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
for assessing impacts to the species from project activities, which requires surveys for valley elderberry longhorn beetles and avoidance and minimization measures within 165 feet from project activities. (FWS Don Pedro 10(j) recommendation 8)				
31. Develop a stand-alone bald eagle and special-status bird management plan that includes annual surveys, protection buffers, limited operation periods, public signage, and reporting incidental observations of all special-status raptor species, including burrowing owl. (BLM Don Pedro revised 4(e) condition 8, FWS Don Pedro 10(j) recommendation 10 and 11, California DFW 10(j) recommendation M9-1)	BLM, FWS, California DFW, staff	$15,000[d]	$20,000[d]	$20,890
Recreational Resources				
1. Annually meet with BLM to discuss measures needed to ensure use and management, public safety, and protection and utilization of the recreation facilities and resources on BLM land. (BLM Don Pedro revised 4(e) condition 11)	BLM, staff	$0[d]	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
2. Implement the provisions in the RRMP (filed as appendix E-7 of the Don Pedro amended final license application).	Districts	$1,197,680	$130,490	$201,200
3. Modify the proposed RRMP to include the measures proposed by the Districts and the following additional measures: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) a provision to invite BLM and other interested parties to an annual coordination meeting to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) conceptual	BLM, staff	$1,213,680[gg]	$135,280[gg]	$206,930

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
drawings and descriptions of project recreation facilities, that are consistent with the outcome of design review by BLM, that would be constructed, reconstructed, or rehabilitated on BLM-managed land; (6) consultation with BLM to design visitor use surveys, to ensure data are collected about topics relevant to visitor use of project facilities on BLM-managed lands; (7) designation of the Fleming Meadows Visitor Center as a project recreational facility and a description of its operation and maintenance; (8) identification of the access designation (i.e., public versus non-public) of adjacent non-project lands on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (9) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as “high impact sites”; (10) construction and maintenance of shoreline access trails on each side of				

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
Ward's Ferry Bridge to provide suitable shoreline access for visitors, provide safe egress from the river for hand-carrying rafts, and reduce erosion and vegetation damage caused by user-created trails; (11) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir; (12) consultation with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day) and making information on the planned boating releases and the minimum flow schedule available to the public; and (13) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of project recreation facilities, including restrooms, that are currently in poor condition or do not meet accessibility guidelines, which				

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
includes proposed accessibility upgrades. The schedule should allow adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities. (BLM Don Pedro revised 4(e) condition 14)				
4. Construct a foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir. (BLM La Grange preliminary 4(e) condition 8, Conservation Groups)	Districts, BLM, Conservation Groups, staff	$72,560	$8,230	$12,510
5. Construct a new boat launch facility to provide boating access upstream of the old Don Pedro Dam when reservoir levels are low.	Districts	$666,670	$2,000	$41,360
6. Develop recreation opportunities at La Grange Reservoir. (California DFW 10(j) recommendation M7-3.1)	California DFW	$78,910[hh]	$12,340[hh]	$17,000
7. Implement the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) to minimize boating hazards in Don Pedro Reservoir.	Districts	$0[d]	$10,000[d]	$10,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
8. Modify the Woody Debris Management Plan (filed as appendix E-5 of the Don Pedro amended final license application) consistent with BLM Don Pedro revised 4(e) condition 4 and to include maintaining a valid burn plan for any woody material stored and burned on BLM-administered lands, and requiring licensees to make all reasonable efforts to prevent large woody debris from interfering with accessible takeout areas for whitewater boaters at Ward's Ferry.	BLM, staff	$5,000[d]	$10,000[d]	$10,300
9. Install an improved boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge.	Districts	$6,419,690	$26,750	$405,750
10. Improve recreational access at Ward's Ferry. (Forest Service 10(a) recommendation 1, California DFW 10(j) recommendation M7-3.2, Conservation Groups recommendation 8, All Outdoors Whitewater, OARS, ARTA, SierraMac Rafting, ECHO recommendation 2, Tuolumne County Board of Supervisors)	Forest Service, California DFW, Conservation Groups, All Outdoors Whitewater, OARS, ARTA, SierraMac Rafting, ECHO, Tuolumne County Board of Supervisors	$12,714,000[ii]	$100,000[ii]	$850,600

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
11. Improve recreation access at Ward's Ferry and address public safety and transportation issues. (Forest Service 10(a) recommendation 1, Tuolumne County Board of Supervisors)	Forest Service, Tuolumne County Board of Supervisors	$1,149,000[jj]	$1,000[jj]	$68,830
12. Develop a Ward's Ferry day-use facility engineered plan. (BLM Don Pedro revised 4(e) condition 13)	BLM	$11,714,000[kk]	$100,000[kk]	$791,560
13. Provide a new boat take-out/put-in facility at RM 25.5 at the location of the proposed fish counting/barrier weir.	Districts	$140,000	$0	$8,270
14. In all but critical water years, cease irrigation gallery withdrawals for one pre-scheduled weekend to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries. In wet, above normal, and normal water years, release 200 cfs for the three-day July 4th holiday, the three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July, or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.	Districts, Conservation Groups, staff	$0[ll]	-$3,360 (energy gain 54 MWh)[ll]	-$3,360

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
15. Provide three-day weekend boating flows on the weekend closest to July 4. (Park Service 10(a) recommendation 3)	Park Service, staff	$0[d]	$0[d]	$0
16. Ensure that all measures to remove water hyacinth that would render the river non-navigable are conducted well before the summer recreational flow season. (Park Service 10(a) recommendation 3)	Park Service	$0[d]	$0[d]	$0
Land Use and Aesthetics				
1. Annually notify BLM about the location and type of any road maintenance projects on BLM lands, and convene a meeting to confer on project details if requested by BLM.	Districts	$0[d]	$7,000[d]	$7,000
2. Develop a transportation system management plan. (BLM Don Pedro revised 4(e) condition 16)	BLM, staff	$5,000[d]	$45,000[d]	$45,300
3. Implement the Fire Prevention and Response Management Plan.	Districts	$5,000[d]	$2,000[d]	$2,300
4. Modify the Fire Prevention and Response Management Plan to include information on fire history, references, results of fire occurrence analysis, permits, and the use and storage of	BLM, staff	$5,000[d]	$2,000[d]	$2,300

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
explosives. (BLM Don Pedro revised 4(e) condition 17)				
5. Prepare a visual resources management plan (to include all lands within project boundary). (BLM Don Pedro revised 4(e) condition 18)	BLM, staff	$5,000[d]	$1,000[d]	$1,300
Cultural Resources				
1. Implement the HPMP filed on February 14, 2019 (BLM Don Pedro revised 4(e) condition 15) except for the dispute resolution process	Districts, BLM, staff	$410,150	$177,160	$201,380

[a] Costs were provided by the Districts in their amended final license application unless otherwise noted.

[b] Capital costs typically include equipment, construction, permitting, and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs that occur on a yearly basis.

[d] Cost estimated by staff.

[e] The cost of this measure is covered by the cost of the previous staff-recommended measure (Geology and Soils Resources measure 2).

[f] There would be no capital cost associated with this measure. The energy estimate is from the Districts' July 30, 2018, filing (Districts, 2018b).

[g] There would be no capital cost associated with this measure. The annual cost is from the Districts' December 11, 2019, filing, section 2.2, p. 10. The energy loss is based on table 1, attachment E from the same document.

[h] Annual cost includes $100,000 per year for consultation and monitoring costs (staff estimate).

[i] Costs included in Aquatic Resources measure 5.

[j] Staff estimate $10,000 in capital cost in year 1 for the plan and an annual cost of $250,000 in year 12.

[k] There would be no capital cost associated with this measure. The energy estimate is from the Districts' May 14, 2018, filing (Districts, 2018a).

[l] There would be no capital cost associated with this measure. The energy estimate is from the Districts' May 14, 2018, filing (Districts 2018a). In modeling the Water Board's condition, the Districts assumed that the Water Board would require the 40 percent of unimpaired Tuolumne River at Modesto (USGS no. 1129000) flow regime specified the substitute environmental document.

[m] Staff estimate $10,000 capital cost in year 1 and an annual cost of $34,990 per year in years 1-30 and $17,550 per year in years 5, 15, and 25.

[n] The cost of this measure is covered by the cost of the following staff-recommended measure (Aquatic Resources measure 30).

[o] The Water Board's recommendation does not provide much detail but appears to be consistent with the staff recommendation.

[p] Districts' May 14, 2018, filing, attachment P (Districts, 2018a).

[q] Staff added $50,000 in capital costs to the cost provided by the Districts in their May 14, 2018, filing, attachment P (Districts, 2018a).

[r] Staff estimated the capital cost to be $5,000 in year 1 and the annual cost to be $330,000 in years 2, 3, and 4, $5,130,000 in year 5, and $1,000,000 in years 6 and 7, and that cost has been split equally between the Don Pedro Project and the La Grange Project.

[s] Staff estimate includes $4,000,000 in years 1–15 and $1,600,000 in years 6–30. Annual cost includes $200,000 in years 3, 6, 9, 12, 15, 18, 21, 24, 27, and 30.

[t] Staff estimate includes $26,000,000 in years 3–13. Annual costs include $200,000 in years 3, 6, 9, 12, 15, 18, 21, 24, 27, and 30.

[u] Staff estimate includes a capital cost of $30,000 in year 1 and $750,000 per year in years 2-30.

[v] Cost provided by the Conservation Groups in their response to the REA notice (Conservation Groups, 2018).

[w] Staff estimate capital cost of $10,000 in year 1 and an annual cost $25,000 per year in years 2–11.

[x] Costs given in FWS's recommendation include capital costs of $9,500,000 in years 1, 6, 9, and 12, and an annual cost not to exceed $1,000,000 per year.

[y] There would be no capital cost associated with this measure. The energy estimate is from the Districts' May 14, 2018, filing, attachment D, tables 2, 3, and 4 (Districts, 2018a).

[z] There would be no capital cost associated with this measure. The energy estimate is from the Districts' May 14, 2018, filing, attachment F, tables 2 and 3 (Districts, 2018a).

[aa] Staff estimate annual cost $5,000 per year every five years starting in year 1.

[bb] Staff estimate capital cost of $20,000 in year 1 and every fifth year thereafter.

[cc] Staff estimate annual cost $25,000 in year 2 and every five years thereafter, and $200,000 per year in years 10, 20, and 30.

[dd] Staff estimate annual cost $17,000 in year 1 and $6,000 per year every five years thereafter.

[ee] Staff estimate capital cost of $15,000 for raptor perch deterrents and an annual cost of $15,000 every three years starting in year 1.

[ff] Staff estimate $110,000 in capital costs and annual costs of $50,000 per year plus $10,000 per year every three years for the additional measures recommended by staff.

[gg] Staff estimates the cost for each component as follows (numbers align with numbers in description): capital $5,000 to revise plan; (1) capital $7,000 in year 1, annual $1,000/year for sign operation and maintenance and $2,000/year for trail operation and maintenance; (2) included in cost to revise plan; (3) included in cost to revise plan; (4) included in cost to revise plan; (5) included in cost to revise plan; (6) annual $2,000/year in year 6, 12, 18, 24, 28; (7) included in cost to revise plan; (8) included in cost to revise plan; (9) included in cost to revise plan; (10) included in cost to revise plan; (11) annual $1,500/year; (12) capital $4,000 year 1 (annual cost assumed to be included in overall project annual operation and maintenance); (13) included in cost to revise plan.

[hh] Staff added a capital cost of $7,000 in year 3 for the boat launch in addition to the cost estimated by the Districts for development of the trail of $80,000 in year 3. Staff also added $5,000 per year starting in year 4 for maintenance of the launch to the $10,000 per year estimated by the Districts for maintenance of the trail.

[ii] Districts' comments on revised BLM conditions filed on September 20, 2018 (Districts, 2018i), plus $1,000,000 for a cell tower estimated by staff.

[jj] Staff estimate capital cost includes $1,110,000 in year 1, $2,000 for two one-time meetings, and $25,000 for an engineering study. Annual cost is 1,000 per year.

[kk] Districts' comments on revised BLM conditions filed on September 20, 2018 (Districts, 2018i).

[ll] Districts (2018a, attachment C, tables 4 and 5).

Table 4.3-2. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the La Grange Hydroelectric Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Geology and Soil Resources				
1. Develop a plan to minimize erosion or sedimentation conditions near river reaches and reservoirs caused by project operation and maintenance. (Water Board preliminary 401 condition 9)	Water Board	$10,000[d]	$1,000[d]	$1,590
2. Develop a soil erosion and sediment control plan for project-related construction activities affecting BLM lands that are within or adjacent to the project boundary. (BLM La Grange preliminary 4(e) condition 3)	Staff, BLM	$5,000[d]	$0[d]	$300
3. Develop a soil erosion and sediment control plan for all project-related construction activities authorized by the license.	Staff	$0[e]	$0[e]	$0
4. If the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Districts must consult with BLM to assess the potential for project-related effects, and whether additional information is required to proceed with the planned activity. (BLM La Grange preliminary 4(e) condition 26)	BLM	$0	$0[e]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Aquatic Resources				
1. Establish an ecological group and host annual meeting. (FWS La Grange 10(j) recommendation 11, California DFW 10(j) recommendation M3-1, Conservation Groups recommendation 3)	FWS, California DFW, Conservation Groups	$0[d]	$10,000[d]	$10,000
2. Provide a minimum flow of 5–10 cfs to the plunge pool downstream of the dam at all times.	Districts, staff	$0	$26,750	$26,750
3. Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice gate channel during powerhouse outages.	Districts, staff	$641,970	$10,700	$48,600
4. Implement the Districts' flow proposal for the Don Pedro Project that includes both interim and "with infiltration galleries" minimum flows, boating flows, pulse flows, and flushing flows. This measure reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project.	Districts	$0[f]	-$258,630 (4,158 MWh/yr energy gain [negative cost])[f]	-$258,630

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
5. Provide the Districts' proposed minimum interim flows until the infiltration galleries are operational, and thereafter maintain the minimum streamflows included in the draft Voluntary Agreement filed with the Water Board on March 1, 2019. Compared to flows that the Districts' propose to be in effect after the infiltration galleries are operational, the Voluntary Agreement flow regime increases the minimum flow required downstream of the infiltration galleries from 75 to 125 cfs in dry and critical water years, and reduces the minimum flow required at the La Grange gage from 350 to 300 cfs in wet, above normal, and below normal water years. This measure reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project, including boating flows, pulse flows, and flushing flows.	Staff	$0[g]	-$256,760 (3,933 MWh/yr energy gain [negative cost])[g]	-$256,760
6. Implement NMFS's recommended flow proposal for the Don Pedro Project that includes minimum flows, pulse flows, recession rates, down-ramping and up-ramping. This measure reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (NMFS recommendation 1)	NMFS	$0[h]	-$609,560 (9,800 MWh/yr energy gain [negative cost])[h]	-$609,560

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
7. Provide the minimum instream flows to be specified by the Water Board. This measure reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (Water Board conditions 1 and 2)	Water Board	$0[i]	-$392,110 (6,304 MWh/yr energy gain [negative cost])[i]	-$392,110
8. Implement the California DFW recommended flow proposal for the Don Pedro Project that includes minimum flows, storage management, geomorphology flows, recession rates, and ramping. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (California DFW (10(j) recommendation 1)	California DFW	$0[g]	-$584,240 (9,393 MWh/yr energy gain [negative cost])[g]	-$584,240
9. Implement The Bay Institute's recommended flow proposal for the Don Pedro Project that includes minimum flows and recession rate flows. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (The Bay Institute)	The Bay Institute	$0[f]	-$764,310 (12,288 MWh/yr energy gain [negative cost])[f]	-$764,310
10. Implement the Conservation Groups' recommended flow proposal for the Don Pedro Project that includes minimum flows, pulse flows, recession rates, and ramping. This line reflects the effect of the implementation of the	Conservation Groups	$0[h]	-$610,870 (9,821 MWh/yr energy gain [negative cost])[h]	-$610,870

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
Don Pedro Project measure on the La Grange Project. (Conservation Groups)				
11. Implement the ECHO recommended flow proposal for the Don Pedro Project including minimum flows. This line reflects the effect of the implementation of the Don Pedro Project measure on the La Grange Project. (ECHO)	ECHO	$0[f]	-$249,800 (4,016 MWh/yr energy gain [negative cost])[f]	-$249,800
12. Maintain a maximum down-ramping rate of 2 inches per hour as measured at the La Grange gage, with exceptions being allowed in the case of emergencies and required to meet flood control requirements.	Staff	$0[d]	$0[d]	$0
13. Develop a stream flow and reservoir level compliance plan. (FWS La Grange preliminary 10(j) condition 1A, Water Board preliminary 401 condition 3)	FWS, Water Board[j], staff	$5,000[d]	$1,000[d]	$1,300
14. Develop a hazardous substance plan. (BLM La Grange preliminary 4(e) condition 34)	BLM, staff	$0[e]	$0[e]	$0
15. Develop a spill prevention control and countermeasure management plan.	Staff	$10,000[d]	$0[d]	$590
16. Conduct DO monitoring from September 1 to November 30 each year for the first two years of the license at 15-minute intervals at three locations: at the project forebay, immediately	Districts	$32,100	$970	$2,870

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
below the powerhouse, and at the lower end of the tailrace channel. (Districts)				
17. Develop a plan to monitor water quality in project reservoirs and locations throughout affected river reaches. (Water Board preliminary 401 condition 6)	Water Board	$0[k]	$85,000[k]	$85,000
18. Develop a plan to determine and mitigate the La Grange Project's contribution to not meeting the applicable Basin Plan DO objectives in the La Grange Powerhouse tailrace.	Staff	$5,000[l]	$5,880[l]	$6,180
19. Develop a water temperature monitoring plan. (FWS La Grange 10(j) recommendation 6)	FWS	$0[d]	$360,000[d]	$360,000
20. Develop a fish rescue plan for the MID diversion. (FWS La Grange 10(j) recommendation 12)	FWS	$0[d]	$150,000[d]	$150,000
21. Provide for fish protection at project facilities. (California DFW 10(j) recommendation M8-1)	California DFW	$0[d]	$75,000[d]	$75,000
22. Develop an aquatic invasive species management plan. (Water Board preliminary 401 condition 8)	Water Board[j], staff	$5,000[d]	$20,000[d]	$20,300
Terrestrial Resources				
1. Provide for annual environmental training of employees and contractors, rather than bi-annual	BLM, FWS, California DFW	$0[d]	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
as proposed. (BLM La Grange preliminary 4(e) condition 2, FWS La Grange 10(j) recommendation 9.4, California DFW 10(j) recommendation M9-1.6, M9-4.1)				
2. Require Districts to host an annual consultation meeting with the resource agencies and interested stakeholders to discuss management of special-status species. (California DFW 10(j) recommendations M3-1 and M9-1.7)	California DFW	$0[d]	$2,000[d]	$2,000
3. Annually consult and review the current list of threatened, endangered, and special-status species that might occur on public land administered by BLM in the project area. (BLM La Grange preliminary 4(e) condition 6, FWS Don Pedro 10(j) recommendation 8(H), California DFW 10(j) Recommendation M9-1.9)	BLM, FWS, California DFW	$0[d]	$2,000[d]	$2,000
4. Implement the draft TRMP for the La Grange Project as provided by BLM and FWS, which includes provisions for: (1) noxious weed surveys the first year following license issuance, and every fifth year thereafter; (2) special-status plant surveys in the first year of license issuance and every tenth year thereafter; and (3) annual employee and staff environmental training and	Districts, BLM	$1,000[m]	$17,170[m]	$17,230

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
annual reporting and agency consultation. (BLM La Grange 4(e) condition 5)				
5. Develop a La Grange TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project activities, including: (1) noxious weeds; (2) special-status plants; (3) special-status bats; (4) western pond turtle; (5) burrowing owl; (6) valley elderberry longhorn beetle; and (7) special-status amphibians and reptiles, including the California red-legged frog and California tiger salamander, opposed to herbicides, where feasible, in areas of sensitive resources. (BLM La Grange 10(j) recommendation 5, FWS La Grange 10(j) recommendation 10)	BLM, FWS, staff	$7,500[d]	$0[d]	$440
6. Include provisions in a La Grange TRMP for: (1) a noxious weed survey of the La Grange Project during the first year of license issuance and with the same schedule as proposed by the Districts for the Don Pedro Project (every five years); (2) future noxious weed surveys that focus on areas that support occurrences of special-status or threatened and endangered plants; and (3) use of manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources.	Staff	$0[n]	$5,500[n]	$5,500

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
7. Include provisions in a La Grange TRMP for: (1) a survey for special-status plants following California DFW protocols at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes, and a summary report assessing the need for developing measures to protect special-status plants from project effects including road and trail maintenance; (2) pre-construction surveys for special-status or threatened or endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat; and (3) implementation of 50-foot buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities, including noxious weed treatment. (California DFW 10(j) recommendation M9-4)	California DFW, staff	$0[o]	$3,080[o]	$3,080
8. Develop a bat monitoring and management plan, in consultation with the resource agencies, within six months of license issuance. The plan would consist of: (1) protocols for monitoring WNS; and (2) public education actions about bats in the project area. (California DFW 10(j) recommendation M9-3.2)	California DFW	$0[p]	$1,990[p]	$1,990

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
9. Include provisions in a La Grange TRMP for a bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project area, resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use, including facilities without installed exclusion devices; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting. Include measures for reporting any sick or dead bat to California DFW and FWS as soon as possible and follow accepted decontamination protocols when entering areas with potential bat occurrence (as found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015). (FWS La Grange 10(j) recommendation 10, California DFW 10(j) recommendation M9-3.2)	FWS, California DFW, staff	$0[q]	$2,250[q]	$2,250
10. Include provisions in a La Grange TRMP to include protective buffers for use of pesticides and avoiding pesticide use within suitable habitat for the San Joaquin kit fox, western burrowing	FWS	$0[d]	$0[d]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
owl, California red-legged frog, and California tiger salamander; and within 500 feet of any documented bat maternity colony. (FWS La Grange 10(j) recommendation 10)				
11. Include provisions in a La Grange TRMP to include protective measures for western pond turtles, which includes recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species. (FWS La Grange 10(j) recommendation 10)	FWS, staff	$5,000[d]	$0[d]	$300
12. Include provisions in a La Grange TRMP for surveys for elderberry plants in accordance with FWS protocols within 165 feet of any ground-disturbing activity and following the FWS (1999b) conservation guidelines for valley elderberry longhorn beetle and the protocols from FWS (2017a) framework for assessing impacts to the species from project activities. (FWS La Grange 10(j) recommendation 8)	FWS, staff	$0[d]	$800[r]	$800
13. Include provisions in a La Grange TRMP for BMPs to avoid adverse effects on wildlife from any pesticide use on BLM lands within 500 feet of suitable aquatic habitat for special-status or	BLM	$0[d]	$0[d]	$0

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
threatened and endangered amphibians and reptiles. (BLM La Grange preliminary 4(e) condition 23)				
14. Include provisions in a La Grange TRMP for BMPs to minimize potential for pesticides to affect non-target species and avoidance and minimization measures where project-related ground disturbance would occur within 300 feet of wetlands and riparian areas. (FWS La Grange 10(j) recommendation 10)	FWS, staff	$0[d]	$0[d]	$0
15. Avoid pesticide use within 500 feet of suitable aquatic and upland habitat for California tiger salamander (FWS La Grange 10(j) recommendation 10).	FWS, staff	$0[d]	$0[d]	$0
16. Include provisions in a La Grange TRMP to include measures to protect California tiger salamander during project-related construction activities (FWS La Grange 10(j) recommendation 10).	FWS, staff	$10,000[d]	$0[d]	$590
17. Develop a bald eagle and special-status bird management plan, in consultation with California DFW and FWS. (BLM La Grange preliminary 4(e) condition 9, FWS La Grange 10(j) recommendation 9, California DFW 10(j) recommendation M9-1)	BLM, FWS, California DFW, staff	$10,000[d]	$5,000[d]	$5,590

Enhancement/Mitigation Measures	Entities	Capital ($2018)[a,b]	Annual Cost ($2018)[a,c]	Levelized Annual Cost ($2018)
18. Consult with the resource agencies regarding the planning and design of any ground-disturbing construction activities and conduct pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat. (BLM La Grange preliminary 4(e) condition 9)	BLM, staff	$0[d]	$2,000[d]	$2,000
19. Prepare a draft BA to address the potential impacts of the project on the San Joaquin kit fox, California red-legged frog, California tiger salamander, and Valley elderberry longhorn beetle. (FWS La Grange 10(j) recommendation 8)	FWS	$2,000[d]	$0[d]	$120
20. Include provisions in a La Grange TRMP for protecting California red-legged frog, California tiger salamander, and Western pond turtle, including: (1) protective buffers for pesticide application within suitable habitat; (2) decontamination protocols to prevent the spread of chytrid fungus; and (3) consultation with California DFW and FWS to identify protection measures for activities requiring ground disturbance within 300 feet of wetlands, riparian	FWS, California DFW	$0[d]	$2,000[d]	$2,000

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
areas, critical habitat or core areas for recovery. (FWS La Grange 10(j) recommendation 10)				
21. Include provisions in a La Grange TRMP for protecting California red-legged frog, California tiger salamander, and Western pond turtle, including (1) control of bullfrog and crayfish populations; (2) surveys for chytrid fungus; (3) protocols for slash removal and storage; (4) provisions to minimize impacts from roads, including potential wildlife-friendly road crossings; and (5) species and habitat monitoring every three years. (FWS La Grange 10(j) recommendation 10)	FWS	$60,000[s]	$17,250[s]	$20,790
22. Include provisions in a La Grange TRMP for protecting San Joaquin kit fox, including (1) discouraging raptor use of transmission lines as perches and (2) habitat surveys. (FWS La Grange 10(j) recommendation 10)	FWS	$5,000[t]	$5,250[t]	$5,550
Land Use and Aesthetics				
1. Develop a fire prevention and response management plan for the La Grange Project in consultation with BLM.	Staff	$5,000[d]	$2,000[d]	$2,300

Enhancement/Mitigation Measures	Entities	Capital (2018$)[a,b]	Annual Cost (2018$)[a,c]	Levelized Annual Cost (2018$)
Cultural Resources				
1. Implement the HPMP filed on July 10, 2018. (BLM La Grange preliminary 4(e) condition 7) except for dispute resolution process	Districts, BLM, staff	$0	$8,000	$8,000

[a] Costs were provided by the Districts in their October 11, 2017, final license application unless otherwise noted (Districts, 2017b).

[b] Capital costs typically include equipment, construction, permitting, and contingency costs.

[c] Annual costs typically include operation and maintenance costs and any other costs that occur on a yearly basis.

[d] Cost estimated by staff.

[e] The cost to implement the plan is covered by the cost of the following staff-recommended measure (Aquatics measure 15).

[f] There would be no capital cost for this measure. The energy effects were provided by the Districts July 30, 2018, filing (Districts, 2018b).

[g] There would be no capital cost for this measure. The energy gain was based on the Districts' December 11, 2019, filing, table 1, Attachment E, as well as the Districts July 30, 2018, filing (Districts, 2018b).

[h] There would be no capital cost for this measure. The energy effects were provided by the Districts' May 14, 2018, filing (2018a).

[i] There would be no capital cost for this measure. The energy effects were provided by the Districts' May 14, 2018, filing (Districts 2018a). In modeling the Water Board's condition, the Districts assumed that the Water Board would require the 40 percent of unimpaired Tuolumne River at Modesto (USGS no. 1129000) flow regime specified the substitute environmental document.

[j] The Water Board's recommendation does not provide much detail but appears to be consistent with the staff recommendation.

[k] Districts (2018a, Attachment P).

[l] The cost was estimated by staff to be $5,000 to revise the Districts' plan and $33,200 per year in years 1–3 to implement the plan.

[m] Staff estimates cost to be $100,000 in years 1, 11, 21 and $50,000 in years 6, 16, and 26.

[n] Staff estimates cost to be $25,000 in years 1, 6, 11, 16, 21, and 26.

[o] Staff estimates cost to be $25,000 in years 1, 11, 21.

[p] Staff estimates cost to be $25,000 in years 10, 20, and 30.

[q] Staff estimates cost to be $30,000 in year 1 and $2,500 in years 6, 11, 16, 21, and 26.

[r] Staff estimates cost to be $10,000 in years 10, 20, and 30.

[s] Staff estimates the cost to be $60,000 capital ($40,000 for chytrid study and $20,000 for road crossings) and annual costs of $15,000 per year in year 1 and every three years thereafter, $10,000 per year for bullfrog control, and $2,000 per year for slash removal.

[t] Staff estimates cost to be a capital cost of $5,000 in year 1 to revise the plan and $15,000 in years 1, 4, 7, 10, 13, 16, 19, 22, 25, 28.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreation opportunities; and the preservation of other aspects of environmental quality. Any license issued must be such as is in the Commission's judgment best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the Don Pedro Hydroelectric Project and licensing the La Grange Hydroelectric Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on these projects and our review of the environmental and economic effects of the proposed projects and their alternatives, we selected the staff alternative as the preferred alternative. We recommend this option because: (1) issuing a new hydropower license for the Don Pedro Project and an original license for the La Grange Project would allow the Districts to continue to operate the projects as economically beneficial and dependable sources of electrical energy for their customers; (2) the combined 172.7 MW of electric capacity of the projects comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the proposed and recommended measures would protect and enhance fish and wildlife resources, and improve recreation opportunities at the projects.

In the following section, we make recommendations as to which environmental measures proposed by the Districts or recommended by agencies and other entities should be included in any licenses issued for the projects.

5.1.1 Measures Proposed by the Districts

Based on our environmental analysis of the Districts' proposals discussed in section 3 and the costs discussed in section 4, we recommend including the following environmental measures proposed by the Districts in any licenses issued for the projects. We show our recommended modifications to the Districts' proposed measures in *italic* and parts of measures that we do not recommend in ~~strikeout~~.

5.1.1.1 Don Pedro Project

General

- Reduce the minimum reservoir level for Don Pedro Reservoir from elevation 600 feet to 550 feet to make an extra 150,000 acre-feet of water available to meet water needs during extended drought conditions.

Aquatic Resources

- ~~Implement~~ *Modify* the proposed Spill Prevention Control and Countermeasure Management Plan *to include: (1) a description of how hazardous substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of equipment and procedures to be used to ensure containment and cleanup of any spilled hazardous substances; (3) a provision to notify agencies within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.*

- Maintain the following minimum streamflows in the lower Tuolumne River downstream of La Grange Diversion Dam to benefit aquatic resources and accommodate recreational boating.

	Proposed Instream Flows with Infiltration Galleries (cfs)		**Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)**
Water Year/Period	**RM 51.7 (La Grange Gage)[a]**	**RM 25.5**	**RM 51.7 (La Grange Gage)**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[b]	150
July 1 through October 15	*300*~~350~~	150[c]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	*125*~~75~~	125
July 1 through October 15	300	*125*~~75~~[c]	175

Water Year/Period	Proposed Instream Flows with Infiltration Galleries (cfs)		Proposed Interim Flows [to be provided until both infiltration galleries are operational] (cfs)
	RM 51.7 (La Grange Gage)[a]	RM 25.5	RM 51.7 (La Grange Gage)
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	*125~~75~~*	125
July 1 through October 15	300	*125~~75~~*	150
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[a] USGS gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] Cease irrigation gallery withdrawals for one pre-scheduled weekend to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

[c] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July, or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

- ~~Provide an annual flushing flow of 1,000 cfs (not to exceed 5,950 acre-feet) on October 5, 6, and 7, with infiltration galleries shut off to improve spawning habitat by mobilizing gravel to flush out accumulated algae and fines prior to peak Chinook salmon spawning. These flows would only be provided in wet, above normal, and below normal water years~~.
- Provide spring outmigration pulse flows in the following amounts to facilitate the outmigration of juvenile fall-run Chinook salmon from the lower Tuolumne River*, and the floodplain rearing pulse flows provided in the draft Voluntary Agreement*. The timing of *spring and floodplain* pulse flows would be adaptively managed following the methods provided in appendix E-1, attachment F, of the Don Pedro amended final license application, *in consultation with NMFS, FWS, California DFW and CCSF*.

- Wet and above normal water years: 150,000 acre-feet
- Below normal water years: 100,000 acre-feet
- First dry water year: 75,000 acre-feet
- Dry water years following a dry or critical water year: [241] ~~45~~,000 acre-feet
- First critical water year: 35,000 acre-feet
- Critical water year following a dry or critical water year: 11,000 acre-feet

The floodplain rearing pulse flows would be timed to coincide with Chinook salmon rearing (prior to the spring migration pulse flows), and would provide a flow of 2,750 cfs for 20 days in wet and above normal water years, 18 days in below normal water years, 14 days in dry water years, and 9 days in critical water years. When one or two below normal water years follow a single dry or critical water year, the duration of floodplain pulse flows would be reduced from 18 days to 14 days. In successive dry or critical water years, no floodplain pulse flows would be provided, and floodplain pulse flows would not resume until an above normal or wet water year occurs. Finally, if three successive below normal water years occur following a wet or above normal water year, the Districts, CCSF and California DFW would confer to determine whether any water is available for a floodplain pulse flow.

- Develop a spill management plan to maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing subject to the constraints of flood control, project safety, and water demand*s to include a provision for annual consultation with resource agencies to determine the preferred magnitude, duration, and timing of controllable spill events*. The spill management plan would identify the preferred timing of releases, minimum durations, ~~and~~ preferred flow rates*, and specific criteria for evaluating whether project operations during the descending limb of the spring snowmelt runoff period reasonably mimic the natural hydrograph.*
- Conduct a coarse sediment management program in the lower Tuolumne River between RM *24.5* ~~39~~ and RM 52, *to include: (1) 75,000 tons of gravel to be placed at sites between RM 52 and RM 39, and 25,000 tons of gravel to be placed at sites between RM 39 and RM 24.5, for a total not to exceed 100,000 tons over the duration of the license; (2) filing of an implementation plan for*

[241] In their April 12, 2019, comments on the draft EIS, the Districts' modified their proposal to reduce the flow volume allocated for spring pulse flows from 75,000 acre-feet to 45,000 acre-feet in dry years following a dry or critical water year (Districts, 2019a).

the first group of gravel augmentation sites within one year, after review and input from California DFW, NMFS and FWS; (3) annual surveys of fall-run Chinook salmon and *O. mykiss*[242] spawning use of new gravel patches for five years following completion of gravel augmentation; (4) *filing of a summary report with the Commission in year 12 after license issuance presenting monitoring, mapping, and evaluation of projects conducted in the first 10 years, and based on the results of the monitoring, any recommendations for additional gravel augmentation at the initial sites or new augmentation sites; and (5) if any new gravel augmentation sites are recommended* to improve spawning conditions for fall-run Chinook salmon and *O. mykiss, require filing of a plan for Commission approval for the new gravel augmentation sites identified in the summary report.*

- Provide gravel mobilization flows of 6,000 to 7,000 cfs in the lower Tuolumne River downstream of La Grange Diversion Dam, during years when sufficient spill is projected to occur, to improve salmonid spawning habitat.
- ~~Implement a fall-run Chinook spawning superimposition reduction program that includes the annual installation of a temporary barrier weir downstream of the new La Grange Bridge after November 15 to encourage spawning on less used, but still suitable habitat~~.
- Conduct a five-year program of experimental gravel cleaning using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology, including monitoring interstitial fines before and after gravel cleaning, to improve the quality of salmonid spawning gravel in the lower Tuolumne River. Gravel cleaning would be conducted at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (RM 50.3) and Peaslee Creek (RM 45.5).
- ~~Construct a permanent fish counting/barrier weir with a Denil-type fishway and counting facility at RM 25.5 to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitat.~~
- ~~Implement a predator control and suppression plan that includes sponsoring fishing derbies, reward-based angling, public outreach programs in local communities to promote fishing for black bass and striped bass, and educational programs on the effects of predation on native salmonid populations, and removal and/or isolation of predatory fish via electrofishing,~~

[242] The term *O. mykiss* is used to represent both resident and anadromous life history forms of rainbow trout/steelhead, *Oncorhynchus mykiss*.

~~seining, fyke netting, and other collection methods upstream and downstream of the proposed weir.~~

- Develop a plan to implement the LTRHIP ~~and associated $38 million capital fund and annual funding accounts~~. The plan would address ~~establishment of the fund account, management of the funds in the account, administration of the Tuolumne Partnership Advisory Committee (TPAC), guidance for selection of recommended enhancement projects by the committee, and the Districts' obligations with respect to~~ the operation, maintenance, monitoring, and reporting associated with enhancement projects. *Incorporate a minimum of 6,535 cubic feet of large woody material into the design of the first group of habitat enhancement projects, anchored in a manner designed to provide the maximum sustained habitat benefit.*

- ~~Create the above-noted TPAC to provide recommendations on development and implementation of the spill management plan and the Lower Tuolumne River Habitat Improvement Program. The committee would consist of the Districts, FWS, and CCSF. Other parties, including National Marine Fisheries Service (NMFS) and California DFW would be encouraged to participate in the committee as full members.~~

- ~~Implement~~ *Modify* the proposed Aquatic Invasive Species Management Plan to include: *(1) educating recreational users on ways to reduce the spread of invasive species by providing signage and information pamphlets at designated public boat access sites and on websites that provide the public with information on project facilities; (2) continuing of the boater self-inspection permit program; (3) identifying project operation and maintenance activities that could result in the introduction, spread, or proliferation of aquatic invasive species, and measures that could be used to limit the spread or introduction of invasive species; and (4) recording and communicating incidental observations of aquatic invasive species to BLM, FWS, and California DFW.*

Terrestrial Resources

- Make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years, subject to other requirements and constraints including flood control, water supplies, spill management, project safety, and rapidly changing weather patterns.

- ~~Implement~~ *Modify* the proposed TRMP (filed as appendix E-6 of the Don Pedro amended final license application), *to include additional provisions for:*

  - *Conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c; California DFW, 2018e) prior to any project-*

related ground disturbance in areas with suitable habitat and implementing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.

- *Conducting noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; using manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources; and implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road.*
- *Conducting surveys for special-status plants following California DFW protocols (California DFW, 2018e) on project lands within the Red Hills ACEC every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, roads and trails that are predominately used for project-related purposes, and where project-related disturbance is reasonably expected to occur, and installing interpretive signs about the unique plant communities of the Red Hills ACEC requesting recreationists to stay on trails.*
- *Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, and BLM for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for protection measures.*
- *Conducting a bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance; and resurveying project facilities with potential for bat occurrence every 5 years to look for evidence of bat use; installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting.*
- *Reporting any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).*
- *Implementing avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.*
- *Describing specific project locations where the Districts' proposed rodent control activities could occur;*

- *Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols (FWS, 2011; FWS, 2003; and California DFW, 2008) to minimize potential for pesticides to affect non-target species prior to any rodent control or ground disturbance activities that could destroy potential burrows; implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox, burrowing owl, and California tiger salamander during other biological surveys for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for protection measures.*
- *Implementing BMPs to protect California tiger salamander from project-related activities, which include conducting project-related ground disturbance or vegetation management within 300 feet of suitable California tiger salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions) and conducting project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15.*
- *Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander.*
- *Decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and aquatic invasive species.*
- *Recording the locations of elderberry plants during pre-construction special-status plant surveys, and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle (FWS, 2017a).*

Recreation Resources

- ~~Implement~~ *Modify* the proposed RRMP *to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) operation and maintenance procedures for the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would*

warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) a provision to invite BLM and other interested parties to an annual coordination meeting to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) conceptual drawings and descriptions of project recreation facilities, that are consistent with the outcome of design review by BLM, that would be constructed, reconstructed, or rehabilitated on BLM-managed land; (6) consultation with BLM to design visitor use surveys, to ensure data are collected about topics relevant to visitor use of project facilities located on BLM-managed lands; (7) designation of the Fleming Meadows Visitor Center as a project recreational facility and measures for its operation and maintenance; (8) identification of the access designation (i.e., public versus non-public) of adjacent non-project lands on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (9) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (10) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide suitable shoreline access for visitors, provide safe egress from the river for hand-carrying rafts, and reduce erosion and vegetation damage caused by user-created trails; (11) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir; (12) consultation with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day) and making information on the planned boating releases and the minimum flow schedule available to the public; and (13) a schedule to construct the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of project recreation facilities, including restrooms, that are currently in poor condition or do not meet accessibility guidelines, which includes proposed accessibility upgrades. The schedule should allow adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities.

- ~~Construct a new boat launch facility to provide boating access upstream of Old Don Pedro Dam when reservoir levels are low.~~

- ~~Implement~~ *Modify* the proposed Woody Debris Management Plan *to include provisions requiring licensees to maintain a valid burn plan for any large woody ~~debris~~ stored and burned on BLM-administered lands, and description of the coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge. This measure will*

prevent large concentrations of wood from accumulating and becoming boating hazards and obstructing water surface and shoreline use.

- ~~Install a new boat take-out/put-in facility at RM 25.5 at the location of the proposed fish counting and barrier weir~~.
- ~~Install an improved boat take-out facility at RM 78 upstream of the Ward's Ferry Bridge~~.

Land Use and Aesthetics

- ~~Annually notify BLM about the location and type of any road maintenance projects on BLM lands, and convene a meeting to confer on project details if requested by BLM~~.
- ~~Implement the Fire Prevention and Response Management Plan (filed as appendix E-2 of the Don Pedro amended final license application) that includes procedures for fire prevention, reporting, and safe fire practices for project facilities.~~
- *Modify the proposed* Fire Prevention and Response Management Plan *to include information on fire history, references, results of fire occurrence analysis, permits, and use and storing of explosives, to ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.*

Cultural Resources

- Implement the HPMP ~~filed as appendix E-8 of the Don Pedro amended final license application~~ *filed on February 14, 2019. However, any disputes regarding cultural resources will be resolved in accordance with the dispute resolution stipulation of the Programmatic Agreement (PA; filed on September 30, 2019) and not the process specified in the HPMP*.

5.1.1.2 La Grange Project

Water Quality

- ~~Conduct DO monitoring in the La Grange Project forebay, immediately downstream from the powerhouse and at the lower end of the tailrace channel, from September 1 to November 30 each year for the first two years of a new operating license. If results indicate that a specific cause for low DO exists, the Districts would develop and file an action plan in year 3 of the license.~~

Aquatic Resources

- Provide a minimum flow of ~~5 to 10~~ *at least 5 cfs* from gates on the MID side of the Tuolumne River to the plunge pool downstream of La Grange Diversion

Dam at all times to ensure consistent and adequate flow to support aquatic resources.

- Install a fish exclusion barrier near the TID sluice gate channel entrance to prevent fish from entering the sluice channel during powerhouse outages.

Recreation Resources

- ~~Construct a recreational foot trail extending from the former Don Pedro Visitor Center parking lot to the La Grange headpond including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow, and reservoir elevation changes).~~ *This measure has been incorporated into the Don Pedro RRMP*.

Cultural Resources

- Implement the HPMP filed on July 10, 2018. *However, any disputes regarding cultural resource will be resolved in accordance with the dispute resolution stipulation of the PA (filed on September 30, 2019) and not the process specified in the HPMP*.

5.1.2 Additional Measures Recommended by Staff

In addition to the Districts' proposed measures listed above, as modified by staff, we recommend including the following new measures in any licenses issued for the Don Pedro Hydroelectric Project and for the La Grange Hydroelectric Project:

5.1.2.1 Don Pedro Project

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project-related construction involving ground-disturbing activities (e.g., construction of new recreational facilities or modification of existing recreational facilities) authorized by any new license to reduce the quantity of soil and sediment entering the river during construction.

Aquatic Resources

- Develop a plan to monitor water temperatures in Don Pedro Reservoir near the dam whenever the reservoir elevation is lower than 700 feet and at five sites in the lower Tuolumne River to inform the management of cool-water storage in Don Pedro Reservoir when the reservoir is drawn down and scheduling spring pulse flows with the goal of benefiting Chinook salmon and *O. mykiss* in the lower Tuolumne River.

- Develop a fall pulse flow release plan that would include provisions for: (1) the annual release of 5,950 acre-feet of water downstream of La Grange

Diversion Dam to promote the upstream migration of Chinook salmon during favorable instream thermal conditions; (2) annual consultation with the fisheries agencies to determine the timing and magnitude of flow releases; (3) annual monitoring of upstream passage at the temporary fish counting weir to assist the determination on the timing of the fall pulse flow releases to coincide with the upstream migration; (4) notification of the selected pulse flow release timing and magnitude to the Commission; and (5) a summary report after 10 years of monitoring to evaluate effectiveness and any recommended changes to the fall pulse flow release plan. These proposed flows would be provided in wet, above normal, and below normal water years only.

- Develop a drought management plan to include: (1) a definition of drought conditions based on available data specific to the project (e.g., current and projected storage in Don Pedro Reservoir, watershed snowpack and precipitation conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); (2) identification of license requirements (e.g., required flow-related measures) that may need a temporary variance to meet any critical shortfalls in water available for consumptive uses during drought conditions; and (3) a description of how available cool-water storage and instream temperatures would be incorporated into the proposed operational variances.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in the license.

Terrestrial Resources

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost on project lands within suitable habitat on all lands within 0.25 mile of the shoreline of Don Pedro Reservoir, conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004) to identify areas where limited vegetation management operating periods are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project

lands are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a transportation system management plan to ensure proper annual and long-term maintenance of project roads and trails over the license term.

- Develop a visual resources management plan that addresses the effects of the proposed Ward's Ferry whitewater take-out improvements and future maintenance on project lands, to ensure visual quality is not degraded by proposed facility construction and ongoing maintenance activities.

5.1.2.2 La Grange Project

Geology and Soils Resources

- Develop a soil erosion and sediment control plan for all project-related construction involving ground-disturbing activities (e.g., construction of the fish exclusion barrier near the TID sluice gate channel) authorized by any new license to reduce the quantity of soil and sediment entering the river during construction.

Water Quality

- Develop a plan to determine and effectively mitigate the La Grange Project's contribution to not meeting the Basin Plan DO objectives in the La Grange Powerhouse tailrace, which would include monitoring of DO and water temperature at 15-minute intervals supplemented with weekly observations of aquatic vegetation and algae, providing annual reports and a final report after three years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objectives, proposed mitigation to address these low DO concentrations, and plans for monitoring the effectiveness for any measure(s) implemented to address La Grange powerhouse tailrace DO that does not meet Basin Plan objectives.

- Develop a spill prevention control and countermeasure management plan to include: (1) a description of how oil, fuels, lubricant products, and other hazardous liquid substances would be transported, stored, handled, and disposed of in a safe manner; (2) a description of the equipment and procedures to be used to ensure containment and cleanup of any spilled hazardous substances; (3) a provision to notify the Water Board, California DFW, FWS, NMFS, and BLM within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of

the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.

Aquatic Resources

- Maintain a maximum downramping rate of 2 inches per hour as measured at the La Grange gage, with exceptions allowed in the case of emergencies and as needed to meet flood control requirements.
- Develop an operation compliance monitoring plan to document compliance with the flow and water level requirements included in the license.
- Develop an aquatic invasive species management plan.

Terrestrial Resources

- Develop a TRMP to provide guidance for the protection and management of terrestrial resources with the potential to be affected by project operations and maintenance activities within the La Grange Project, to include:
  - Conducting a noxious weed survey of the La Grange Project in the first year of license issuance and every five years, with noxious weed surveys focusing on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control of noxious weeds, where feasible (instead of herbicides), in areas with sensitive resources.
  - Implementing BMPs to minimize potential for pesticides to affect non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.
  - Conducting a survey for special-status plants on project lands following California DFW protocols (California DFW, 2018e) at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes, and a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance;
  - Conducting pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols (FWS, 2017a, b, and c; California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat; and implementing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities.

- Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, BLM, and the Commission for the purpose of tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.
- Conducting a bat survey of the La Grange Project focused at project facilities where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within the first two years of license issuance to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use, including facilities without installed exclusion devices; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.
- Reporting any sick or dead bat found at the La Grange Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).
- Recording the locations of elderberry plants during pre-construction special-status plant surveys, and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in FWS's *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a).
- Recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project boundary, and developing protection measures.
- Decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.
- Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, in accordance with FWS protocols (FWS, 2011) prior to any ground disturbance activities that could destroy potential burrows; implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox during other biological surveys for the purpose of

tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.

- Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander.
- Implementing the following BMPs to protect California tiger salamander during project-related construction within suitable habitat: (1) conduct project-related ground disturbance or vegetation management within 300 feet of suitable salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions); (2) conduct project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15; (3) provide training by a qualified biologist for all contractors, work crews, and on-site personnel; (4) inspect all construction pipe, culverts, or similar structures that are stored at the construction site for one or more overnight periods before the pipe is subsequently moved, buried, or capped. If during inspection the salamander is discovered inside a pipe, refrain from moving that section of pipe until the biological monitor follows FWS protocols to safely move the animal; (5) inspect all vehicles and equipment for the presence of salamanders prior to moving, and if a salamander is found, refrain from moving the vehicle until the biological monitor follows FWS relocation protocols; (6) at the end of each work day, cover all excavated, steep-walled holes or trenches with plywood or similar materials or provide one or more escape ramps constructed of earth fill or wooden planks, inspect such holes or trenches for trapped animals prior to filling, and if at any time a trapped salamander is located, cease all work in the immediate area until the biological monitor follows FWS protocols to safely move the animal; (7) refrain from using monofilament netting for erosion control measures in suitable habitat, and instead, use tightly woven (less than 0.25-inch diameter) biodegradable fiber netting or biodegradable coconut coir matting; and (8) provide a biological monitor meeting FWS standards to monitor work sites to ensure BMPs are implemented.

- Develop a bald eagle and special-status bird management plan that includes: (1) annual bald eagle nesting, wintering, and night roost surveys on suitable habitat within 0.25 mile of the project boundary, conducted in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004), to identify areas where limited vegetation

management operating periods[243] are needed; (2) a 0.25-mile protective buffer on project lands around nests and communal night roosts, unless consultation with BLM, FWS and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer on project lands around any new bald eagle nest or communal night roost; (4) installation of signs on project lands to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species at the project to determine if protective buffers on project lands are needed; and (6) consultation with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

Land Use and Aesthetics

- Develop a fire prevention and response management plan to ensure that project operation and maintenance activities are conducted in a manner that does not contribute to the ignition and spread of wildfires.

5.1.2.3 Rationale for Additional Staff-recommended Measures and Modifications

Below, we discuss our rationale for our additional staff-recommended measures and modifications to the proposed measures for both projects. Draft license articles are attached in appendix B for the Don Pedro Project and appendix C for the La Grange Project.

Erosion Control

BLM 4(e) condition 3 for both projects specifies that, within one year of license issuance, the Districts must develop a soil erosion and sediment control plan for erosion and/or restoration actions to be carried out by the Districts on or affecting BLM lands that are within or adjacent to the project boundaries. The condition requires that an effective plan should include: (1) a description of BMPs for erosion control that would be applied in specific circumstances; (2) provisions for inspecting erosion control measures while they are in place; (3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event); (4) techniques that would be used to stabilize sites once construction is completed; and (5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

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[243] Limited operating periods include seasonal restrictions on vegetation maintenance or other activities that result in loud noises that would have potential to disturb nesting or winter roosting bald eagles, as described in the National Bald Eagle Management Guidelines (FWS, 2007).

BLM Don Pedro revised 4(e) condition 35 and La Grange preliminary 4(e) condition 26 additionally specify that if the Districts propose ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA process, the Districts, in consultation with BLM, would determine the scope of work and potential for project-related effects, and whether additional information is required to proceed with the planned activity.

Water Board preliminary 401 condition 9 states that it would likely require the Districts to develop a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused by the projects' operations and maintenance.

Based on our analysis in sections 3.3.1.2, *Geologic and Soil Resources, Environmental Effects*, and 3.3.3.2, *Terrestrial Resources, Environmental Effects*, project operation may result in some shoreline erosion along Don Pedro Reservoir, but the effect of project operation on shoreline erosion is limited because much of the shoreline consists of rock outcrop and shallow soil. Erosion from waves on the reservoir is also limited because the irregular shaped reservoir keeps the fetch[244] relatively short and limits the heights of waves. However, the proposed construction (i.e., rehabilitate existing recreational facilities, construct new recreational facilities, and construct additional project features such as a fish exclusion barrier near the TID sluice gate channel and a whitewater take-out facility upstream of Ward's Bridge) would likely result in ground-disturbing activities that would cause short-term, localized erosion and associated water quality and habitat effects in Don Pedro Reservoir, La Grange Reservoir, and in the Tuolumne River downstream of the proposed project facilities. To minimize water quality degradation from erosion during construction, we recommend the Districts develop, in consultation with the Water Board, NMFS, California DFW, FWS, and BLM, soil erosion and sediment control plans for both projects. These plans would apply to all project construction activities authorized under any license and would include the five components specified by BLM. We estimate such a plan would have a levelized annual cost of $300 for the Don Pedro Project and $300 for the La Grange Project, and the benefits to the aquatic environment by protection of water quality would be worth the costs.

Drought Management

The Districts' relicensing proposal includes several flow-related measures that specify how flow releases into the lower Tuolumne River and storage requirements would be adjusted during years when water availability is limited. These measures include reducing minimum flows, spring pulse flows, and flows released to flush gravel and support boating during drier water years and lowering the minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet. The reduced

[244] The term *fetch* is the straight-line distance across a waterbody that is subject to the forces of wind. The *fetch* is a factor used in determining wave heights in a reservoir.

minimum operating elevation would make an additional 150,000 acre-feet of storage available to meet instream flow and water supply needs. NMFS 10(j) recommendation 1.6 recommends that in the event that three or more consecutive, dry and/or critically dry water years occur, operations of the Don Pedro and La Grange Projects be modified. Under this measure, by March 10 of the second or subsequent dry and/or critically dry water year, the Districts would notify the appropriate resource agencies (the Water Board, NMFS, California DFW, and FWS) of the Districts' concerns in meeting one or more license conditions. By May 1 of the same year, the Districts would consult with the appropriate agencies to discuss the Don Pedro and La Grange operational plans to manage the drought conditions.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Drought Management*, given the highly variable nature of hydrologic conditions and the increasing water demand in the region, an extreme or protracted drought could occur that would require a variance from conditions of any new license issued for the Don Pedro Project. However, it is unclear how NMFS's recommendation to trigger the development of a drought plan when three or more consecutive dry and/or critically dry water years occur would result in a better balance among competing needs than the flows developed by the Districts based on their modeling. Additionally, the Districts' proposed lowering of the minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet would assist in meeting both environmental and consumptive water needs during any prolonged drought. However, it is possible that the flow adjustments proposed by the Districts during drier water years may not be sufficient to address shortages that could occur if a drought longer or more severe than those that occurred during the period of record modeled by the Districts were to occur, and it would be beneficial to determine in advance what steps would be taken if such conditions were to occur. Therefore, we recommend the Districts develop a drought management plan, in consultation with the Water Board, California DFW, BLM, NMFS, and FWS, for the Don Pedro Project that includes a definition of drought conditions based on available data specific to the project (e.g., current and projected storage in Don Pedro Reservoir, watershed snowpack and precipitation conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations); which license requirements would be temporarily modified during drought conditions; and how the project would be operated when drought conditions occur (e.g., reduction in minimum flows). We estimate the plan would have a levelized annual cost of $300, and the benefits to water supply and the aquatic environment would be worth the cost.

Operation Compliance Monitoring

The Districts propose to use two flow monitoring locations to monitor compliance with the proposed license conditions: (1) the existing USGS gage 11289650 (Tuolumne River Downstream of La Grange Diversion Dam, or La Grange gage), and (2) a new USGS gage measuring the flow into the two new infiltration galleries pipelines. The

La Grange gage would be used to monitor compliance for flows between the La Grange gage (RM 51.7) and RM 25.5. For flows downstream of RM 25.5, the Districts would subtract flows measured at the proposed infiltration gallery pipeline gage from flows measured at the La Grange gage to yield the instream flow downstream of the infiltration galleries.

Water Board preliminary 401 condition 3 specifies that it would likely require the Districts to develop a streamflow and reservoir level compliance plan for both projects. At a minimum, this plan would include: (1) locations where the Districts would monitor streamflow and reservoir levels; (2) equipment to be used by the Districts to monitor streamflow and reservoir levels in compliance with requirements of the certification; (3) a description of how the equipment used by the Districts to monitor streamflow and reservoir levels in compliance with the requirements of the certification would be deployed, calibrated, operated, and maintained; (4) a description of how the data would be retrieved from the equipment to monitor compliance with the requirements of the certification related to streamflow and reservoir levels, including frequency of data downloads, quality assurance/quality control procedures, and data storage; and (5) a description of how streamflow and reservoir level data would be provided to the Water Board.

California DFW 10(j) recommendation M1-1 and FWS 10(j) recommendation 1 recommend that the Districts develop a plan to monitor compliance with flow and water level requirements specified in any licenses for both projects. The plans would describe: (1) locations where the Districts would monitor compliance with license requirements related to streamflow and reservoir levels; (2) equipment to be used by the Districts to monitor compliance with streamflow and reservoir level requirements; (3) how the equipment to monitor compliance would be deployed; (4) how data would be retrieved from the equipment, including frequency of data downloads, quality assurance/quality control procedures, and data storage; (5) how the Districts would make streamflow and reservoir level data available to the Commission, agencies, and the public; and (6) how the Districts would update the proposed plan as needed in the future. NMFS, California DFW, FWS, and the Conservation Groups also recommend that the Districts add an additional minimum instream streamflow compliance gage in the lower Tuolumne River. The new gage would be located in the river up to 1,500 feet downstream of the Districts' existing and proposed infiltration galleries (RM 25.9).

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Streamflow and Reservoir Level Compliance Monitoring*, the provisions recommended by the Water Board, California DFW, and FWS would provide an effective plan for monitoring compliance with license requirements and procedures for submitting streamflow and reservoir compliance data to the Commission. Therefore, we recommend that the Districts prepare an operation compliance monitoring plan for both projects that incorporates the provisions recommended by these agencies.

If the Commission finds that the infiltration galleries are appropriate to include in the projects as licensed facilities, we recommend that flow compliance downstream of the infiltration galleries be monitored using the method proposed by the Districts. We conclude that, in this case, the agencies' recommendation to add an additional streamflow compliance gage in the lower Tuolumne River downstream of the Districts' proposed infiltration galleries would be unrelated to compliance with the operational requirements of any license issued for the project. As noted in section 3.3.2.1, *Aquatic Resources, Affected Environment, Water Quantity*, California DWR lists 26 points of diversion along the lower Tuolumne River between La Grange Diversion Dam and the San Joaquin River, with an estimated total combined withdrawal capacity of 77 cfs (California DWR, 2013). Of the 26 points of diversion listed by California DWR, 12 diversions exist between the La Grange gage (RM 51.7) and the agency recommended gage location (i.e., near RM 25) and account for over half (43 cfs) of the estimated total combined withdrawal capacity of all diversions on the lower Tuolumne River (Water Board, 2018b). As such, we do not recommend the agency-recommended gage located near RM 25 because it would not monitor compliance with potential license requirements and would have no nexus to the projects. However, if the Commission does not include the infiltration galleries as part of the license, we recommend requiring the Districts install an instream flow gage downstream of the infiltration galleries for the project-related purpose of monitoring flow requirements included in any license issued for the Don Pedro Project. We estimate that the plans would each have a levelized annual cost of $1,300, and the benefits to environmental resources would be worth the costs.

Spill Prevention, Control, and Countermeasures

Constructing new project facilities, modifying existing project facilities, and routine and non-routine maintenance could affect water quality if pollutants (e.g., fuels, lubricants, herbicides, pesticides, and other hazardous materials) are discharged into project waterways. For the Don Pedro Project, the Districts propose to implement a Spill Prevention Control and Countermeasure Management Plan that identifies relevant federal, state, and local regulations.

BLM Don Pedro revised 4(e) condition 43 and La Grange preliminary 4(e) condition 34 specify that within one year of issuance of any new licenses or prior to undertaking activities on BLM lands, the Districts shall file with the Commission a BLM approved plan for oil and hazardous substances storage and spill prevention and cleanup. At a minimum, the plan must require the Districts to: (1) maintain, in the project area, a cache of spill cleanup equipment suitable to contain any spill from the project; (2) periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the project area; and (3) immediately inform BLM of the magnitude, nature, time, date, location, and action taken for any spill. BLM would require that the plan include a monitoring plan that details corrective measures that would be taken if spills occur. The plan would include a requirement for a weekly written report during any construction that

documents the results of the monitoring. BLM specifies that during planning and prior to any new construction or maintenance not addressed in an existing plan, the Districts would notify BLM, and BLM would determine whether a new plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup is needed. BLM would require any such plan to be filed with the Commission.

Water Board preliminary 401 condition 10 specifies it would likely require the Districts, in consultation with the relevant resource agencies, to develop a plan for storage, use, transportation, and disposal of hazardous materials in the project areas. The Water Board specifies that the plan should discuss the measures and equipment required to prevent or limit the extent of any hazardous material spill. This plan would also include protocols to prevent adverse effects on beneficial uses if hazardous materials are spilled.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Spill Prevention, Control, and Countermeasures*, the Districts' proposed measure only addresses managing spill risks of hazardous materials associated with the Don Pedro Recreation Agency warehouse and fuel island, and does not adequately address management of oil or other hazardous materials associated with the projects' hydroelectric facilities. Therefore, we recommend that the Districts develop separate plans for each project, in consultation with the Water Board, California DFW, BLM, FWS, and NMFS, to manage oil or other hazardous materials associated with the projects' hydroelectric facilities. The plans should focus on the management of oil, fuels, lubricant products, and other hazardous liquid substances and describe: (1) how they would be transported, stored, handled, and disposed of in a safe and environmentally acceptable manner; (2) the equipment and procedures used to ensure containment and cleanup of any spilled hazardous substances; (3) a provision to notify the Water Board, California DFW, BLM, FWS, and NMFS within 24 hours of discovering a hazardous substances spill; and (4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future. If the Districts are required to document all spill and cleanup activities as described above, BLM's specified weekly reporting during construction would not be warranted. However, we recognize that BLM's 4(e) conditions would be included as mandatory conditions in any licenses issued for the projects. We estimate that the plans would have a levelized annual cost of $590 for the Don Pedro Project and $590 for the La Grange Project, and the benefits to aquatic and terrestrial resources would be worth the costs.

Water Quality Management and Compliance

As discussed in section 3.3.2.1, *Aquatic Resources, Affected Environment, Water Quality*, existing water quality parameters (DO, dissolved copper, and mercury) have occasionally been recorded outside the recommended ranges that support designated

beneficial uses. Changing the operations of either project has the potential to affect water quality. To address the low DO concentrations that have been observed in the La Grange Powerhouse tailrace,[245] the Districts propose to monitor DO from September 1 to November 30 in the first two years of a new La Grange Project operating license and to submit an action plan if the cause for low DO levels is found. This proposal includes collecting DO information at 15-minute intervals at three locations: (1) the La Grange Project forebay, (2) immediately below the La Grange Powerhouse, and (3) at the lower end of the La Grange Powerhouse tailrace channel. At the end of each year's monitoring period, the Districts would compile, analyze, and submit the DO data as an annual report to the Commission. The Districts state that in the event the monitoring indicates a specific cause for low DO, they would develop and submit an action plan to the Commission in year 3 of license issuance.

Water Board preliminary 401 condition 6 specifies that it would likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to monitor water quality. This plan would address: (1) monitoring locations, (2) monitoring periods, (3) monitoring parameters, and (4) reporting, and would consider in-situ DO, recreation-related water quality, and bioaccumulation monitoring components.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quality Management and Compliance*, the Districts' proposed operation of the Don Pedro Project would not substantially change the hydraulics or water quality in Don Pedro or La Grange Reservoirs or in releases from the project powerhouses. While the Districts are not proposing major changes in project flow releases, reservoir elevations could increase or decrease by 10 feet or more and potentially affect reservoir water quality under other stakeholders' recommended flow releases for the Don Pedro Project. In addition, the Districts propose to lower the minimum water level in Don Pedro Reservoir from elevation 600 feet to 550 feet so that additional storage may be used during prolonged droughts. Low DO concentrations near the bottom of Don Pedro Reservoir would likely continue and may contribute to the release of mercury from sediments and subsequently continue to cause bioaccumulation in aquatic organisms, some of which may be consumed by humans. However, while concentrations of mercury and other metals may increase in newly constructed reservoirs, such increases are less likely to occur in the project reservoirs that have been in place for decades. It is unclear how additional bioaccumulation data collected under Water Board preliminary 401 condition 6 would be used to guide project operation.

Our analysis of Lower Tuolumne River DO concentrations found that the La Grange Powerhouse tailrace channel experiences DO concentrations as low as 4.0 mg/L and that in some years DO is frequently below 8.0 mg/L in late September to early

[245] Instantaneous measurements of DO concentration are as low as 4.0 mg/L in the La Grange Powerhouse tailrace channel.

November, even while DO in the mainstem channel remains at 9.0 mg/L or higher. The cause(s) of these low DO concentrations are not evident from the available information. The Districts' proposed monitoring would enable the Districts to: (1) gain a better understanding of the diel pattern of DO concentrations and conditions when DO concentrations are lower than the Basin Plan objectives of 8.0 mg/L which is applicable between October 15 and June 15 and 7.0 mg/L applicable for the remainder of the year, (2) determine whether low DO concentrations coincide at multiple sites, and (3) determine whether these low DO concentrations in the La Grange Powerhouse tailrace are consistently reaerated to at least the Basin Plan objective by the downstream end of the powerhouse tailrace channel. However, this monitoring would not determine whether low DO concentrations in the forebay are caused by low-DO inflows from upstream or local conditions or document links between DO concentrations with water temperature and aquatic vegetation build-up and/or die-off. Additionally, the Districts' proposal does not include provisions to include the resource agencies in reporting monitoring results or for developing an approach to mitigate any observed detrimental project effects. Therefore, we recommend the Districts develop a plan for the La Grange Project, in consultation with the Water Board, California DFW, FWS, and NMFS, to determine and effectively mitigate the La Grange Project's contribution to not meeting the Basin Plan DO objectives in the La Grange Powerhouse tailrace. The goals of the plan would be to determine the extent of project-caused DO concentrations that do not meet the Basin Plan DO objectives in the La Grange Powerhouse tailrace and effectively mitigate any such low DO concentrations. The plan should include: (1) monitoring of DO and water temperature at 15-minute intervals in the upper end of La Grange Reservoir, La Grange Powerhouse forebay, immediately downstream of the La Grange Powerhouse, and at the downstream end of the powerhouse tailrace channel for up to three years, beginning in one year of license issuance; (2) supplementing these data with weekly observations of aquatic vegetation and algae in the La Grange Powerhouse forebay and near the penstock intake; (3) identifying the monitoring season based on the timing of recent DO concentrations less than the water quality objective; (4) annual reporting on the monitoring program for distribution to the consulted agencies and the Commission; and (5) submitting, for Commission approval, a final report after three years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objective, proposed mitigation to address low DO concentrations, and plans for effectiveness monitoring for any measure(s) to be implemented to address low DO concentrations. We estimate that the plan would have a levelized annual cost of $6,180, and the benefits to water quality would be worth the cost.

Water Temperature Monitoring

The lower Tuolumne River is listed under CWA section 303(d) as impaired for temperature, based on life-stage-specific 7DADM values (EPA, 2011). Under current conditions, warm water temperatures provide sub-optimal habitat for Chinook salmon and *O. mykiss* downstream of La Grange Diversion Dam, particularly for spawning and egg incubation. Based on the Districts' modeling studies, the Don Pedro Project affects

water temperatures in the main channel of the Tuolumne River downstream of Don Pedro Dam (RM 54.8). Although the Districts evaluated potential effects of lower Tuolumne River temperature on *O. mykiss* (Verhille et al., 2016; Stillwater Sciences, 2017c) and Chinook salmon (Stillwater Sciences, 2017b), they do not propose water temperature targets or monitoring for either project because they believe there is no evidence that such compliance targets are warranted and there is little agreement on what those targets should be to be meaningful.

Water Board preliminary 401 condition 7 for both projects specifies that the Districts develop, in consultation with relevant resource agencies, a plan to monitor potential effects on water temperature from the projects by monitoring water temperature in Don Pedro Reservoir, La Grange Reservoir, and the lower Tuolumne River. FWS 10(j) recommendation 6 for both projects and California DFW 10(j) recommendation M2-1 for both projects recommend that the Districts develop a water temperature monitoring plan that includes the projects' reservoirs and project-affected reaches of the lower Tuolumne River. California DFW 10(j) recommendation M2-1 further recommends the plan include location-specific, temperature-performance measures that are consistent with CWA section 303(d) water temperature objectives for the lower Tuolumne River, a reporting schedule for annual reports that details temperature gage and flow data, and summary reports every five years. California DFW 10(j) recommendation M2-2 recommends life-stage location-specific temperature objectives to be determined over short duration (e.g., hourly or daily) and applied under specific conditions after five years of implementing the plan. California DFW 10(j) recommendation M2-3 recommends developing a schedule for each report that includes providing the reports to the TREG, including California DFW, the Water Board, FWS, and NMFS, and holding the Districts financially responsible for implementing the plan, but includes a provision allowing any organization of the TREG to be assigned the lead in implementing portions of the plan. NMFS 10(j) recommendation 1.4 recommends establishing temperature gages near RM 25 and the Robert's Ferry Bridge crossing at RM 39.5. These gages would record water temperatures at 1-hour or shorter intervals so that the data can be made publicly available in real time. NMFS 10(j) recommendation 1.5 recommends that the Districts prepare an annual report for submittal to the Commission and the resource agencies. The report would use empirical temperature data from the lower Tuolumne River to describe the timing, magnitude, and duration of temperature targets exceedance events and analyze operational changes needed to prevent similar exceedance events in the future. The Bay Institute recommends a flow regime for the projects that is partially based on water temperature objectives. Temperature objectives incorporated into its recommended flow regime are 7DADMs of 12.5ºC for spawning, 12.5ºC and 13.0ºC for incubation, 14.5ºC for holding, 15.5ºC for migration, 16.0ºC for rearing, and 16.0ºC for "suitable release."

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Temperature Monitoring*, we conclude that the Districts' modeling of each scenario to represent corresponding proposed and recommended project operations (see

tables 3.3.2-27 and 3.3.2-28) captures the issues that would influence temperature in the lower Tuolumne River for most conditions, including those occurring during the severe 1987–1992 multi-year drought. However, the Don Pedro Reservoir elevation, flow and water temperature conditions in sequential low-flow years vary depending on the timing and the magnitude of hydrologic and meteorologic conditions, and confidence in the reservoir model's simulated temperatures decreases as the reservoir's elevation drops closer to the crest of the old dam. This results in the temperature models providing limited value in directing operations in these situations, especially when Don Pedro Reservoir drawdown causes the powerplant to draft warm epilimnetic water from the reservoir. Water temperature monitoring during extended drought conditions would aid in forecasting the potential effects of temporarily modifying project operations when these conditions occur. In addition, temperature monitoring in the lower Tuolumne River during these periods would enable evaluation of the effectiveness of actual project operations and facilitate adapting project operations to maximize the benefits to aquatic resources, if needed.

In the draft EIS, we concluded that monitoring water temperatures in the lower Tuolumne River during non-drought periods would not be likely to lead to a decision to alter project operation. However, during the 10(j) meeting and in several follow-up filings, California DFW, NMFS, and FWS provided clarification and additional detail on how instream temperature monitoring results could be used to guide scheduling spring and fall pulse flows to provide maximum benefits to salmonids. Based on our enhanced understanding of agency recommendations, we conclude that lower Tuolumne River temperature monitoring results could be used to guide the timing of fall pulse flows year-to-year so that they are released after the river has cooled to levels favorable for Chinook salmon spawning and to estimate the growth and maturation of juvenile Chinook salmon so that the spring pulse flows can be timed to occur when the fish are ready to begin their downstream migration.

Therefore, we recommend the Districts develop a water temperature monitoring plan for the Don Pedro Project in consultation with FWS, NMFS, BLM, California DFW, and the Water Board. The plan should include a provision to monitor water temperatures in the Don Pedro Reservoir whenever its elevation is lower than 700 feet. It should also have a provision for year-round water temperature monitoring in the lower Tuolumne River at five locations. These five temperature monitoring stations should include real-time monitoring at the La Grange gage and a site near the temporary fish counting weir; the locations and monitoring protocols for the other three monitoring locations should be selected in consultation with the agencies. The Districts, in consultation with the agencies, should develop an approach for monitoring the change in Don Pedro Reservoir's available cool-water storage using either an array of temperature loggers set at different elevations or monthly vertical profiles. The plan should also include provisions to make water temperature data from below the La Grange gage and temporary fish counting weir available in real time and Don Pedro Reservoir temperature data available according to the schedule defined in the plan, file annual summary reports

of all temperature monitoring conducted in each year, and file a summary report after five years that includes any recommendations for adjusting future monitoring and measures recommended to enhance water temperature conditions to benefit Chinook salmon and *O. mykiss* in the lower Tuolumne River. However, we conclude that little value would be gained by monitoring temperatures between Don Pedro Dam and the La Grange Diversion Dam because the short retention time and geomorphic characteristics limit warming in this reach, and the La Grange Project has virtually no influence on lower Tuolumne River water temperatures. We estimate that the plan would have a levelized annual cost of $36,360 and conclude that the benefits to water quality and aquatic resources would be worth the cost.

Minimum Flows and Pulse Flows

Project operations affect instream flows in the lower Tuolumne River from Don Pedro Dam (RM 54.8) to its confluence with the San Joaquin River. These altered flow conditions affect the river's capacity to support spawning, rearing, and other life stages of resident and anadromous fish and may also affect additional physical processes, including sediment transport, floodplain connectivity, water temperature, and the maintenance of riparian vegetation. In regulated river reaches that contain productive aquatic habitat, resource managers often establish instream flow regimes to maintain ecological functions and processes that are important for sustaining aquatic and riparian biota. However, balancing the different resource values associated with a given flow regime often involves a complex series of tradeoffs that affect conditions for different fish species and life stages, consumptive water uses, recreation, and power generation.

In their amended final license applications, the Districts propose to implement base flows designed for specific salmonid life stages in the lower Tuolumne River, flushing flows to clean gravels of accumulated algae and fine-grained sediments prior to peak Chinook salmon spawning, pulse flows to facilitate the outmigration of juvenile fall-run Chinook salmon, and gravel mobilization flows to redistribute augmented gravel in years when sufficient spill is projected to occur. For all flow-related recommendations, the flow schedules are based on five water year types (wet, above normal, below normal, dry, and critical) determined using the 60-20-20 San Joaquin River Index. The Districts propose two sets of base flows: interim base flows that would be implemented until the proposed infiltration galleries are operational, and a second set of flows that would be implemented after the infiltration galleries are operational (refer to table 3.3.2-29). Once the infiltration galleries are operational, the proposed flows would provide additional flow in the 26-mile-long reach between La Grange Diversion Dam and the infiltration galleries from June 1 through October 15. The Districts propose to install a gage in the flow line from the infiltration galleries (infiltration gallery pipeline gage) that would be used in conjunction with the La Grange gage to monitor compliance with the flows downstream of the infiltration galleries. In addition, to facilitate the outmigration of juvenile fall-run Chinook salmon, the Districts propose to provide spring pulse flows that would use between 11,000 acre-feet and 150,000 acre-feet of water,

depending on the water year type. At the La Grange Project, the Districts propose to formalize the practice of releasing a minimum flow of 5 to 10 cfs to the plunge pool below the La Grange Diversion Dam.

NMFS, California DFW, the Conservation Groups, and The Bay Institute recommend considerably higher flows than the Districts, with variable patterns based on a percentage of unregulated flow or on a percentage of overall water demand (see section 3.3.2.2, *Aquatic Resources, Environmental Effects, Minimum Flows and Pulse Flows,* for a complete description of each stakeholder's recommended minimum flow regime).

In addition to its recommended minimum flows, NMFS recommends the Districts maintain a flow of no less than 300 cfs in all years as measured at a new flow gage to be installed downstream of the proposed infiltration galleries and implement fall pulse flows, as shown in table 3.3.2-31, of specific volumes of water to be released along with the minimum instream flows.

In its preliminary terms and conditions, the Water Board indicates (preliminary 401 conditions 1 and 2) that it would likely set a condition on minimum instream flows by water year type in light of the whole record including, but not limited to, the Commission's record (including recommendations by resource agencies), the final NEPA document, the final California Environmental Quality Act document, the updated Bay-Delta Plan, and the Basin Plan.

Along with its recommended minimum flows, California DFW recommends that the Districts release spring floodplain activation flows at rates and timing (after February 16 and before May 1) according to recommendations by the TREG and approved by California DFW, FWS, and NMFS based on a pulse flow of 10,000 acre-feet in critical and dry years and 15,000 acre-feet in below normal, above normal, and wet years. In addition, California DFW recommends that the Districts implement spring recession flows (tables 3.3.2-34 and 3.3.2-35) and adult Chinook salmon fall attraction pulse flows as recommended by the TREG and approved by California DFW, FWS, and NMFS, using a fall pulse flow volume of 10,000 acre-feet in critical years, 15,000 acre-feet in dry and below normal years, and 20,000 acre-feet in above normal and wet years. California DFW 10(j) recommendation M1-9 also recommends the Districts release geomorphic flood pulses that are greater than 6,000 cfs for at least 20 days, at least once every 10 years. If eight years elapse without a geomorphic flood pulse occurring from flood releases, the Districts should release a geomorphic flood pulse in the next wet or above normal water year.

In addition to its recommended minimum flows presented in table 3.3.2-36, the Conservation Groups recommend that the Districts release fall pulse flows to attract salmon with release specifics to be determined by an implementation committee. Flow volumes of pulse flows in addition to the October base flow volume would be 20,000 acre-feet in wet and above normal years, 15,000 acre-feet in below normal and dry years, 10,000 acre-feet in critical years, and 7,500 in super critically dry years. The Conservation Groups also recommend the Districts provide a riparian recession flow in

above normal, below normal, and dry water years. The recession rate would be 180 cfs per day when the recession initiation flow value is equal to or greater than 1,400 cfs and remain at that rate until the daily flow value decreases to 1,400 cfs or less. The recession rate for flows equal to or less than 1,400 cfs would be a 9 cm per day (about 3.5 inches per day) drop in stage for the first 6 days, and a 3 cm per day (about 1.2 inches per day) drop in stage thereafter, until base flow is reached. Furthermore, the Conservation Groups call for a suite of measures intended to keep the water bank from going negative and to help to preserve CCSF's total system storage at a level where CCSF could limit the frequency of water rationing. The Districts would designate the water year types based on the 50 percent exceedance estimated unimpaired inflow to La Grange given in the February, March, April, and May California DWR Bulletin 120 reports. In its recommendation 1, ECHO recommends the Districts provide 60 percent unimpaired flow from February to June to protect salmon.

During Project relicensing, the Districts conducted a series of instream flow studies, habitat analyses, and modeling exercises to help develop their proposed seasonal instream flow releases for the lower Tuolumne River. The Districts also used a project operations model, a reservoir water temperature model, Chinook salmon and *O. mykiss* production models, a socioeconomic model, and a floodplain hydraulic model to evaluate the effects of various project alternatives on fish productivity, water supply, recreation, socioeconomics, and project economics. The Districts also ran each flow and non-flow (coarse sediment management program, gravel mobilization flows, gravel cleaning, instream habitat improvement, and predator control) measure recommended by the stakeholders through this suite of models.

Based on our analysis, the unregulated hydrograph would be more closely mimicked by the resource agencies'/stakeholders' recommended streamflow regimes than the Districts' proposal or the draft Voluntary Agreement. Mimicking an unregulated hydrograph would provide for a seasonal variety of flows including pulses of high flows that facilitate flushing of gravels and the outmigration of smolts and lower stable flow periods that benefit Chinook salmon spawning and the rearing life stages of Chinook salmon and *O. mykiss*. However, the resource agencies' and other stakeholders' recommended flow regimes would also have a substantial negative effect on the water supplies of the Districts and CCSF, and any incremental ecological benefits of these flow regimes over those proposed by the Districts must be weighed against the effects on water supplies.

By increasing the volume of water in the lower Tuolumne River to meet aquatic species flow requirements, the amount of water available for agricultural operations would decrease, and in years where there is not sufficient water to meet full demand, these shortages would result in rationing that would reduce economic output from the agricultural sector. Our analysis of the Districts' modeling results (section 3.3.8.2, *Socioeconomics, Environmental Effects, Effects of Proposed and Recommended Flow Regimes on Agriculture*) indicates that the Districts' proposed flow regime and the flow regime included in the draft Voluntary Agreement would not result in rationing or reduce

agricultural production in wet, above normal, below normal, or dry water years. In critical water years, which occurred 26 percent of the time over the 42-year period of record analyzed, the losses of economic output from agricultural production are estimated to be $53 million under the Districts' proposed with-infiltration galleries flow regime and $195 million under the flow regime included in the draft Voluntary Agreement.

In critical water years, all of the agency and NGO-recommended flow regimes would have much larger impacts on agricultural production, with estimated reductions in economic output ranging from $603 million to $902 million for the flow regimes recommended by the state and federal agencies and from $570 million to $1.2 billion for the flow regimes recommended by the NGOs. Most of the agency and NGO-recommended flow regimes also produce substantial impacts to economic output from agricultural production in wet, above normal, below normal and dry water years, compared to no impact in these water year types for the Districts' and draft Voluntary Agreement flow regimes (see table 3.3.8-15).

Reduced surface water supplies can have widespread effects on the regional economy, including the displacement of households and businesses. In section 3.3.8.2, *Socioeconomics, Environmental Effects, Effects of Proposed and Recommended Flow Regimes on Municipal and Industrial Use,* we estimated the economic costs of proposed and recommended flow regimes to water users supplied by the SFPUC using a replacement cost of $2,500 per acre-foot, based on the cost of water produced by the Carlsbad Desalination Project. While we recognize that SFPUC could accomodate these deficits using a combination of approaches and water sources including increased conservation efforts, imported water supplies, local groundwater, other local surface water, banked groundwater, and recycled water, we consider $2,500 per acre-foot to be a reasonable value to use for evaluating the relative magnitude of potential costs to SFPUC water users.

We applied this value to the estimated supply deficits to estimate the cost to municipal and industrial users in the SFPUC service area of replacement water for each flow regime (tables 3.3.8-12 and 3.3.8-13). The results indicate that the Districts' proposed flow regime, as well as the flow regime included in the draft Voluntary Agreement, would not incur any cost to replace water in wet, above normal, below normal, or dry water years under the existing RWS water demand of 238 mgd or the projected future water demand[246] of 265 mgd. Of the flow regimes recommended by the agencies and NGOs, the estimated cost of replacement water would amount to more than $200 million in all water year types for The Bay Institute's and ECHO's recommendations, and in below normal and dry water years the cost of replacement water

[246] SFPUC estimated that water demand would increase to 265 mgd within 20 years.

would be more than $265 million for NMFS' recommended flow regime and more than $167 million for the Conservation Group's recommended flow regime.

In critical water years, the estimated cost to replace water under the Districts' proposed flow regime[247] would be $33.5 million under the existing water demand of 238 mgd and $75.4 million under the projected future water demand of 265 mgd. For the draft Voluntary Agreement flow regime, the cost of replacement water in critical water years would be $100.5 million under the existing 238 mgd water demand and $148 million under the projected future water demand of 265 mgd. The estimated cost of replacement water in critical water years for the flow regimes recommended by NMFS, the Water Board and California DFW would range between $265 million and $433 million, and the flow regimes recommended by the Conservation Groups, The Bay Institute, and ECHO would range between $198 million and $299 million. Under the estimated future water demand of 265 mgd, the estimated cost of replacement water in critical water years for the flow regimes recommended by NMFS, the Water Board and California DFW would range between $296 million and $408 million[248].

Aquatic habitat conditions may be slightly better under the resource agencies'/stakeholders' recommendations than those under the Districts' proposal, we concluded in the draft EIS that the Districts' proposal would provide nearly the same amount of habitat improvement with less of a reduction in the amount of water available to meet the Districts' irrigation demands and the CCSF's water supply needs. Within these constraints, in the draft EIS we recommended implementing the Districts' proposed interim minimum flows without the infiltration galleries as a requirement of any license issued for the Don Pedro Project. However, we also recognized the benefits associated with the resource agencies' recommended floodplain inundation flows and their associated and gradual (natural) recession rates because these recommendations would provide valuable off-channel rearing habitat for Chinook salmon and would further benefit juvenile salmonids through the reestablishment of riparian vegetation.

In response to the Districts' December 11, 2019, AIR response, CCSF[249] submitted comments in February 2020 to assert RWS water supply rationing in critical drought years would likely increase by 5 to 10 percent under the implementation of the draft Voluntary Agreement, ultimately resulting in 10 to 20 percent systemwide rationing. This increase in water supply rationing is about 5 percent greater than the

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[247] Costs were calculated based on the permanent flow regime that would go into effect after the infiltration galleries are operational.

[248] The cost of replacement water that would be required under the NGO-recommended flow regimes under the future water demand of 265 mgd could not be estimated because the amount of rationing that would occur under these flow regimes was not simulated by the SFPUC.

[249] Comments submitted on February 3, 2020.

increase in water supply rationing CCSF expects to occur under the Districts' proposal with infiltration galleries (i.e., 10 to 15 percent systemwide rationing in critical drought years). In their April 12, 2019, comments on the draft EIS, CCSF and BAWSCA[250] express support for the Districts' proposal with infiltration galleries, indicating the Districts' proposal achieves the needed balance between environmental and municipal water supply needs. CCSF further indicates systemwide rationing levels up to 20 percent could be absorbed by reductions in water deliveries to the residential sector, without resulting in substantial losses in economic output to the Bay Area.

Following review of the Districts' December 11, 2019, AIR response, the agencies' responses to our section 10(j) preliminary determination of inconsistencies, comments on the draft EIS comments on the Districts' 2019 AIR response, and our attempts to resolve the inconsistencies, we have modified several of the flow-related recommendations included in our draft EIS. As an alternative to the Districts' proposed minimum flows, we now recommend implementation of the Districts' proposed minimum flows as modified in the draft Voluntary Agreement (including both the interim flows and the proposed flow regime that would be implemented after the infiltration galleries are operational), as it is apparent that these flows, which are very similar to the Districts' proposal, would substantially improve physical habitat conditions for both *O. mykiss* and Chinook salmon in the Tuolumne River compared to the base case. As described in our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Minimum Flows and Pulse Flows*, the Districts' proposed flow regime, as modified in the Voluntary Agreement (as measured at La Grange Gage), would improve aquatic habitat conditions downstream of the La Grange Diversion Dam, and would continue to meet existing and projected water demands in the region. For example, the Districts' proposed base flows, as modified in the draft Voluntary Agreement would provide between 71 and 99 percent of maximum WUA for all life stages of *O. mykiss* (depending on life stage and water year type), from 66 to 73 of percent of maximum WUA for Chinook fry, and from 94 to 98 percent of maximum for Chinook juveniles. Chinook spawning WUA would range from 89 to 100 percent of maximum depending on water year type. In addition, the draft Voluntary Agreement's base flows would result in the coolest simulated June through September water temperatures upstream of RM 46 (see appendix G). Together, these increased flows and cooler water temperatures would be expected to further

[250] CCSF and BAWSCA's comments on the draft EIS are supported by additional water supply interests including the Purissima Hills Water District, North Coast County Water District, Westborough Water District, Alameda County Water District, Mid-Peninsula Water District, Coastside County Water District, Estero Municipal Improvement District, Guadalupe Valley Municipal Improvement District, City of San Bruno, City of Brisbane, City of East Palo Alto, Town of Hillsborough, City of Modesto, City of Santa Clara, City of Daly City, City of Hayward, City of Palo Alto, City of Menlo Park, City of Millbrae, City of Redwood, and City of Sunnyvale.

improve aquatic habitat in the lower Tuolumne River, particularly for salmonid rearing, spawning, and egg incubation, and would help achieve the ESA recovery goals for the lower Tuolumne River. Downstream from the proposed infiltration galleries, the higher flows from June 1 to October 15 in dry and critical water years would reduce the temperature but are not expected to maintain optimal water temperatures for salmonids in the summer; however, they would be less stressful to salmonids present in this reach.

Consistent with the draft EIS, we continue to recommend implementation of the Districts' proposed and the draft Voluntary Agreement's suggested spring pulse flows (and their associated recession rates) because they would likely increase the survival of outmigrating juvenile Chinook salmon in the Tuolumne River, particularly during periods of high turbidity associated with spill events. Spring pulse flows would also mobilize and redistribute sediments that provide potential germination sites for riparian tree species if these flows do not recede too quickly. We now recommend implementation of the Districts' proposed pulse flows AMP, because maximizing the benefit of these pulse flows requires a greater understanding of the emigration behavior of Tuolumne River fall-run Chinook salmon. In addition, the Districts' proposed and draft Voluntary Agreement's suggested floodplain rearing flows, and their associated durations based on water year type, are expected to benefit fry and juvenile *O. mykiss* and fall-run Chinook salmon because floodplain inundation is known to reduce predation rates, increase habitat availability, and increase food supply for native fish species. These pulse flows are also anticipated to increase cottonwood recruitment and recolonization in the lower river. Finally, our recommended spill management plan would allow key water-supply-entities (the Districts and CCSF) to work collaboratively with wildlife resource agencies to develop management strategies (including the magnitude and duration of the spill events) to make the best use of this excess water.

Regarding the need for fall pulse flows, in the draft EIS we noted that there was little evidence supporting the need for fall pulse flows to promote the upstream migration of adult Chinook salmon in the Tuolumne River. Consequently, we did not recommend including a requirement for fall pulse flows in any license issued for the Don Pedro Project. However, subsequent to filing the draft EIS (at the September 19, 2019, 10(j) meeting), the resource agencies provided compelling multi-year, site-specific evidence that fall pulse flows appear to facilitate/initiate the upstream migration of Chinook salmon in both the lower Tuolumne and Stanislaus Rivers. Examples of this relationship in the lower Tuolumne River during years with (2013 and 2016) and without (2014 and 2015) fall pulse flows are provided in figures 3.3.2-34 through 3.3.2-37. In their response to staff's October 28, 2019, summary of the 10(j) meeting, the Districts indicated that they disagree with staff's statement that all meeting attendees were in "general agreement" about the biological benefits of fall pulse flows. They also indicated that a rigorous review of the information presented at the 10(j) meeting is necessary before any conclusions can be reached about what these data demonstrate. While the additional information regarding effects of fall pulse flows on upstream migration would help to eliminate some of the uncertainty (benefits and risks) associated with the measure,

there is a relationship between fall pulse flows and weir counts (adult migration). Based on this new information, we are now recommending the implementation of fall pulse flows to attract adult Chinook salmon to spawning areas in the Tuolumne River. The magnitude, timing, and duration of the fall pulse flows would be developed as a component of our recommended spill management plan (see below). We also recommend ongoing weir monitoring and the preparation of a summary report within 10 years of license issuance to evaluate the effectiveness of this measure and to determine if any additional monitoring would be appropriate. Once these questions are answered, staff can then balance any benefits associated with these flows with their effects on water supply and determine if these pulse flows should continue or be discontinued in support of other beneficial uses.

California DFW's recommended geomorphic flood pulses (flows that are greater than 6,000 cfs for at least 20 days at least once every 10 years) are intended to support the geomorphic processes required to sustain a healthy river. Based on experimental flows conducted in McBain and Trush (2000), tracer rocks mobilized at a flow of 5,400 cfs with a duration of a few days. The Districts' proposal would provide a gravel mobilization flow of 6,500 cfs for two days (i.e., 25,800 acre-feet of water) when sufficient spill is projected to occur. Because the goal is to initiate gravel movement that would flush fine sediment, a flow duration greater than two days is not warranted. In addition, California DFW provides no site-specific justification for a flow duration of 20 days that would require a flow volume of 238,000 acre-feet (which is about 10 times the volume needed to accomplish the intended purpose), and that flow duration would reduce the number of years in which gravel mobilization flows could occur. Consequently, we do not recommend implementing California DFW's geomorphic flood pulses; instead, we recommend the Districts' proposed gravel mobilization flows.

In summary, we conclude that the flow regime included in the draft Voluntary Agreement provides nearly as much benefit to aquatic resources as the alternative flow regimes recommended by the agencies and NGOs but would have substantially lower effects on agricultural production and municipal and industrial water users. While the draft Voluntary Agreement flow regime is similar to that proposed by the Districts, it would extend the benefits of cooler water temperatures further downstream, and the floodplain rearing pulse flows would further improve habitat conditions for rearing Chinook salmon. While the costs to agricultural, municipal and industrial water users of the flow regime included in the draft Voluntary Agreement are substantial, the benefits to Chinook salmon and *O. mykiss*, which would act synergistically with habitat enhancements to be implemented through the LTRHIP, warrant these costs.

At the La Grange Project, continuing to provide a minimum flow of at least 5 cfs would support favorable water quality for resident and migratory fish species, maintain a stable flow regime for fish present in the plunge pool, and allow sufficient egress to the tailrace channel for any fish that enter the TID sluice gate channel. We estimate that this measure would have an annualized cost of $26,750 and conclude that the benefits of this measure would be worth the cost.

Spill Management Plan

On October 2, 2018, FWS filed revised 10(j) recommendation 2 for the Don Pedro Project, which calls for the development of a spill management plan that would maximize the benefit of spill events for fall-run Chinook salmon floodplain rearing. The spill management plan would offer a means for the agencies to provide recommendations on how to control the magnitude, timing, and duration of spill events into the lower Tuolumne River to improve fall-run Chinook salmon floodplain rearing habitat. In its supporting documentation, FWS suggests target months for management of available flow volumes, minimum spill flow releases to be managed, minimum durations, and schedules for spring and fall pulse flows. FWS also suggests that the Districts seek recommendations on implementation of the spill management plan from the TPAC that would be created pursuant to FWS's revised Don Pedro 10(j) recommendation 4. However, FWS also states that the Districts would retain ultimate control over actual spill amounts, timing, and management but should make all reasonable efforts to implement TPAC recommendations regarding spill management whenever possible.

In response to FWS's revised 10(j) recommendations, the Districts support the Commission's adoption of revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project.[251] The Districts also acknowledge in their letter filed October 17, 2018, that in many years, sufficient flexibility exists to manage releases from Don Pedro Reservoir that exceed the minimum flow requirements to benefit native fish species downstream of the reservoir and to meet the Districts' primary obligations and responsibilities related to water supply, instream flow requirements, flood control, and project safety. The Districts also state that during these times of flexibility, they would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph for the Tuolumne River.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Spill Management Plan*, we determine that a spill flow of at least 1,750 cfs, which FWS states should be the minimum spill release to maximize habitat benefits, could be maintained from March through April in wet and above normal water years and for an average of 13 days in below normal water years. However, in dry or critical water years, flows of 1,750 cfs would likely be unavailable. We conclude that excess water would be available, particularly in wet and above normal water years, and that water could be used to provide either additional pulse flows to benefit outmigrating smolts or potentially optimize juvenile floodplain rearing habitat. Such management could include moderating the recession rates to more closely mimic the natural hydrograph to support riparian vegetation development. We conclude that the spill management plan would allow key water-supply-entities (Districts and CCSF) to work collaboratively with fish and wildlife resource agencies (FWS and potentially NMFS and California DFW) to

[251] Revised 10(j) recommendation 3 is for the LTRHIP.

develop management strategies to make the best use of this excess water. Therefore, we recommend the Districts develop a spill management plan for the Don Pedro Project in consultation with FWS, NMFS, California DFW, and CCSF and file it for Commission approval. The plan should include annual consultation with FWS, NMFS, California DFW, and CCSF to determine the preferred magnitude, duration, and timing of releases to make the best use of excess water and include specific criteria for evaluating whether project operations during the descending limb of the spring snowmelt runoff period reasonably mimic the natural hydrograph. However, releases during spill periods would remain subject to the constraints of flood control, project safety, and water demands. We estimate that the plan would have a levelized annual cost of $9,650, and the benefits to aquatic resources would be worth the cost.

Ramping Rates and Fish Stranding

Rapid changes in streamflow associated with hydroelectric project operation have the potential to adversely affect aquatic resources by stranding fish in shallow, low-gradient gravel bar areas and off-channel habitat; temporary loss of fish habitat or loss of habitat access; and dewatering of amphibians, aquatic insects, and plant life (Hunter, 1992). In addition to scheduled changes in flow releases, unit outages at the La Grange Powerhouse can result in a disruption of otherwise continuous flows downstream of the powerhouse, and the resulting flow releases over the dam sluice gates can attract migratory fishes into the sluice gate channel, where they are vulnerable to stranding when flow resumes through the La Grange Powerhouse.

The Districts propose to install a fish exclusion barrier at the sluice gate channel entrance to allow the sluice gate to divert flows during an outage and prevent fish from entering the sluice gate channel where dewatering or stranding could occur once hydropower generation is restored. The barrier would be designed to function during flows of up to 7,000 cfs.

As noted above, California DFW 10(j) recommendation M1-6 recommends that the Districts follow daily spring recession rates from May 31 through July 1 that range between about 3,570 and 250 cfs (see tables 3.3.2-34 and 3.3.2-35 for the Tuolumne River at the La Grange gage and downstream of the infiltration galleries, respectively). California DFW 10(j) recommendation M1-8 further recommends that for all controllable flow rate changes above 200 cfs that are not already managed by their recommended recession rates, flow increases should be less than or equal to double the amount of release during any 1-hour period and decreases in flow should be no more than 2 inches per hour and less than or equal to 500 cfs in any single 24-hour period.

NMFS 10(j) recommendation 1.7 recommends that incremental upramping at both projects should occur evenly over a 24-hour period with a maximum of 500 cfs per 24-hour period in all water years. Compliance would be measured at La Grange gage and at a new gage located near RM 25. When flows at the La Grange gage are less than 4,000 cfs between April 1 and July 31 in wet, above normal, and below normal water

years, NMFS recommends the Districts avoid reducing flows by more than 7 percent of the previous 24-hour average flow, unless required because of flood control operations or emergencies. When flows at the La Grange gage are less than 2,000 cfs between April 1 and July 31 in dry water years, NMFS recommends the Districts avoid reducing flows by more than 10 percent of the previous 24-hour average flow, unless required because of flood control operations or emergencies. When the above two down-ramping scenarios are not in effect, downramping should occur evenly over a 24-hour period, and the Districts should not reduce flows by more than 500 cfs in any single 24-hour period.

Numerous studies in California have shown that ramping rates in the 1 to 2 inches per hour range minimize any adverse effects on aquatic biota. For example, in 2004, PacifiCorp completed a literature-based assessment of the potential effects associated with ramping regimes in river reaches affected by the Klamath Hydroelectric Project. The study found that ramping rates ranging from 0.1 to 0.6 foot per hour resulted in minimal stranding and were well within the natural range of those found in unregulated river systems (PacifiCorp, 2004), and recommendations described in Hunter (1992) also suggest that reductions in river stage of no more than 1 to 2 inches per hour are generally protective of juvenile anadromous salmonids. Based on our analysis in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Ramping Rates and Fish Stranding* and *Reservoir Fish Stranding*, we determined that the proposed flow regime for the Don Pedro Project is compatible with maintaining an hourly stage change downstream of La Grange of 1-inch per hour, or less, from 97 to 100 percent of the time. However, more rapid changes in stage could occur because of powerhouse operations, changes in spill rates, or if the rate at which flows are diverted into the TID or MID canals at the La Grange Project were to change rapidly. Therefore, for flow releases downstream of the La Grange Project, we recommend the Districts implement a year-round downramping rate not to exceed 2 inches per hour to protect juvenile salmonids in the lower Tuolumne River with exceptions being allowed in the case of emergencies and as needed to meet flood control requirements. Additionally, we recommend that to the extent possible, the Districts conduct downramping at night, when Chinook salmon are less vulnerable to stranding. We estimate that maintaining these ramping rates would have a negligible cost to the project and would benefit fishery resources in the lower Tuolumne River.

Floodplain Habitat Restoration

In the draft EIS, we analyzed the California DFW, Tuolumne River Conservancy, and Conservation Groups recommendations for floodplain habitat restoration, and the Districts' reply comments in opposition to a specific plan for this restoration. We used the results of the Districts' hydraulic model (TUFLOW) for the lower Tuolumne River that simulates the interaction between flow within the main channel and the floodplain downstream of the La Grange Diversion Dam to the confluence with the San Joaquin River and applied the model results to estimate floodplain juvenile salmonid rearing habitat (HDR and Stillwater Sciences, 2017). Based on this analysis, we concluded that

flows above bankfull discharge are associated with increases in habitat area for fry and juvenile life stages of lower Tuolumne River salmonids. Floodplain inundation along the lower Tuolumne River is initiated at a flow of approximately 1,100 cfs. Based on flows in the 1971–2012 period of record, flows at the La Grange gage greater than 1,500 cfs would occur from February through July in 28 years (or more than 60 percent of years) under the Districts' proposed flow regime. Flows exceeding 2,500 cfs would occur in 45 percent of years in that period. Extended periods of springtime floodplain inundation (e.g., 14 to 21 days) regularly occur at a 2- to 4-year recurrence interval in the lower Tuolumne River under the base case (water years 1971–2012) hydrology. In addition, in years when the projects spill water, the Districts state that they would make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions and benefit salmonid floodplain rearing, consistent with FWS revised 10(j) recommendation 2 (the spill management plan). Therefore, we did not recommend a floodplain rearing habitat restoration plan.

We also analyzed the FWS revised Don Pedro 10(j) recommendation 3, which was filed on October 2, 2018, and calls for the development of an LTRHIP that would provide funding for planning, designing, and constructing specific in-channel, riparian, and floodplain improvements in the lower Tuolumne River that would benefit native salmonid species, with the first priority being the uppermost 25 miles of the lower Tuolumne River. The LTRHIP would be developed by the Districts in coordination with FWS, NMFS, California DFW, and CCSF, and filed with the Commission for approval. The LTRHIP would have a total capital fund of $38 million to be funded with four equal payments of $9.5 million beginning within six months of the Commission's approval of the LTRHIP implementation plan and being fully funded by the 12th anniversary of license issuance. This recommendation would replace FWS's original Don Pedro 10(j) recommendation 3 (Restore and Enhance Juvenile Salmonid Rearing Habitat in the Lower Tuolumne River) and 10(j) recommendation 4 (Coarse Sediment and Gravel Replacement and Restoration Plan). FWS also states that establishment of the LTRHIP would be in lieu of the Districts' proposed hatchery, boulder placement, and hyacinth funding enhancement measures.

On October 17, 2018, the Districts filed a response to the FWS's October 2, 2018, filing. The Districts support the withdrawal of 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects and the Commission's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS's revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal; the Districts' proposed restoration hatchery, boulder placement, and donations to California Boating and Waterways to aid in hyacinth control are considered withdrawn from the proposal.

The purpose of the LTRHIP is the development of a long-term habitat restoration strategy to be implemented via an associated capital fund ($38 million) and annual funding (up to $1 million per year for operation and maintenance, monitoring, and reporting) for actions that protect and enhance salmonid populations and aquatic habitat

in the lower Tuolumne River. The associated fund would support non-flow resource measures that enhance habitat for native salmonid species. The Districts would be responsible for disbursing monies from the LTRHIP account, as recommended by the TPAC, and would be responsible for executing and implementing contracts for design, permitting, construction, monitoring, and reporting related to the improvement projects. Types of enhancement projects may include spawning habitat improvements, floodplain habitat improvements, riparian restoration, improved connectivity between the river channel and adjacent floodplains, slough development, improvements to in-channel structural complexity, and LWM installation and replacement. The TPAC would prioritize and recommend habitat improvement projects, with the primary beneficiaries of the projects being native salmonid species. The project selection process would follow the SHIRA or another technically rigorous approach approved by the TPAC. SHIRA focuses on traditional approaches for improving salmonid spawning and rearing habitat to decrease differences between existing riverbed elevations and adjacent floodplain habitats. Typically, initial work using SHIRA is focused on instream additions of gravel and contouring of existing gravels. Gravel cleaning, as proposed by the Districts, could be a complementary component of efforts to contour and improve existing gravel. FWS lists areas adjacent to the lower Tuolumne River that may be suitable for restoration efforts, based on GIS databases, totaling approximately 27 miles of shoreline on the lower Tuolumne River that are publicly owned, are designated as open space, and/or have existing conservation easements.

In the draft EIS, we concluded that overall, the recommended LTRHIP overseen by the TPAC appears to be a program that could improve salmonid habitat in the lower Tuolumne River, mitigating project effects on spawning and rearing habitat, and could benefit anadromous fish populations in the lower river. However, we found that although FWS has identified enhancement projects that could be implemented using the $38 million capital fund and lists potential enhancement sites in the lower 52.5 miles of the river, few specifics are provided as to how the $38 million would be spent, and whether this would mitigate project effects or serve as project-related enhancement. As noted above, we also concluded that additional measures for floodplain habitat restoration are not needed because existing project operations include periods of high flows on a regular basis (two- to four-year recurrence interval in the 1971 to 2012 period of record) that would sufficiently inundate the floodplain and provide substantial habitat for Chinook salmon and *O. mykiss* fry and juveniles, the two life stages that would benefit the most from additional floodplain habitat.

However, in some lower-flow years when the Don Pedro Reservoir is storing the spring runoff, that storage operation would reduce downstream flows and the extent of floodplain inundation, adversely affecting salmonid rearing habitat. In the draft EIS, to estimate the effect of Don Pedro Reservoir storage during spring runoff under proposed

operations,[252] using the output from the Districts' operations model, we determined the amount of storage (in acre-feet) retained in March and April[253] and the average amount of inundation area that is reduced because of reservoir storage. We ran this analysis for all five water year types for the period of record and found that the greatest effect of reservoir storage occurs in March, when reservoir storage may result in the reduction from 22 acres to 148 acres of floodplain inundation, depending on water year type, with an overall reduction of 44 acres for all water year types for the total lower river. The reduction of inundated area in the more upstream gravel-bedded reach is about half of the total river reduction. We also concluded that the overall effect of reservoir storage on potential floodplain rearing habitat in the lower river is not substantial. The overall reduction of 44 acres would represent about 49 percent of the total inundation at 1,000 cfs and about 2 percent of the total inundation at 9,000 cfs.

In lieu of making changes to reservoir storage to mitigate this project effect, which could have substantial adverse effects on downstream water supply, the Districts could mitigate the ongoing adverse effects of reduced floodplain inundation by implementing floodplain enhancement measures. In order to establish whether the Districts' proposed off-site mitigation would be commensurate with the project operational effect on floodplain habitat, we estimated in the draft EIS (using the FWS average cost of $146,836 per acre for floodplain reconnection/restoration projects) that the LTRHIP $38 million capital fund would greatly exceed the cost for restoring our overall estimate of 44 acres of floodplain habitat reduced due to reservoir storage. The draft EIS also noted that the details of the LTRHIP were unclear because they failed to describe: (1) precisely what habitat restoration projects would be funded; (2) where those projects would be located in the lower river; (3) how the Districts would obtain the rights needed to access a property for restoration and maintenance activities for each proposed improvement site; (4) how compliance with the ESA and NHPA would be obtained at each site; and (5) the details on the project design and scope of operation and maintenance activities that would occur at each habitat improvement site to allow the Commission to determine whether the site should be included in the project boundary. Because of these uncertainties, the high cost of the program (levelized annual cost of $2,707,820), and the limited effects of project reservoir storage on floodplain inundation, we did not recommend the LTRHIP in the draft EIS.

However, since issuance of the draft EIS, additional detailed information on potential projects that could be implemented under the LTRHIP has been filed with the Commission. This includes four projects that were described in an August 15, 2019,

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[252] Note that this only estimates the effect of reservoir storage and not any other consumptive uses.

[253] March and April are important months for fall-run Chinook rearing and are the months when floodplain inundation typically occurs.

filing by the Districts; additional comments filed by state and federal agencies and other parties supporting the Districts' proposal; and discussions among these same parties at the September 19, 2019, section 10(j) meeting held in Sacramento, California. These filings and discussions have provided further clarification of the proposed LTRHIP.

Further, on December 11, 2019, the Districts filed a response to staff's September 17, 2019, AIR, which requested that the Districts complete additional modeling simulations to allow Commission staff to adequately address several alternatives included in the draft EIS, including the effects of implementing the LTRHIP on Chinook salmon and *O. mykiss* productivity, and on June 17, 2020, filed results of re-running scenarios through these models after correcting an error that was discovered in them. The Districts' modeling showed that the LTRHIP would increase Chinook salmon smolt productivity by 9 to 19 percent and *O. mykiss* young-of-year productivity by 3 percent over the draft Voluntary Agreement flows alone.[254] This modeling indicated that the LTRHIP would have a beneficial effect on salmon and *O. mykiss* populations in the lower Tuolumne River, and we believe that the benefits would be even greater if ELJs were incorporated into the LTRHIP projects to further increase habitat diversity, as we discuss in the following subsection, *Large Woody Material Augmentation*. Therefore, because of these new modeling results and the additional information provided by the Districts on potential projects that could be implemented under the LTRHIP, staff is now recommending that the LTRHIP be made a condition of any licenses issued.

As we discussed above, potential habitat restoration under the LTRHIP could exceed our estimated average of 44 acres of floodplain habitat reduced due to reservoir storage. Thus, any additional floodplain habitat restored under the LTRHIP would be considered habitat enhancement that would increase fry to smolt survival and go hand in hand with the recommended flow measures for the project. The LTRHIP would also include terrestrial habitat improvements that could benefit terrestrial species, such as the 76.8 acres of riparian tree plantings included as part of the Bobcat Flat Phase III Project

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[254] Flows would increase below the infiltration galleries in dry and critical years from 75 to 125 cfs from July 1 to October 15, but would decrease slightly at the La Grange gage from 350 to 300 cfs in wet, above normal, and below normal water years. Draft Voluntary Agreement flows would also include floodplain rearing pulse flows, which would include a spring floodplain pulse flow rate of 2,750 cfs for 9 to 20 days, depending on water year type, to provide additional floodplain inundation to benefit aquatic habitat and improve other floodplain functions. We conclude that implementation of the suggested floodplain rearing pulse flows would benefit fry and juvenile *O. mykiss* and fall-run Chinook salmon because floodplain inundation would likely reduce predation rates, increase habitat availability, and increase food supply (see the subsection entitled *Minimum Flows and Pulse Flows* in section 3.3.2.2 of this final EIS).

described in the Districts' August 15, 2019, filing. The Districts' plan to implement the initial four sites during the first five years of the license, monitor, and then file a plan in year 6 for the next set of three to five projects is reasonable and should be made a condition of any licenses. We previously estimated a levelized annual cost of $2,707,820 for the LTRHIP. Although this would be one of the higher cost measures under any new licenses, this long-term measure would provide habitat enhancement for both aquatic and terrestrial resources and would be worth the cost. However, we do not recommend that the $38 million capital fund and $1 million annual funding accounts be made part of any license issued, because the Commission is concerned with protecting resources with specific enforceable provisions towards that end, rather than requiring a licensee to provide a general funding source to be used at least in part, by entities over which the Commission has no authority, and to fund unspecified measures and actions to which the Commission may or may not have control through a license. Instead, we recommend that the Districts identify and implement specific measures under the LTRHIP in consultation with federal, state, and local agencies and approved by the Commission. As license conditions, implementation of these measures would be the responsibility of the Districts and would be under the jurisdiction of the Commission.

Large Woody Material Augmentation

LWM provides habitat structure in rivers and streams and can influence sediment storage and channel morphology through its effect on flow, water velocity, and sediment transport. Reducing the amount of LWM can reduce the complexity of aquatic habitat and the carrying capacity for aquatic biota. The Districts propose to implement their draft Woody Debris Management Plan, which calls for continuing the current practice of collecting woody debris on Don Pedro Reservoir in boom rafts that are anchored along the reservoir's edge, burning this material during fall and winter when reservoir levels are low, and informing BLM of its prior year actions in an annual memorandum.

NMFS 10(j) recommendation 3 recommends LWM enhancement and management for both projects, including provisions for: (1) counting and acquiring LWM from the projects' reservoirs and roads and during sediment harvesting from nearby dredger tailings; (2) collecting, storing, and prioritizing LWM for enhancement projects; (3) placing LWM in the lower Tuolumne River; and (4) monitoring and reporting on the overall LWM enhancement and management effort. Under NMFS's recommendation, LWM is defined as structurally sound logs with or without rootwads that are at least 3 feet long and at least 8 inches in diameter measured 4 feet from the large end, while key pieces of LWM are logs greater than 25 feet long with rood wad attached and 24 inches or greater in diameter (measured 4 feet from the rootwad). Under NMFS's 10(j) recommendation 3, the Districts would survey the upper reaches of Don Pedro Reservoir following any peak flow equal to or greater than a 1.5-year return interval flow and secure all LWM floating in the reservoir or perched on the reservoir margin so that it can be retrieved for removal later that season. The Districts would also annually remove LWM from the projects' reservoirs and store the material at locations

that minimize transport time to the restoration reaches and are secure from illegal firewood cutting and other non-designated consumptive uses. NMFS's specific recommendations on the quantities, placement locations, and replenishment quantities and frequencies are detailed in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Large Woody Material Augmentation.* In its 10(j) recommendation 3, NMFS further recommends that the Districts map the LWM in the lower Tuolumne River to inventory all LWM in four lower Tuolumne restoration reaches. The mapping effort would begin with an initial inventory of existing wood to prioritize the initial LWM augmentation efforts and update the inventory as LWM is augmented each year. In water years with high flow sufficient to mobilize and transport LWM, the augmented reaches would be remapped to verify existing wood locations. The Districts would also prepare an annual report to the Commission on the status of the LWM management program and monitoring, including amount and types (e.g., size ranges) of LWM collected during the year, amount and location of material transported, and any noted biological use of LWM.

California DFW 10(j) recommendation M4 recommends LWM enhancement and management provisions for both projects. California DFW recommends the Districts place 1,600 pieces of LWM in the lower Tuolumne River from La Grange Diversion Dam downstream to the confluence with the San Joaquin River, within or adjacent to floodplain lowering and planting sites, where feasible, and at an appropriate distribution, density, and configuration as recommended by a qualified restoration ecologist and in consultation with the resource agencies. California DFW recommends the Districts comply with California DFW Fish and Game Code § 1602, which requires any person, state or local governmental agency, or public utility to notify California DFW before beginning any activity that will substantially modify a river, stream, or lake. Additionally, California DFW further recommends the Districts submit an implementation monitoring report that includes: (1) the quantity and quality of placed gravel and LWM; (2) the locations and duration of placed LWM, if dislodged, and placement/augmentation; (3) the results of monitoring of the placement/augmentation of gravels, subsequent geomorphic distributions (movement, representative gravel quality, and bedload morphological change), and improvement (additions) of suitable anadromous salmonid spawning and rearing habitat by individual reach; and (4) the quantity, timing, and disposal method of LWM removed from Don Pedro Reservoir and La Grange Reservoir. California DFW recommends the Districts submit this report to the TREG by March 1 each year and submit a final annual report to the Commission, following approval by California DFW, BLM, FWS, and NMFS. California DFW also recommends that the Districts submit a separate annual report to the Commission and California DFW, BLM, FWS, NMFS, and the Water Board by March 15, describing the implementation and effectiveness monitoring.

Water Board preliminary 401 condition 4 specifies that it would likely require the Districts, in consultation with relevant resource agencies and the boating community, to develop a plan to address the reduction of LWM downstream of La Grange Diversion Dam. The Districts may also be required to monitor the implementation and

effectiveness of LWM augmentation and submit associated reports to the Water Board's deputy director. The Districts would be required to develop a plan to minimize effects on beneficial uses from LWM placement and installation.

The Conservation Groups recommend that within six months of any new licenses issued for the projects, the Districts develop a large woody debris placement and management plan in consultation with TRTAC. The Conservation Groups recommend that the plan: (1) describe potential collection locations of LWM in Don Pedro Reservoir or other locations in the Tuolumne River Watershed; (2) describe potential options for moving LWM from Don Pedro Reservoir to the Tuolumne River downstream of La Grange Diversion Dam; (3) identify suitable LWM placement locations in the active channel of the Tuolumne River downstream of La Grange Diversion Dam to the confluence with the San Joaquin River; (4) require consultation with state and federal agencies regarding effects of LWM on safety or maintenance of bridges; (5) require consultation with qualified recreational boating groups to ensure safety with regard to placement of LWM in the context of channel design; (6) require an evaluation of the efficacy, costs, and permitting requirements of providing permanent anchorage to the placed LWM; (7) reinstall LWM annually to ensure no net loss of LWM; (8) develop a regular LWM effectiveness monitoring and reporting process; and (9) describe necessary permits and a permitting timeline.

In the draft EIS, we concluded that the Don Pedro and La Grange Dams intercept most LWM moving downstream from the upper Tuolumne River Basin, and the projects reduce the frequency and magnitude of high flows in the lower river, limit LWM transport, and reduce geomorphic processes that often deliver local sources of wood to the channel. We also concluded that a comprehensive LWM management plan, as recommended by the resource agencies, would likely provide much more complex habitat over a longer period and would have a clear nexus to the project. But we questioned whether LWM measuring less than 16 inches in diameter (at 4 feet from the large end) and less than 20 feet in length would provide the structural benefits that are currently lacking in the lower Tuolumne River (given its existing bankfull width) and even then, pieces of this size may need to be aggregated into log jams to provide the desired benefits. The availability of larger pieces of LWM in Don Pedro Reservoir appeared to be limited. We also noted that although the resource agencies identify placement targets for the lower Tuolumne River, an LWM management plan should be designed to mitigate the ongoing effects of the projects on wood recruitment, and we therefore recommended that the Districts develop a comprehensive LWM management plan for the Don Pedro Project, in consultation with state and federal resource agencies. This LWM management plan would increase the amount of LWM downstream of the La Grange Diversion Dam by guiding the placement of LWM collected from Don Pedro Reservoir, monitoring enhanced sites, and revising the plan over time based on monitoring data.

In comments on the draft EIS and in discussions that occurred at the September 19, 2019, section 10(j) meeting, FWS stated that it appears that staff limited its analysis to only using natural wood input to Don Pedro Reservoir and recommended

using other sources of salvage wood that would provide easier logistics. FWS requested that any license requirement should allow the collection of wood outside the reservoir because LWM is available from a variety of sources where salvage wood may be available and easier to access. NMFS agreed with FWS's recommendation but continued to recommend specific LWM augmentation amounts of approximately 100 pieces of LWM per mile based on studies of Chinook salmon habitat from 19 other river systems in the region. NMFS also requested that the final EIS analyze NMFS's specific plan for LWM (NMFS 10(j) condition 3) along with the scientific rationale that supports it and use this analysis to determine the specifics of a plan (including total volume of wood per year) to be implemented in the license order. The Districts continued to question whether LWM enhancement would provide any habitat benefits in a river the size of the lower Tuolumne River because much of the LWM would likely just pass through the lower river during high flows, noting that habitat formation from LWM usually decreases with increasing channel width. The Districts also commented that it would be infeasible to recover LWM from Don Pedro Reservoir where it currently is collected and corralled because of the difficult logistics (steep shoreline terrain, lack of roads along the shoreline), so the staff plan to only collect LWM from the reservoir would not be possible.

Also related to aquatic habitat enhancement, as we discuss above in *Floodplain Habitat Restoration,* based on additional information filed by the Districts and the continued support for the LTRHIP by FWS and NMFS, we conclude that there is good basis for concluding this program would mitigate project effects in the lower Tuolumne River, as well as be considered habitat enhancement that would increase fry to smolt survival and go hand in hand with the recommended flow measures for the project. Sufficient details of the initial four projects that would be implemented under the LTRHIP have been provided by the Districts for staff to assess the technical merits of the program, and we now recommend the LTRHIP. Although the initial four projects as described by the Districts would primarily involve gravel augmentation, channel manipulations, and riparian plantings, the four proposed and future projects under the LTRHIP could also involve LWM installation, and it would be logical and more efficient to include any plans for LWM enhancement and management under the LTRHIP, instead of under a separate and duplicative LWM management plan as we previously recommended. This would allow coordination of LWM enhancement with other habitat enhancement measures under the LTRHIP. However, we revised our analysis to further assess the volume of LWM that should be used for aquatic habitat enhancement in the lower Tuolumne River, in consideration of previous recommendations made by NMFS and other stakeholders.

We reviewed the NMFS recommendation (100 pieces of LWM per mile) and California DFW recommendation (1,600 pieces of LWM from La Grange Diversion Dam to the confluence with the San Joaquin River, or 31 pieces per mile) and their specifications for the size (volume) of wood pieces to be used for habitat enhancement to derive their recommended LWM loading in cubic feet per mile. We also reviewed other

studies in California that NMFS used as the basis for its placement guidelines (Albertson et al., 2013; Senter and Pasternack, 2010), and determined the LWM loading for Albertson et al. (2013), which was the more comprehensive study that examined 19 other river systems in central California that support Chinook salmon. We also reviewed the Tuolumne River-specific LWM study conducted for the Districts (Stillwater Sciences, 2017a) that estimated the volume of LWM currently deposited in the lower river (RM 51.8 to 24) and in Don Pedro Reservoir and categorized wood pieces by width and length. The LWM loadings per mile discussed by the various studies and recommended by NMFS and California DFW are provided below.

- Albertson et al. (2013) observed for 19 existing streams = 72.4 cubic feet
- NMFS recommended = minimum of 1,565 cubic feet
- California DFW recommended = minimum of 1,751.5 cubic feet
- Stillwater Sciences (2017a) observed for all wood sizes = 420.9 cubic feet
- Stillwater Sciences (2017a) observed larger wood sizes only = 235 cubic feet

This comparison of LWM loadings indicates that both the NMFS and California DFW recommendations for LWM loading are substantially higher than those observed in the 19 streams surveyed by Albertson et al. (2013) and by Stillwater Sciences (2017a) in the lower Tuolumne River. The NMFS and California DFW recommendations represent a much larger volume of wood than was observed by Albertson et al. (2013), which NMFS used as a basis for its recommended LWM loadings. Both the NMFS and California DFW recommendations specify a majority of large LWM in any LWM be used for habitat enhancement, with the objective that this LWM would remain stable and would not be washed out by high flows, yet the 19 streams surveyed by Albertson et al. (2013) appear to maintain a much lower LWM loading in streams that are known to support salmon in California's Central Valley.

Because the NMFS and California DFW recommended LWM volume exceeds the LWM volume observed in other streams in the region and compared to the likely magnitude of project effects, we developed alternative LWM loadings for use in habitat enhancement as part of the LTRHIP. As noted above, Stillwater Sciences (2017a) found that the lower Tuolumne River (RM 51.8 to 24) already contains 235 cubic feet per mile (total of 6,535 cubic feet for this reach) of larger LWM, although much of it was not in the wetted channel. In addition, comparison of the proportion of large wood in the river and the reservoir (9.5 percent versus 23.9 percent, respectively) suggests that the project has reduced the abundance of large wood in the lower river by about half. Using this estimate, doubling the loading of large LWM in the lower river (i.e., introduce 6,535 cubic feet) would mitigate project effects. However, it would be most effective to only introduce this LWM to the river upstream of RM 24, in the reach that has the most suitable habitat for salmonids, and to focus on areas most likely to benefit from additional LWM, which could include ELJs. Downstream of RM 24, the river is less suitable for salmonids because the river channel has been modified by construction of levees and the

loss of riffles and point bars due to in-river gravel mining, resulting in reaches that are wide and deep and of limited habitat value, and likely have low potential to retain LWM. We estimate that an ELJ would likely use a volume of 250 to 500 cubic feet of LWM, so the addition of 6,535 cubic feet of LWM could contribute enough material for 13 to 26 ELJs, which should be clustered in target areas with the greatest potential for habitat enhancement. While this level of LWM enhancement is lower than what is recommended by NMFS and California DFW, it would be substantially higher than the average volumes reported by Albertson et al. (2013) for 19 Central Valley streams known to support salmon. We note that NMFS previously recommended that the Districts first inventory the LWM in the lower Tuolumne River restoration reaches to prioritize the initial LWM augmentation efforts and update the inventory as LWM is augmented each year. NMFS's recommendation would be a reasonable approach to managing LWM distribution in the lower river. The specific plans for LWM management, however, should be developed as part of the interagency consultations under the LTRHIP.

In the draft EIS, we recommended that LWM for habitat enhancement only be collected from Don Pedro Reservoir; however, based on comments received, this would not be feasible. Thus, the Districts and other parties to the LTRHIP should obtain LWM for habitat enhancement from any available feasible sources, which according to agency comments are readily available in the Tuolumne River Watershed including BLM lands in the project vicinity and the Stanislaus National Forest. For LWM that accumulates in Don Pedro Reservoir, the Districts should continue to use their current methods of collecting and corralling LWM behind floating booms and burning the LWM once the reservoir level recedes and the LWM deposits on the shoreline. There appears to be no other feasible and economical way to gather and remove that LWM from the reservoir because of the steep topography and limited road access to the shoreline.

Comprehensive LWM management, developed as part of the LTRHIP in consultation with the resource agencies, would ensure that any plans are well developed and capable of meeting stated enhancement objectives. Any planning should identify sources of LWM for habitat enhancement and identify suitable LWM size classes, locations for placement, and placement methods (i.e., anchoring and/or incorporation into ELJs) in the lower Tuolumne River. Monitoring and mapping the location of LWM as a component of the LTRHIP monitoring program would also provide an indication of their stability and inform the need for future placement activities. Any license issued should require that the Districts file implementation plans for the first group of projects to be implemented, and any proposed monitoring should be focused on measuring the success of implementation. The Districts have indicated that they have already designated $4 million for LWM enhancement as part of the LTRHIP, and we estimate that the incorporation of LWM augmentation into the LTRHIP as we recommend would have no additional cost.

Coarse Sediment Management

The availability and composition of river gravels influence the suitability of spawning habitat for anadromous and resident fish. Coarse gravel also provides substrate for algae and invertebrates, both of which are important components of the aquatic food web.

The Districts propose several measures to improve salmonid spawning habitat, including (1) augmenting the river gravels with 74,945 tons (57,650 cubic yards) of coarse (0.125 to 5.0 inches in diameter) sediment from RM 52 to RM 39 over a 10-year period following issuance of a new license; (2) providing gravel mobilization flows of 6,000 to 7,000 cfs measured at the La Grange gage for at least two days at an estimated average frequency of once every three to four years; (3) conducting a five-year experimental gravel cleaning program; and (4) developing and installing a temporary barrier weir to encourage spawning on less used, but still suitable, high-quality riffles in the lower Tuolumne River, and in-turn, reducing fall-run Chinook redd superimposition. The Districts also propose to implement annual surveys of fall-run Chinook salmon and *O. mykiss* spawning use of new gravel patches for five years following completion of gravel augmentation.

The Districts' proposed coarse sediment management program (item 1 from the list of measures above) would have an estimated levelized annual cost of $418,670. NMFS and California DFW recommend the Districts develop a gravel augmentation program for the lower Tuolumne River. Specifically, NMFS 10(j) recommendation 2 recommends that over the duration of any licenses issued for the projects, the Districts should add a total volume of 752,000 cubic yards of coarse gravel (spawning and non-spawning) in the lower Tuolumne River, at a rate of 18,800 cubic yards per year. We estimate the NMFS recommendation would have a levelized annual cost of $3,132,330. California DFW 10(j) recommendation M4 recommends that the Districts update the coarse sediment management plan prepared by McBain and Trush (2004) for both projects and develop project designs with the TREG within two years of license issuance. The updated plan would: (1) describe potential locations for gravel collection to place into the reaches of the Tuolumne River between La Grange Diversion Dam (RM 52.2) and Geer Road Bridge (RM 24.0); (2) describe any other potential options for providing and placing gravel in the La Grange Diversion Dam to Geer Road Bridge reaches; (3) require consultation with the TREG regarding annual gravel augmentation with respect to geomorphic and hydrologic annual variations; (4) plan for annual gravel augmentation with respect to geomorphic and hydrologic factors, access, and suitability for gravel addition; (5) include an implementation timeline; (6) report and evaluate any legal constraints on gravel placement, and any federal, state, or local permits that may be needed; and (7) receive approval by California DFW, NMFS, and FWS. Upon completion of the updated plan, the Districts would place at least 200,000 cubic yards of sediment annually for 10 years to mitigate for project impacts until at least 1,950,824 cubic yards of additional sediment has been placed in the river to fill SRPs. In

the DEIS, we estimated the California DFW recommendation would have an estimated levelized annual cost of $12,206,340.

The Conservation Groups comment that the Districts' proposed coarse sediment management program is inadequate and recommend (recommendation 6) gravel augmentation and restoration and predatory habitat reduction provisions for both projects that are identical to California DFW's 10(j) recommendation 4, with an identical estimated cost. Water Board preliminary 401 condition 5 specifies that it would likely require the Districts, in consultation with the relevant resource agencies, to develop a plan to facilitate coarse and fine sediment transport past La Grange Diversion Dam in the Tuolumne River. In the draft EIS, we estimated the Water Board's condition would have a levelized annual cost of $41,640. However, that cost was not computed correctly, and the correct cost should have been reported as $672,190 in the draft EIS.

In the draft EIS, we concluded that the projects reduced the amount of coarse sediment entering the lower Tuolumne River and that without some form of ongoing gravel augmentation over the term of the licenses, the river channel would slowly degrade and eventually become gravel limited. It was also evident that gravel augmentation efforts associated with the projects' 1995 Settlement Agreement helped increase coarse sediment storage in the reach and that most of this coarse sediment has been retained, increasing the amount of available salmonid spawning habitat.

Because the projects intercept gravel that would otherwise be available as spawning habitat in the lower Tuolumne River, and would continue to do so for longer than 10 years, we recommended in the draft EIS that the Districts develop a coarse sediment management plan, in consultation with NMFS, FWS, California DFW, and the Water Board, that includes a gravel augmentation program that would extend throughout the term of any new licenses issued for the projects. However, river channel effects associated with gold and aggregate mining and filling the bedload traps/SRPs have no direct nexus to the project or project operation. Rather, we concluded the coarse sediment management plan should focus on providing high-quality spawning habitat for anadromous salmonids in those reaches that have the greatest potential for increasing salmon and steelhead production (i.e., the first 12.4 miles downstream of La Grange Diversion Dam). We also concluded that periodic monitoring and mapping of augmented spawning gravels (i.e., once every 10 years over the term of the licenses), as recommended by NMFS, California DFW, and the Conservation Groups, should be required to evaluate the performance of the augmentation efforts and inform the need for future augmentation. We also recommended that the annual volume of gravel added to the river be commensurate with the estimated annual amount of coarse bed material lost from storage in the lower Tuolumne River in the 12.4-mile long primary spawning reach upstream of RM 39, which is about 1,300 tons per year (1,000 cubic yards per year). We further noted that obtaining the gravel to be placed in the lower reaches from the existing dredger-tailings piles along the river, as recommended by NMFS, California DFW, and the Conservation Groups, would potentially make implementation relatively efficient, as opposed to importing gravels from outside the projects, which could result in off-site

environmental effects at the harvest site. In the draft EIS, we estimated that the staff recommended coarse sediment management plan would have a levelized annual cost of $41,640 and concluded the benefits to aquatic resources would be worth the cost. However, as noted for the Water Board's condition, that cost was incorrectly computed and should have been reported as $672,190 in the draft EIS.

However, the draft EIS did not recommend that the Districts develop a five-year program of gravel cleaning and monitoring because continuing gravel augmentation for the duration of the license in conjunction with gravel flushing and mobilization flows would more effectively address the long-term project effects on gravel quantity and quality that is caused by the interruption of gravel transport by Don Pedro Reservoir. We estimated that the plan would have a levelized annual cost of $197,010 and concluded the benefits to spawning habitat would not be worth the cost. While we recognized that implementation of the Districts' proposed spawning surveys would provide data on the annual distribution and abundance of fall-run Chinook salmon and *O. mykiss* entering the Tuolumne River for five years, it was unclear how these data would be used to inform future gravel augmentation measures because annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by multiple factors that are outside the Districts' control. Consequently, we did not recommend the Districts' proposed spawning surveys in any licenses issued for the projects.

We further concluded in the draft EIS that the Districts' proposed fall-run Chinook spawning superimposition reduction program would not fully address the lack of suitable spawning habitat in the lower Tuolumne River and could also result in the "take" of federally listed steelhead through potential injury from the temporary barrier. We also noted that implementation of a coarse sediment management plan as recommended by staff, potentially as part of a future LTRHIP, would address the lack of suitable spawning habitat more fully than the proposed superimposition reduction program and without the potential "take" of federally listed species. As such, we did not recommend including a requirement to implement the fall-run Chinook salmon spawning superimposition reduction program proposed by the Districts, in any licenses issued for either project. We concluded in the draft EIS that the benefits of this program would not warrant its levelized annual cost of $205,290.

In comments on the draft EIS and in discussions that occurred at the September 19, 2019, section 10(j) meeting, the resource agencies did not agree with the volumes of gravel the Districts are proposing or with the staff-recommended coarse sediment management plan. NMFS continued to request much higher quantities and argued that the Districts should provide mitigation for the full volume of coarse sediment that Don Pedro Reservoir prevents from moving downstream, based on studies by McBain and Trush (2004) and Stillwater (2013d). The Districts also commented and noted that the 18,800 cubic yards/year volume from McBain and Trush (2004) refers to unimpaired sediment delivery, not existing conditions, which have been affected by the development of upstream storage reservoirs and diversions. They also noted that these estimates were

calculated based on the difference between volumetric surveys of Don Pedro Reservoir conducted in 1920 and 2011, and the accuracy of the 1920 survey (old Don Pedro reservoir) is disputable. The Districts measured current bedload transport and the largest estimate was 3,000 tons (2,308 cubic yards) per year, an insufficient amount to fill the SRPs. NMFS commented that the higher estimates from McBain and Trush (2004) and Stillwater (2013d) align with other studies estimating the bedload input to Don Pedro Reservoir. NMFS requested that staff determine a volume for gravel augmentation to include in the license article and that the enhancement reach be extended farther downstream than RM 39 because of documented spawning downstream of that point. The parties to the section 10(j) meeting also discussed the SRPs created by historical instream aggregate mining, with NMFS noting that while these are not project-related effects, the gravel captured in Don Pedro Reservoir prevents the recovery of these reaches, and the lack of high flows has reduced recruitment of gravel from the floodplain. California DFW also noted that riffles created by past gravel augmentation efforts often are removed by high-flow events and require continued augmentation to compensate for the lack of gravel transported from upstream sources. The Districts commented that the staff alternative is generic in nature and suffers from the same deficiencies that staff identified for the LTRHIP.

Staff suggested in section 10(j) meeting discussions that it would be most cost-effective to focus gravel augmentation on the areas where it is needed, rather than focusing on volumes. Staff noted that a recommended volume of gravel augmentation was provided in the draft EIS, but was not included in the draft license article; however, a volume would be included in the final license article. Staff was also receptive to modifying the river miles where gravel augmentation is needed and requested additional information about specific sites to best mitigate the limiting factors for Chinook salmon. Because of these additional discussions and stakeholder comments, we revised our analysis of gravel augmentation in section 3.3.2.2 of this final EIS. While we still agree that gravel augmentation is needed in the lower Tuolumne River via the Districts' proposed coarse sediment management program, which we believe could be implemented in coordination with the LTRHIP, we have further analyzed the amount of gravel needed and the locations for augmentation.

NMFS, California DFW, and FWS filed follow-up comments after the section 10(j) meeting to provide additional backup to the discussions and to provide the agency slides presented at the meeting. Both NMFS and California DFW continue to maintain their previous section 10(j) recommendations for additional sediment to be placed in the river, with a primary objective to fill the SRPs. In addition, California DFW recommends the Districts apply the bedload transport rating curve developed by McBain and Trush (2004) to any new flow schedule required by the Commission or the Water Board for the Don Pedro or La Grange Projects to calculate average annual bedload transport rates for sediment > 8 mm (0.3 inch). California DFW recommends the Districts annually add this amount of gravel to the lower Tuolumne River to ensure no net loss of spawning habitat occurs, which at a minimum should be 2,500 cubic yards of

cleaned spawning-sized gravel. The FWS follow-up filing included information on Chinook salmon redd distribution in the lower Tuolumne River from 2014 to 2018, showing that annually from 27 to 42 percent of the redds are constructed downstream of RM 39 to as far downstream as RM 24.5. In the draft EIS, staff had recommended gravel placement only as far downstream as RM 39.

Our revised analysis in section 3.3.2.2 of this final EIS indicates that the Districts' proposed gravel augmentation, if evenly allocated over a 40-year license term, would result in 1,441 cubic yards per year, and if spread evenly over their proposed 13-mile-long reach (RM 52 to RM 39) would be 111 cubic yards per mile.[255] For comparison, the loss of 4,549 to 6,707 cubic yards over eight years in the 6.7-mile-long study reach used by Stillwater Sciences (2013d) was 85 to 125 cubic yards per mile, similar to the gravel augmentation rate proposed by the Districts. Stillwater Sciences (2013d) also reported, and we note above, that past gravel augmentation efforts in the river have maintained spawning gravels with the addition of approximately 44,750 cubic yards of gravel to the river from 2002 through 2012. Further, Stillwater Sciences (2013d) reported an overall increase in spawning gravels in the lower Tuolumne River (RM 52 to RM 23) from 2001 to 2012, including spawning gravel in riffles, with an estimated maximum suitable spawning area of 1,370,917 square feet for Chinook salmon and 346,029 square feet for *O. mykiss*. Depending on the flow schedule and the redd size used in the calculation, this amount of spawning habitat could support from 47,882 to 59,795 spawning Chinook salmon and approximately 803,178 to 854,547 *O. mykiss* (Stillwater Sciences, 2013d). This indicates that the current amount of spawning gravel in the lower river could support spawning populations substantially higher than current levels, and that the level of gravel augmentation proposed by the Districts would be sufficient to maintain and enhance spawning gravels in the segment of the lower river where augmentation is proposed to take place.

Both NMFS and California DFW recommend substantially higher levels of gravel augmentation, with a focus on filling in the SRPs that are the result of past in-river mining operations unrelated to the projects. Although NMFS acknowledges that the Districts are not responsible for creation of the SRPs, it believes the presence of the projects has intercepted gravel that would have otherwise filled the SRPs if the projects had not been built. Once the SRPs are filled in, NMFS further recommends another 5,400 cubic yards of cleaned spawning-sized gravel be introduced per year to create or restore spawning riffles, with a total volume of 188,000 cubic yards, which would require about 35 years to complete. Staff, however, does not agree the Districts are responsible for mitigating in-river effects of mining, which was not a direct effect of the projects.

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[255] This metric is for comparison purposes only. In reality, gravel would not be spread evenly over the full reach and instead would be placed in specific areas that would have the best potential for habitat enhancement and would measure much less than the full reach.

However, a portion of any gravel introduced by the Districts would be transported to and settle in the SRPs during high-flow events, so some refilling of the SRPs would occur under any gravel augmentation program, although at a slower rate than contemplated by NMFS and California DFW (10 to 15 years). The volume of gravel augmentation recommended by NMFS and California DFW may also be excessive for the lower Tuolumne River based on the size and morphology of the river. The agencies are recommending the annual placement of from 48,880 to 260,000 tons (37,600 to 200,000 cubic yards) of coarse sediment, and the logistics of a gravel augmentation program of that magnitude, including potential impacts associated with gravel sources, transportation logistics, and access roads/points to the river for gravel distribution, have not been addressed.[256]

Although we are not recommending the level of gravel augmentation recommended by NMFS and California DFW, we agree that some additional gravel augmentation should occur in portions of the river downstream of RM 39 (our previous downstream limit for gravel augmentation). Information provided by the agencies at the section 10(j) meeting, and later filed by FWS, showed that from 2014 to 2018, an average of about 36 percent of Chinook salmon redds were constructed downstream of RM 39 to as far downstream as RM 24.5. This lower river reach was shown to be an important reach for Chinook salmon spawning, and this reach should be included as part of the gravel augmentation program. Because on average about one-third of the spawning occurs from RM 39 to RM 24.5, we are recommending the Districts' originally proposed 75,000 tons (57,692 cubic yards)[257] of gravel augmentation be increased by one-third or 25,000 tons (19,230 cubic yards) for distribution between RM 39 and RM 24.5. We also recommend that any gravel augmentation program be made part of the LTRHIP, which would allow the Districts and the agencies to consult in the preparation of specific plans for the 100,000 tons (76,923 cubic yards) of gravel to be augmented.[258] The Districts proposed to evaluate the need for additional gravel at the initial sites and the need for additional augmentation sites as part of the gravel augmentation study to be filed in year 12 of any license issued; and then file an implementation plan for any new gravel augmentation sites identified in the year 12 report. We also recommend this approach for

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[256] For example, although the size of dump trucks may vary, using 15-ton trucks would require from about 3,260 to 17,300 truckloads to annually distribute the tonnage recommended by the agencies.

[257] The Districts proposed 74,945 tons (57,650 cubic yards) of gravel augmentation, but we are rounding this up to 75,000 tons (or 57,692 cubic yards) for convenience.

[258] If we assume that the 100,000 tons (76,923 cubic yards) would be distributed over a 40-year license term, about 2,500 tons or 1,923 cubic yards would be distributed per year.

management of the gravel augmentation program and agree with redd surveys of new gravel patches for five years following completion of gravel augmentation, which would help to determine effectiveness and guide future augmentation efforts. We estimated in the draft EIS that a gravel augmentation program as proposed by the Districts would have a levelized annual cost of $418,670. We estimate the additional cost for expanding the program by 25,000 tons and adding more sites in the lower river would be $138,160 (levelized), and the additional habitat benefits would be worth the cost. The total levelized cost of the staff recommended program is therefore estimated to be $556,840.

Another aspect of spawning habitat enhancement proposed by the Districts is a five-year experimental gravel cleaning program with associated redd and substrate surveys. We concluded in the draft EIS that continuing gravel augmentation for the duration of the license in conjunction with gravel flushing and mobilization flows would more effectively address the long-term project effects on gravel quantity and quality than an experimental gravel cleaning program. However, the Districts' December 11, 2019, and subsequent June 17, 2020, response to staff's September 17, 2019, AIR included additional modeling simulations to allow Commission staff to adequately assess the effects of proposed non-flow measures, including the effects of implementing the proposed gravel cleaning program on Chinook salmon smolt productivity, *O. mykiss* young-of-year productivity, and *O. mykiss* adult replacement rate. The Districts' modeling showed that the gravel cleaning program, implemented in conjunction with the draft Voluntary Agreement flow regime, would increase Chinook salmon smolt productivity by 19 to 22 percent, *O. mykiss* young-of-year productivity by 12 to 24 percent, and the *O. mykiss* adult replacement rate by up to 2 percent compared to implementing the draft Voluntary Agreement flow regime alone.[259] This modeling indicated that the gravel cleaning program would have a substantial beneficial effect on salmon and *O. mykiss* populations in the lower Tuolumne River. Therefore, because of these new modeling results, staff is now recommending the proposed gravel cleaning program as a condition for any licenses issued, which would include pre-cleaning surveys that are intended to help avoid conducting gravel cleaning where and when it would disturb spawning fish or eggs incubating in the gravel. We estimate that the program would have a levelized annual cost of $197,010, and the benefits to spawning habitat would be worth the cost.

Regarding the Districts' proposed fall-run Chinook spawning superimposition reduction program, which we did not recommend in the draft EIS, we continue to not recommend this program. The Districts' June 17, 2020, filing with additional modeling

[259] Flows would increase below the infiltration galleries in dry and critical years from 75 to 125 cfs from July 1 to October 15, but would decrease slightly at the La Grange gage from 350 cfs to 300 cfs in wet, above normal and below normal water years.

results showed no increase resulting from this program compared to draft Voluntary Agreement flow regime, supporting our draft EIS conclusions that the program would not be worth the cost.

Aquatic Invasive Species Management Plan

New Zealand mudsnails, quagga mussels, and zebra mussels are invasive aquatic mollusk species that compete for habitat and food resources and have the potential to affect aquatic communities. While neither the Districts nor the resource agencies have reported these species in Don Pedro Reservoir or the Tuolumne River, the New Zealand mudsnail has been documented in the lower Merced River between Crocker-Huffman Diversion Dam (RM 52.2) and the Highway 59 Bridge (RM 42.0). Water hyacinth is an invasive aquatic plant species that the Districts have documented throughout the lower Tuolumne River between RM 24.5 and the confluence with the San Joaquin River.

The Districts propose to implement an Aquatic Invasive Species Management Plan (filed on October 11, 2017) that includes: (1) providing information to recreational users on ways to reduce the spread of invasive species; (2) continuing the boater self-inspection permit program for invasive mollusks; and (3) conducting routine operation and management activities, using the following BMPs: (a) identifying aquatic invasive species that may be introduced by a given activity, (b) implementing preventive measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs.

Water Board preliminary 401 condition 8 specifies the Districts develop a plan, in consultation with resource agencies, to manage aquatic invasive species by establishing a framework with specific activities to minimize the spread and impact of aquatic invasive species on native fauna and habitats and identifying and describing aquatic invasive species currently established within the project areas and aquatic invasive species with high potential to become established within the project areas. California DFW 10(j) recommendation M10 recommends the Districts implement the revised Aquatic Invasive Species Management Plan filed with California DFW's recommendation. California DFW's revised plan would address the same species as the Districts' plan but would also address didymo, Asian clam, hydrilla, Brazilian waterweed, and Eurasian milfoil. Many of California DFW's recommended provisions are either similar to or slightly modified from provisions in the Districts' plan. California DFW's revised plan also includes provisions for annual consultation among the Districts, California DFW, and BLM to ensure that the goals and objectives of the plan are met, the proposed recommendations are implemented, and the plan is reviewed, updated, and/or revised, as needed, when changes to the existing aquatic invasive species conditions occur. BLM Don Pedro revised 4(e) condition 6 specifies that, following consultation with BLM, the Districts file a BLM-approved aquatic invasive species management plan within one year of any new licenses issued for the project. BLM provided an approved plan containing its preliminary condition and the same provision as listed previously in California DFW's

plan and addressing the same invasive species. However, in BLM's plan, all invasive plant species would be addressed in the TRMP specified by BLM Don Pedro revised 4(e) condition 7.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Aquatic Invasive Species Management*, while most of the components of the resource agencies' recommended plans are similar to those proposed in the Districts' plan, the Districts' plan lacks certain beneficial components included in the resource agencies' plans. Therefore, we recommend the Districts revise the Aquatic Invasive Species Management Plan to include provisions to: (1) provide information (i.e., signage and information pamphlets at designated public boat access sites) to educate recreational users on ways to reduce the spread of invasive species; (2) continue the boater self-inspection permit program and provide aquatic invasive species information, including prevention measures (such as self-inspection permits), on websites that provide the public with information on project facilities; (3) identify project operation and maintenance activities that could result in the introduction, spread, or proliferation of aquatic invasive species, and the measures that would be used to control each species for which there is a risk of spread or introduction; (4) record and communicate incidental observations of aquatic invasive species to BLM, FWS, and California DFW. We estimate the plan would have a levelized annual cost of $26,300, and the benefits to aquatic resources would be worth the cost. We additionally recommend that the Districts develop an aquatic invasive species management plan for the La Grange Project similar to that described for the Don Pedro. We estimate the plan for the La Grange Project would have a levelized annual cost of $20,300, and the benefits to aquatic resources would be worth the cost.

Bald Eagle and Special-status Bird Management Plan

Don Pedro Reservoir supports multiple nesting bald eagles, and three active nests were observed during the Districts' 2012 nesting survey. Although the Districts did not conduct surveys for bald eagles within the La Grange Project, La Grange Reservoir likely supports bald eagles, at least occasionally, because of its abundance of fish. Activities that could disturb bald eagle foraging and nesting include operation and maintenance of the projects, such as woody debris management and recreational uses (e.g., camping, hiking, motorized and non-motorized boating, and off-highway vehicle use). These activities could also affect bald eagles roosting on Don Pedro Reservoir during the winter.

Based on our analysis in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Bald Eagles*, increasing the buffer distance around active bald eagle nests from 0.125 mile, as proposed, to 0.25 mile and providing signs to inform recreationists of the temporary closure(s) would benefit bald eagles because evidence suggests that human disturbance at the Don Pedro Project has been responsible for previous bald eagle nest failures. Including annual nesting surveys in a revised, stand-alone bald eagle and special-status bird management plan, rather than the periodic surveys proposed by the

Districts, would allow the Districts to protect active nests every year. Because golden eagles rarely occur at the projects, and no nests have been reported, we do not see any benefit to the species by including additional protective measures for golden eagle in a revised bald eagle and special-status bird management plan. However, the reporting of incidental sightings as part of the TRMPs for both projects would serve to protect golden eagle by noting their location in relationship to potential project-related disturbances. BLM and Central Sierra Audubon have conducted wintering counts for bald eagles near Don Pedro Reservoir during mid-January from 1994 to 2012 with the number of bald eagles on Don Pedro Reservoir varying from 5 to 34 per survey and averaging 20 bald eagles per year (BLM, 2018). Conducting annual winter population and night roost surveys, as recommended by FWS, in a revised, stand-alone bald eagle and special-status bird management plan for the Don Pedro Project would minimize potential adverse effects on wintering bald eagles.

Project operation and maintenance and recreational activities could disturb several other birds of prey that potentially nest and forage at the Don Pedro Project but are not addressed by the Districts' Don Pedro TRMP, including the American peregrine falcon, white-tailed kite, osprey, golden eagle, and Swainson's hawk. Of these, the Districts have documented occurrences of the osprey and golden eagle, but Swainson's hawk have been seen nearby and suitable habitat exists. We recommend that the Districts document incidental observations of all raptor species, including burrowing owl, while performing bald eagle surveys and other activities at the Don Pedro Project, and implementing protective buffers around any active nests of special-status birds. This measure would help avoid or minimize project effects on these special-status birds. We analyze this measure separately from bald eagles in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, *Other Special-status Birds*, but evaluate its costs together with bald eagle management in section 4 and recommend that measures to manage all birds be included in the bald eagle and special-status bird management plans for both projects.

We recommend the Districts modify the bald eagle management section of the Districts' Don Pedro TRMP to develop a stand-alone bald eagle and special-status bird management plan, in consultation with the resource agencies. This plan would include: (1) annually conducting bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 0.25 mile of the shoreline of Don Pedro Reservoir; (2) conduct surveys in accordance with the *Bald Eagle Breeding Survey Instructions* (California DFW, 2010) and the *Protocol for Evaluating Bald Eagle Habitat and Populations in California* (Jackman and Jenkins, 2004); (3) if any new nests or communal night roosts of wintering eagles are located, coordinate with BLM, FWS, and California DFW to establish a protective buffer on project lands around each area; (4) increase the protective buffer on project lands around active bald eagle nests and communal roosting sites from 0.125 mile as proposed, to 0.25 mile, unless consultation with the resource agencies allows for a reduced protective buffer if eagles nesting in the area demonstrate a greater tolerance; (5) install signs on project lands to inform recreationist of any temporary closure(s) around active bald eagle nests; (6) collect

incidental observations of all raptor species at the project while performing other activities within the Don Pedro Project boundary, to determine if protective buffers on project lands are needed; and (7) consult with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds. We estimate the plan would have a levelized annual cost of $20,890, and the benefits to bald eagles and other special-status birds would be worth the cost. We additionally recommend the Districts develop a similar bald eagle and special-status bird management plan for the La Grange Project. We estimate the plan would have a levelized annual cost of $5,590.

Terrestrial Resources Management Plan

To minimize potential adverse effects on terrestrial resources at the Don Pedro Project, the Districts propose to implement their TRMP (Districts, 2017a, appendix E-6) for the duration of a new license. The Districts, however, do not propose a management plan for terrestrial resources at the La Grange Project. The Don Pedro TRMP covers the following components: (1) special-status plant species protection and monitoring; (2) noxious weed prevention and management measures; (3) valley elderberry longhorn beetle host plant guidelines; (4) descriptions of bi-annual employee and contractor training; and (5) procedures for revegetation following ground-disturbing activities. The plan includes specific guidelines for protecting and managing special-status bats, bald eagles, western pond turtles, and the federally threatened valley elderberry longhorn beetle.

BLM, FWS, and California DFW comment that the Districts' proposed Don Pedro TRMP would not provide adequate protections for several special-status plants and animals and federally listed species. Specifically, FWS Don Pedro 10(j) recommendation 11 and FWS La Grange 10(j) recommendation 10 recommend that the Districts revise the Don Pedro TRMP and develop a La Grange TRMP with protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, and California tiger salamander. FWS-recommended measures include (1) control of bullfrog populations; (2) surveys for chytrid fungus; (3) protocols for slash removal and storage; (4) provisions to minimize impacts from roads, including potential wildlife-friendly road crossings; (5) measures to discourage raptor use of transmission lines as perches in suitable habitat for the San Joaquin kit fox and western burrowing owl and (6) species and habitat monitoring every three years. FWS also included Layne's butterweed and Red Hills vervain in this recommendation for the Don Pedro Project and included the western pond turtle in its recommendation for the La Grange Project.

BLM Don Pedro 4(e) condition 7 specifies that the Districts file a revised, BLM-approved Don Pedro TRMP that addresses the western pond turtle, California red-legged frog, special-status bats, noxious weeds, and special-status plants. BLM La Grange 4(e) condition 5 specifies that the Districts file a BLM-approved La Grange TRMP that addresses noxious weeds and special-status plants. For guidance, BLM and FWS provided the Districts with a revised Don Pedro TRMP and a template version for

the La Grange TRMP, the latter being an edited version of the Districts' plan for the Don Pedro Project. California DFW 10(j) recommendation M9 recommends that the Districts include the La Grange Project in a revised TRMP for both projects with similar protective measures for special-status or threatened and endangered species as included in the BLM conditions and FWS recommendations.

The Districts propose several capital improvement projects that could have both short-term and long-term, direct and indirect impacts on vegetation (i.e., habitat) and wildlife. While the Districts' proposed noxious weed surveys would serve to ensure that noxious weeds do not increase, it would be most effective for the Districts to focus on areas where noxious weeds are most likely to occur or be introduced, which include the Don Pedro Reservoir shoreline, along the busy roads and trails of Don Pedro Project recreational areas, in heavily grazed areas, and around project facilities. Modifying the Districts' Don Pedro TRMP to emphasize the use of manual control of noxious weeds in areas with sensitive resources, where feasible, would be a simple modification to protect all special-status plants in addition to ESA/CESA-listed species. Additionally, the Districts documented the occurrence of giant reed, a California DFA B-listed noxious weed, within the Don Pedro Project that was not proposed for management by the Districts in their Don Pedro TRMP. Controlling this population of giant reed would reduce its potential spread to other areas of either project.

Due to the substantial number of special-status plants at the Don Pedro Project, we conclude that the Districts' proposed management of special-status plants is lacking protections because the proposed surveys would only focus on known occurrences of special-status plants. It is likely that new populations of special-status species could become established over the duration of the license period and monitoring only known populations would be insufficient to protect new occurrences from project effects. Revising the Don Pedro TRMP and developing a similar plan for the La Grange Project, to include surveys of additional areas where project operation and maintenance activities could affect special-status plants would serve to further protect all populations. In addition, the conservation of special-status or threatened and endangered plants would be provided by Districts' implementation of buffers around special-status plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities, including noxious weed treatments, and removing the flagging or fencing when the work is complete. To ensure flagging and fencing include all special-status and threatened and endangered plant species, we recommend the Districts conduct surveys prior to any project-related ground disturbance in suitable habitat for these species.

The Districts last conducted a bat survey more than seven years ago, in 2012. Because bat habitat use could change for reasons such as drought or wildfire, a reevaluation of bat use at Don Pedro Project facilities, where the potential exists for conflict with humans, would provide for more accurate decisions about the proposed protective measures (i.e., exclusion devices). Performing this survey during peak bat maternity season (July 1 through August 31) would help to inform if and where any

maternity roosts exist within the project. However, because either bat roosting behavior or human use of project facilities could change, periodic surveys would be necessary to ensure that project operations do not affect bats over the duration of the license. Bats would be afforded further protection if the Districts resurvey all project facilities that have the potential for bat occurrence every five years, rather than resurveying only facilities with installed exclusion devices. Additionally, given the recent observation of WNS fungus in California, we recommend the Districts report any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and follow accepted decontamination protocols when entering areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015). This would prevent inadvertent spread of the fungus and help the resource agencies track the spread of the fungus in the state.

Regarding the use of pesticides, we expect that the Districts will follow application labels, as directed by EPA, and support the responsible use of pesticides in proximity to any documented maternity colony. The Commission does not enforce pesticide regulations and does not typically include such requirements as a condition of the project license. However, the Districts have not proposed any protective measures for burrowing animals, including burrowing owls, in the Don Pedro or La Grange Projects because they concluded that there would be no project effects. The Districts' use of smoke and carbon monoxide to control rodents within developed recreational areas would present some risks to other non-target wildlife. While their method leaves rodent burrows intact following treatment, burrows would likely collapse without maintenance by ground squirrels and the important habitat they provide to other species could be lost. Including provisions in the TRMPs for both projects to evaluate burrows for usage by burrowing owls, California tiger salamanders, and San Joaquin kit fox prior to rodent control activities would avoid this potential effect. The conservation of these three burrowing species would also be further advanced if the Districts document any incidental sightings of them at the Don Pedro Project. Lastly, the Districts have not proposed any protective measures for special-status, or federally listed reptiles and amphibians. Amphibians are sensitive to the potentially adverse effects of pesticide use and could be affected by reduced water quality as a result of runoff from ground-disturbing activities. However, implementing BMPs to minimize potential for pesticide use to affect non-target species would avoid or minimize any potential adverse project effects on California tiger salamanders, California red-legged frogs, and western pond turtles. Also, to ensure that ground-disturbing activities do not adversely affect aquatic habitats that amphibians depend upon, we recommend that the Districts implement BMPs to minimize potential for pesticide use to affect non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

Based on our analysis in sections 3.3.3.2, *Terrestrial Resources, Environmental Effects*, and 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*, we do not recommend adopting FWS recommendations to (1) control bullfrog populations;

(2) survey for chytrid fungus; (3) implement protocols for slash removal and storage; (4) implement provisions to minimize impacts from roads, including potential wildlife-friendly road crossings; and (5) conduct species and habitat monitoring every three years. While we agree there are examples where bullfrog control has been successful, these instances are limited to relatively small water bodies with limited potential for recolonization. We are not aware of any bullfrog control measures that we expect would be effective on the scale of Don Pedro Reservoir. We do not recommend that the Districts conduct surveys for chytrid fungus because there is little the Districts would be able to do to remove the presence of the fungus if it is identified. We conclude that this measure would do little to reduce any effects of the fungus on frog populations in the project area. However, we do recognize the potential for project staff to inadvertently spread the fungus from one water body to another. To reduce potential for this cross contamination, we recommend including procedures in the TRMP for decontaminating field equipment to prevent spread of aquatic pests and disease between waterbodies. This measure would provide additional protections for frogs from chytrid fungus and protect other fish and wildlife from other pests. We do not recommend additional measures related to the disposal of slash from fuels reduction or hazard tree removal to protect California red-legged frog because the recovery plan states the species has been extirpated from the Tuolumne River basin, the Districts' habitat surveys indicate potential habitat is unsuitable, and the agencies have not provided any information to indicate the frogs are present in any location within the dispersal distance or evidence of plans to reintroduce the species to the project area. We do not recommend the construction of wildlife-friendly road crossings because we are unaware of any evidence to suggest project roads have had adverse effects on these species, nor do we recommend raptor controls on transmission lines because the Districts do not own or maintain transmission lines as part of the project facilities. Finally, we do not recommend species and habitat monitoring surveys because the agencies provide no information for how these surveys would be used to modify project operations or how any observed changes in habitat would be tied to project effects. Combined, we estimate these measures would have a levelized annual cost of $60,000 and conclude they would not provide benefits to terrestrial wildlife to warrant the cost.

However, the Districts should revise the Don Pedro TRMP, in consultation with BLM, FWS, and California DFW, to include additional protections for special-status or threatened or endangered species. As proposed, the Districts' Don Pedro TRMP would cover the following components: (1) special-status plant species protection and monitoring; (2) noxious weed prevention and management measures; (3) valley elderberry longhorn beetle host plant guidelines; (4) descriptions of bi-annual employee and contractor training; and (5) procedures for revegetation following ground-disturbing activities. The plan also would include specific guidelines for protecting and managing special-status bats, bald eagles, and western pond turtles. Because the Districts do not propose a plan to manage terrestrial resources at the La Grange Project, we conclude that the Districts also should develop a La Grange TRMP.

The Don Pedro TRMP should include: (1) conducting noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants, using manual control of noxious weeds where feasible (instead of herbicides), in areas with sensitive resources; (2) implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road; (3) implementing BMPs to minimize potential for pesticide use to affect non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas; (4) recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, BLM, and the Commission; (5) conducting surveys for special-status plants following California DFW protocols (California DFW, 2018e) on project lands within the Red Hills ACEC every five years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and where project-related disturbance is reasonably expected to occur; (6) installing interpretive signs about the unique plant communities on project lands within the Red Hills ACEC and requesting that recreationists stay on trails; (7) conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c; California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities; (8) conducting a bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence surveys during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance; and resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting; (9) reporting any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015); (10) recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle and following the avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a) if elderberry plants are identified; (11) describing specific project locations where the Districts' proposed rodent control activities could occur; (12) conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols (FWS, 2011; FWS, 2003; and California DFW, 2008) prior to any rodent control or ground disturbance

activities that could destroy potential burrows, implementing avoidance measures for any occupied or potentially occupied burrows, and documenting any anecdotal evidence of San Joaquin kit fox, burrowing owl, and California tiger salamander during other biological surveys; (13) implementing BMPs to protect California tiger salamander from project activities, including conducting project-related ground disturbance or vegetation management within 300 feet of suitable California tiger salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions) and conducting project-related ground disturbance in suitable upland habitat only between July 1 and October 15; (14) avoiding use of pesticides on project lands within 500 feet of suitable aquatic and upland habitat for California tiger salamander; and (15) decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.

The La Grange TRMP should include: (1) conducting a noxious weed survey of the La Grange Project in the first year of license issuance and every five years, with future noxious weed surveys focusing on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control methods where feasible (instead of herbicides), in areas with sensitive resources; (2) focusing future noxious weed surveys in areas that support occurrences of special-status or threatened and endangered plants; using manual control of noxious weeds where feasible (instead of herbicides), in areas with sensitive resources; (3) implementing BMPs to minimize potential for pesticide use affecting non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas; (4) conducting a survey for special-status plants following California DFW protocols at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and preparing a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance; (5) conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS, 2017a, b, and c; California DFW, 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities; (6) recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, BLM, and the Commission; (7) conducting a bat survey of the La Grange Project focusing on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with

evidence of bat roosting; (8) reporting any sick or dead bat found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015); (9) recording the locations of elderberry plants during special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle; following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a) if elderberry plants are identified; (10) developing protective measures for western pond turtles, including recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project boundary, and consulting with FWS and California DFW to develop protective measures for the species; (11) decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species; (12) conducting surveys for San Joaquin kit foxes in accordance with California FWS (FWS, 2011) protocols prior to any ground disturbance activities that could destroy potential burrows, implementing avoidance measures for any occupied or potentially occupied burrows, and documenting any anecdotal evidence of San Joaquin kit fox, during other biological surveys; (13) implementing BMPs to protect California tiger salamander, including conducting project-related ground disturbance or vegetation management within 300 feet of suitable California tiger salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions) and conducting project-related ground disturbance in suitable upland habitat only between July 1 and October 15; and (14) avoiding use of pesticides on project lands within 500 feet of suitable aquatic and upland habitat for California tiger salamander.

Finally, as discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* and 3.3.4.2, *Threatened and Endangered Species, Environmental Effects,* while we have not identified any proposed construction activities associated with the Don Pedro Project with potential to affect California tiger salamander, we recognize some construction activities would occur at the La Grange project, including installation of a fishway. FWS recommends multiple measures that would protect California tiger salamander from construction activities. However, while FWS recommends requiring stoppage of work to wait for observed animals to relocate on their own, we conclude that this measure is unrealistic and poses a risk of workers either ignoring observations or moving animals without following proper handling procedures. Instead, because biological monitors would be on site and properly trained to relocate animals out of harm's way, we recommend the applicant follow FWS relocation protocols to move the animals. Such relocation would prevent injury without requiring extended work stoppage periods. Therefore, we recommend the TRMP for the La Grange Project include the following measures to protect California tiger salamander during construction of the fish

barrier in the La Grange sluice gate channel: (1) provide training from a biologist meeting FWS standards for all contractors, work crews, and on-site personnel; (2) inspect all construction pipe, culverts, or similar structures that are stored at the construction site for one or more overnight periods before the pipe is subsequently moved, buried, or capped, and if during inspection, the salamander is discovered inside a pipe, refrain from moving that section of pipe until the salamander has escaped on its own and contact FWS for further instruction; (3) inspect all vehicles and equipment for the presence of salamanders prior to moving, and if a California tiger salamander is found, follow FWS relocation protocols; (4) cover all excavated, steep-walled holes or trenches with plywood or similar materials at the end of each work day or provide one or more escape ramps constructed of earth fill or wooden planks and inspect such holes or trenches for trapped animals prior to filling, and if a trapped salamander is located, cease all work in the immediate area until the biological monitor follows FWS protocols to safely move the animal; (5) refrain from using monofilament netting for erosion control measures in suitable habitat and instead, use tightly woven (less than 0.25-inch diameter) biodegradable fiber netting or biodegradable coconut coir matting; and (6) provide a biological monitor meeting FWS standards to monitor work sites to ensure BMPs are implemented. We estimate the levelized annual cost of these measures for California tiger salamander would be $5,590 and conclude the benefits to the species would be worth the cost.

We estimate that all the components of the revised Don Pedro TRMP would have a total levelized annual cost of $37,340 and a La Grange TRMP would have a total levelized annual cost of $12,960, and the benefits to terrestrial resources would be worth the cost. While we do not adopt some of BLM, FWS, and California DFW's recommended measures related to western pond turtle and California red-legged frog, BLM Don Pedro 4(e) condition 7 would require these species be included in the revised Don Pedro TRMP and be included as a mandatory condition in any licenses issued for the projects.

Recreation Resource Management Plan

The Districts propose to implement their RRMP for the Don Pedro Project (Districts, 2017a, appendix E-7). The plan would address the development of new facilities downstream of Geer Road near RM 25 for non-motorized boating access and public viewing at a proposed fishway and counting window at the fish counting/barrier weir. Developing additional unspecified facilities during the license term would be based on need as determined by periodic monitoring. The plan states the Districts would be responsible for operating and maintaining: (1) three existing recreational areas with campgrounds, day-use areas, and boat launches; (2) areas with limited infrastructure (e.g., floating restrooms and boat-in campsites); and (3) areas receiving recurrent dispersed recreation that have no infrastructure. The Districts also intend to construct a new visitor center near Fleming Meadow to replace the building destroyed by fire in 2016. At the La Grange Project, the Districts propose to construct a foot trail extending

from the former Don Pedro Visitor Center parking lot to the La Grange Reservoir, including directional signage as well as signage to delineate private land and inform visitors about potential hazards at the end of the trail (e.g., spillway, flow and reservoir elevation changes). The Conservation Groups support the Districts' measure to provide a pedestrian trail. BLM Don Pedro revised 4(e) condition 14 specifies implementing the Districts' plan as revised by BLM to: (1) include information about facility condition and accessibility; (2) include a GIS map showing landownership at recreational facilities; (3) categorize Ward's Ferry as a developed, multi-use recreational facility; (4) add text with guidance for constructing and reconstructing facilities on BLM-managed lands; (5) consult BLM to develop visitor survey questions; and (6) consult BLM about the need for updating the plan. In addition, BLM Don Pedro revised 4(e) condition 11 specifies annual consultation, at a minimum, to create an annual opportunity to initiate or adjust actions within the scope of the plan to meet visitor needs and protect environmental resources and specifies inviting BLM staff to participate in field and facility inspections.

Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects, Recreation Resource Management*, while the proposed Recreation Management Plan for the Don Pedro Project thoroughly explains the Districts' responsibility for operating and maintaining campgrounds, day-use areas, and areas with few or no site amenities would ensure these project recreational facilities are safe and functional through the license term, it does not identify the Don Pedro shoreline access trail, which is partially located on BLM-managed land, as a project facility or describe the Districts' responsibility for operating and maintaining the trail. Additionally, while the plan includes a monitoring component whereby the Districts would consider changes or revisions to the plan in response to visitor use data it compiles and reports every 12 years, it does not describe any threshold or condition that would need to be met or specify how BLM (the public land manager) would be involved in the review to determine the need for additional facilities or a plan revision. Land management agency coordination is also a missing component of the Districts' plan with regard to constructing or reconstructing recreational facilities located on BLM-managed public land and designing visitor use surveys. The Districts do not propose to include their proposed visitor center as a project facility. However, the visitor center fits within the definition of a project recreational facility because the Districts would be building this facility at an existing project recreational development, and it is at a central location where project visitors can obtain information about the project. Regarding BLM's recommendation for categorizing the restroom at Ward's Ferry as a developed multi-use recreational facility, Ward's Ferry consists of a single vault restroom and does not have tables, grills or other such site amenities, and consequently fits within the Districts' category definition of a recreational area with limited facility infrastructure. The Districts' proposed plan includes provisions to address new recreation needs within the project boundary as they evolve throughout the term of the license. This includes reconstructing worn and outdated facilities, especially restrooms that do not meet accessibility requirements, during the license term. Without providing for recreation facility reconstruction during the license term, project

visitor needs and expectations are not likely to be met in the future, and it is uncertain when project facilities would comply with accessibility requirements.

The proposed non-motorized trail would provide access to the La Grange Project, but the proposed route traverses land within the Don Pedro Project boundary owned by the Districts and public land managed by BLM. Although the trail is proposed as a La Grange Project facility, we conclude that the trail should be included in the license for the Don Pedro Project because (1) the trailhead location would serve visitors to the Don Pedro Project; (2) it would avoid overlapping project boundaries; and (3) much of the proposed route coincides with a road the Districts use to access the Don Pedro spillway. Identifying the development of the proposed non-motorized trail in the RRMP and specifying the Districts' responsibility for their operation and maintenance would ensure adequate and safe public shoreline access. Because the proposed route passes near project infrastructure, signage, fencing, and gates, diverting use away from project features should be incorporated into the trail design to address project security and public safety concerns. The Districts' proposed new boat launch near old Don Pedro Dam would be a project recreational facility but its location, design concepts and provision for operation and maintenance are not provided in the RRMP. Additionally, flow rates are currently not publicly available. This affects the public's ability to plan flow-dependent recreational activities and know when minimum flow levels will occur. However, sources outside the project, such as irrigation withdrawals, also affect flow levels.

Therefore, we recommend the Districts modify the RRMP for the Don Pedro Project (Districts, 2017a, appendix E-7), in collaboration with BLM to include: (1) installation of signs, fences, and gates, where appropriate, along the Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail; (2) a description of the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term; (3) a description of the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years; (4) a provision to invite BLM and other interested parties to an annual coordination meeting to discuss the management, public safety, protection, and use of project recreation facilities and resources; (5) conceptual drawings and descriptions of project recreation facilities, that are consistent with the outcome of design review by BLM, that would be constructed, reconstructed, or rehabilitated on BLM-managed land; (6) consultation with BLM to design visitor use surveys, to ensure data are collected about topics relevant to visitor use of project facilities on BLM-managed lands; (7) designation of the Fleming Meadows Visitor Center as a project recreational facility and a description of its operation and maintenance; (8) identification of the access designation (i.e., public versus non-public) of adjacent non-project lands on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land; (9) specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as "high impact sites"; (10) construction and maintenance of shoreline access trails on each side of Ward's Ferry Bridge to provide

suitable shoreline access for visitors, provide safe egress from the river for hand-carrying rafts, and reduce erosion and vegetation damage caused by user-created trails; (11) a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir; (12) consultation with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day) and making information on the planned boating releases and the minimum flow schedule available to the public; and (13) a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward's Ferry shoreline access trails, and reconstruction of project recreation facilities, including restrooms, that are currently in poor condition or do not meet accessibility guidelines, which includes proposed accessibility upgrades. The schedule should allow adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities. We estimate that the revised RRMP would have a levelized annual cost of $219,450, and the benefits to recreational resources would be worth the cost.

Woody Debris Management Plan

Woody debris that passes down the Tuolumne River to Don Pedro Reservoir under current conditions can be a boating hazard, and large concentrations of wood accumulating near Ward's Ferry Bridge can obstruct water surface and shoreline use. The Districts propose to implement their draft Woody Debris Management Plan, which calls for continuing the current practice of collecting woody debris on Don Pedro Reservoir in boom rafts that are anchored along the reservoir's edge, burning this material during fall and winter when reservoir levels are low, and informing BLM of its prior year actions in an annual memorandum.

BLM Don Pedro revised 4(e) condition 4 specifies that the Districts maintain a burn plan, prepared by BLM in coordination with the Districts, and approved by BLM, for any large woody debris stored and burned on BLM-administered lands and make all reasonable efforts to prevent large woody debris from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry. All Outdoors, OARS, Sierra Mac River Trips, Inc., American River Touring Association, ECHO: The Wilderness Company also recommend that the Districts manage woody debris on the reservoir to maintain access at Ward's Ferry Bridge and on the reservoir surface to maintain access and navigability.

Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects, Large Woody Debris Management* and *Recreation Management at Ward's Ferry Bridge*, problems associated with woody debris accumulation on Don Pedro Reservoir, including restricted access, impaired navigability, effects on public safety, and effects associated with delayed disposal would likely continue because the Districts propose to continue the existing practices. The Districts' plan states removal would be conducted to limit public safety hazard, but it does not state any objective for maintaining navigability. Additionally, accumulations of woody debris, topographic constraints, and the

availability of few suitable disposal areas located on public land create a need for a plan that considers BLM agency land management guidance and integrates BLM staff into planning debris disposal. Therefore, we recommend the Districts revise the Woody Debris Management Plan, filed October 11, 2017, to include provisions requiring the Districts to obtain and maintain a valid burn plan for any woody material stored and burned on BLM-administered lands and requiring the Districts to make all reasonable efforts to prevent woody material from interfering with navigability and accessible take-out areas for whitewater boaters at Ward's Ferry. Through this process, BLM would identify designated disposal sites and treatment descriptions and describe the coordination between the Districts and BLM to ensure appropriate staff from the relevant agencies are on-site during burn periods. In the draft EIS, we recommended the Districts also consult with FWS, BLM, the Water Board, and California DFW. However, following BLM's clarification that it prepares the burn plan with information submitted from the Districts, we no longer recommend requiring the Districts to consult with other agencies aside from BLM on this matter. We estimate that developing and implementing the plan would have a levelized annual cost of $10,300, and the benefits to recreational boating would be worth the cost.

Ward's Ferry Access and Facility Improvements

Forest Service (10(a) recommendation 1) recommends in part, that to minimize user conflict at river access sites, the Districts should provide trails from parking areas to picnic tables, fish cleaning stations, and areas with changing water levels. The Conservation Groups (recommendation 8-3) and All-Outdoors Whitewater recommends the Districts provide pedestrian access to the Tuolumne River at or near Ward's Ferry Bridge that is functional at all water levels, that minimizes conflicts with motorized vehicles, and that is sufficient to meet current and future needs.

Based on our analysis in section 3.3.5.2, *Recreation*, *Environmental Effects*, *Recreation Management at Ward's Ferry Bridge*, we recommend including the above trails in any license for the Don Pedro Project because the existing trails are steep with uneven footing, and whitewater boaters have an increasing distance to carry boats and equipment up to the road as the reservoir lowers. Having trails that are constructed to meet trail standards, including slope, width, and tread, would improve footing for boaters taking out at Ward's Ferry Bridge and reduce erosion potential. The trails would additionally provide shoreline access necessary to address various effects of reservoir fluctuations.

Non-motorized, Recreational River Boating

The Districts' proposed minimum flows and the slightly modified minimum flows included in the draft Voluntary Agreement, designed to benefit aquatic resources, would also increase the flows available for boating opportunities in the lower Tuolumne River. In addition, the Districts propose to provide weekend flow releases specifically to enhance non-motorized, recreational river boating on the lower Tuolumne River: (1) in

wet, above normal, and below normal water years, withdrawal of water at the infiltration galleries would cease for one pre-scheduled weekend in June to provide additional flow to the river downstream of the infiltration galleries (to be monitored below the proposed fish counting/barrier weir at RM 25.5); and (2) in all but critical water years, the Districts would provide a flow of 200 cfs at RM 25.5 for the three-day July 4 holiday, the three-day Labor Day holiday, and for two pre-scheduled additional weekends in either July or August. Park Service 10(a) recommendation 3 for the Don Pedro Project recommends scheduling the proposed 200-cfs boatable flow for the July 4 holiday on the 3-day weekend that occurs closest to the actual holiday,[260] as well as conducting any measures to remove water hyacinth that would render the river non-navigable well before the summer recreational flow season.

Minimum flow regimes recommended by the stakeholders for aquatic resources, as well as the operation of the infiltration galleries, would also affect the frequency of flows suitable for boating in the lower Tuolumne River. Based on our analysis of the percent of time flows downstream of the infiltration galleries would be at least 200 cfs, (see table 3.3.5-3 in section 3.3.5.2, *Recreation, Environmental Effects, Non-motorized, Recreational River Boating*), flows would be sufficient for boating in the lower Tuolumne River at least 87.5 percent of the time in wet and above normal water years under each of the proposed and recommended flow regimes. The Districts' proposed interim flow regime, which would be in effect until the infiltration galleries are operational, would provide boatable flows 100 percent of the time in below normal water years and 84.8 percent of the time in dry and critical years. After the infiltration galleries are operational, the frequency of boatable flows would be reduced to 79.3 percent of the time in below normal water years, 39.0 percent of the time in dry years, and 29.1 percent of the time in critical water years. Boatable flows would occur slightly more frequently under the flow regime included in the draft Voluntary Agreement, with boatable flows occurring 84.8 percent of the time in below normal water years, 52.8 percent of the time in dry years, and 42.4 percent of the time in critical water years. The flow regimes recommended by the Water Board and ECHO would both provide boatable flows ranging between 45.3 and 50.8 percent of the time in below normal, dry and critical water years, and the flow regimes recommended by NMFS, California DFW, and the Conservation Groups would provide boatable flows 100 percent of the time in all water year types. The flow regime recommended by The Bay Institute would provide boatable flows approximately 100 percent of the time in all but critically dry water years, when boating flows would be available 82.8 percent of the time.

Although the flow regimes recommended by NMFS, California DFW, and the Conservation Groups would provide the most boating opportunities, as discussed above in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Minimum Flows and Pulse*

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[260] The recommendation does not indicate a preference for providing flows on the preceding or succeeding weekend when the holiday occurs on a Wednesday.

Flows, increasing the amount of water in the Tuolumne River to benefit aquatic resources and boating conditions also decreases the amount of water available for agricultural operations and municipal and industrial use. All the flow regimes recommended by the resource agencies and NGOs would have 3 to 7 times the level of adverse economic impacts relative to the Districts' proposed interim flows and the flows included in the draft Voluntary Agreement, which would go into effect after the infiltration galleries are operational. NMFS's recommended flow regime would result in an annual loss 4 to 5 times greater, California DFW's recommended flow regime would result in an annual loss 6 to 7 times greater, and the flow regimes recommended by FWS, the Water Board, and the Conservation Groups would result in an annual loss 3 to 3.5 times greater than the Districts' proposed interim flows and the draft Voluntary Agreement flows. While the District's proposed interim flows and staff-recommended draft Voluntary Agreement flows would provide less boatable days than the other stakeholders' proposed flow scenarios, the Districts' interim and draft Voluntary Agreement flows would continue to meet both the Districts' irrigation demands as well as CCSF's domestic water supply needs and have the least economic impact. Therefore, we recommend including the Districts' proposed interim flows and staff-recommended draft Voluntary Agreement flows in any license issued for the Don Pedro Project.

Park Service 10(a) recommendation 3 to schedule the July 4th holiday boating flow releases on the weekend that is nearest to July 4th would align the event with a predictably higher recreational use period. This approach would enable more boaters to take advantage of suitable flows. Park Service does not specify when releases should take place when the holiday occurs on a Wednesday. Because it would be difficult to predict in advance which of the two weekends surrounding the holiday would generate the most use, the Districts should use their discretion for scheduling the event. We estimate that this measure would have no cost, and we recommend its inclusion as a license condition for any license issued for the Don Pedro Project.

Regarding Park Service 10(a) recommendation 3 to conduct any measures to remove water hyacinth well before the summer recreational flow season, no measures have been proposed or recommended to require water hyacinth removal as a condition of any licenses issued. Although the Districts proposed in their amended final license application to provide funding to California DFW to support water hyacinth removal, this measure was withdrawn when the Districts agreed to fund the LTRHIP, and no other parties have recommended requiring water hyacinth removal as a license condition. Therefore, there is no need to include a condition specifying the timing of measures to remove water hyacinth.

The Districts also propose to install a new boat take-out/put-in facility at RM 25.5, at the location of the proposed fish counting/barrier weir. Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects, Non-motorized, Recreational River Boating*, the proposed facility would not be needed because we are not recommending the proposed fish counting/barrier weir.

Transportation System Management

The Districts use roads and trails crossing public and private lands to operate and maintain the projects and for public recreational access and propose to continue implementing the existing Don Pedro License Article 17,[261] which requires them to annually notify BLM of the location and type of any road maintenance projects on BLM-managed land and, if necessary, convene a meeting to discuss these projects. BLM Don Pedro revised 4(e) condition 16 specifies that the Districts develop a Transportation System Management Plan for BLM approval. Tuolumne County recommends the Districts meet with the county to discuss assisting with improvements to Ward's Ferry Road and the intersection of County Road J-59 and Bonds Flat Road.

Based on our analysis in section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects, Transportation System Management*, we conclude that under the Districts' proposal to continue implementing the existing Don Pedro License Article 17, expectations about maintenance standards and responsibilities for project roads among the various landowners and managing agencies would continue to be uncertain during the duration of any new license issued. Conversely, the provisions specified under BLM Don Pedro revised 4(e) condition 16 would clarify responsibilities, thereby reducing the number of roads that are in poor condition, improve the quality of public access, and reduce other effects of poor road maintenance such as erosion. As such, we recommend the Districts develop a transportation system management plan, as specified by BLM, at the Don Pedro Project that applies to all roads and trails that are necessary for project purposes in accordance with the Commission's 2006 policy statement on hydropower licensing settlements (FERC, 2006). To ensure proper annual and long-term maintenance of project roads and trails over the license term, the plan should also: (1) identify all roads and trails that are predominately used for project-related purposes; (2) demonstrate that each identified road is predominately used for project-related purposes and describe all non-project-related uses on each identified road; (3) develop condition assessments for each identified project road and trail; and (4) specify maintenance standards. We estimate that developing and implementing a modified version of BLM's plan, with the additional provisions recommended above would have a levelized annual cost of $45,300, and the benefits to transportation and environmental resources would be worth the cost. Regarding Tuolumne County's recommendation, the intersection of county-maintained roads J-59 and Bonds Flat Road is about 1.5 miles northwest of Don Pedro spillway, both roads are county roads used primarily for public purposes, and neither road meets the Commission's definition of a project road. The project use of

[261] This is the standard article in Form L-2 which states, "In the construction and maintenance of the project, the location and standards of roads and trails, and other land uses, including the location and condition of quarries, borrow pits, spoil disposal areas, and sanitary facilities, shall be subject to the approval of the department or agency of the United States having supervision over the lands involved."

these roads is considered incidental and project assistance to Tuolumne County to make road improvements would mainly serve non-project users. As such, we do not recommend including Tuolumne County's recommendation in any license issued for the Don Pedro Project.

Fire Prevention Plan

The Districts propose to implement a Fire Prevention and Response Management Plan to provide fire prevention procedures, reporting, and safe fire practices for Districts' personnel and contractors responsible for operating and maintaining the Don Pedro Project. The plan includes descriptions of the Districts' actions, responsibilities, and access related to wildland fire preparedness and reporting, including (1) equipment, vehicles, and tools for District staff and job sites; (2) fire index monitoring and activity curtailment, as appropriate; (3) debris burning; (4) vegetation clearance; (5) communication systems; (6) access routes, water sources, and helicopter landing areas; (7) fire investigation; (8) emergency contact information; and (9) fire safety signage at recreational facilities. BLM Don Pedro revised 4(e) condition 17 specifies implementing a version of the Districts' plan for the Don Pedro Project that includes revisions to include information such as fire history, references, analysis descriptions, permits, and use and storing of explosives. The revised version also requires BLM approval before filing with the Commission for its approval.

Based on our analysis in section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects, Fire Prevention and Response*, we conclude that the Districts' plan would not ensure project activities are conducted in accordance with agency requirements. BLM Don Pedro revised 4(e) condition 17, which includes consultation with BLM to finalize and approve the plan, would likely meet BLM's objective for the plan to describe processes for obtaining authorizations and approvals and the requirements necessary to adhere to BLM fire restriction orders. Although, as noted in our analysis, some of the content of BLM's fire plan would create difficulty for determining compliance, we expect some of this content would be corrected during consultation with BLM to finalize the plan or, if necessary, in response to Commission plan review comments prior to plan approval. Adopting BLM Don Pedro revised 4(e) condition 17 would likely address BLM's concerns about permitting and coordination; therefore, we recommend adopting this agency condition. We estimate that finalizing the plan in consultation with BLM and implementing the plan would have a levelized annual cost of $2,300, and the benefits to environmental resources would be worth the cost. Additionally, because the threat of wildland fire also exists at the La Grange Project, we further recommend the Districts develop a similar separate fire prevention and response management plan for the La Grange Project. We estimate that developing and implementing the plan would have a levelized annual cost of $2,300, and the benefits to environmental resources would be worth the cost.

Visual Resources Management Plan

Aesthetic effects related to new construction could change the appearance of project infrastructure as could disturbances caused by future maintenance activities related to new construction, such as vegetation removal. The Districts do not propose any specific measures to manage visual resources at either project. However, the Districts state in their amended final license application for the Don Pedro Project, they will adhere to BMPs and consult with BLM during the planning and construction of the extended riprap on Don Pedro Dam and regarding the proposed off-license boating access platform immediately upstream of Ward's Ferry Bridge, to minimize impacts to BLM aesthetic resources, and ensure conformance with BLM aesthetic resources goals. BLM Don Pedro revised 4(e) condition 18 specifies that within one year of any license issued for the Don Pedro Project, the Districts develop a visual resources management plan on BLM-administered lands that are within the FERC project boundary.

Based on our analysis in section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects, Visual Resource Management*, the small number of existing project facilities situated within BLM-administered land are not inconsistent with the visual resource management parameters associated with the BLM land on which those facilities are located. We also conclude that the proposed extension of riprap on the upstream face of Don Pedro Dam could affect the existing visual appearance at the project; however, it is not on BLM land and any potential associated visual impacts would likely occur infrequently. However, in section 3.3.6.2, we conclude that the Districts' proposed measures are inadequate because they do not provide for BLM approval of the plan, nor do the Districts address effects of proposed new facilities or future maintenance activities for new facilities (e.g., painting infrastructure at the proposed Ward's Ferry take-out). Therefore, we recommend the Districts develop a visual resources management plan for the Don Pedro Project as specified by BLM, to include, at a minimum, a description of the materials and color of the materials to be used in construction of the new take-out facilities, to ensure the new facilities blend with the existing environment and minimize any effects on visual resources. We estimate that the plan would have a levelized annual cost of $1,300, and the benefits to visual resources would be worth the cost.

Historic Properties Management Plan

Continued operation, recreational use, new construction, and mitigation measures associated with other environmental resources that would be included in any new licenses issued for the projects could affect cultural resources listed in or eligible for inclusion in the National Register. The Districts filed separate HPMPs for the Don Pedro and La Grange Projects and propose to manage project effects on historic properties through the implementation of these HPMPs. BLM Don Pedro revised 4(e) condition 15 and La Grange preliminary 4(e) condition 7 specify that upon Commission approval, the Districts must implement the respective HPMPs.

Based on our analysis in section 3.3.7.*2, Cultural Resources, Environmental Effects, Historic Properties Management Plans*, we conclude the Districts' HPMPs provide measures that are consistent with the Advisory Council and Commission's 2002 guidelines. However, the process for dispute resolution detailed in the HPMPs place specific requirements on the Commission, including requirements to respond to disputes within a specified period of time. While this process is not unreasonable, it does not mirror the plan for dispute resolution that is found in the Commission's PAs for hydroelectric projects; as a signatory to the PA, the Commission must follow the process that will be provided in the PA.

We estimate the HPMPs would have a levelized annual cost of $201,500 for the Don Pedro Project and $8,030 for the La Grange Project, and the benefits to cultural resources would be worth the cost.

5.1.3 Other Measures Not Recommended by Staff

In addition to those measure discussed in the previous section for which staff-recommended alternatives or modifications, staff concludes that some of the measures proposed by the Districts or recommended by other interested parties would not contribute to the best comprehensive use of the Tuolumne River water resources, do not exhibit sufficient nexus to project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following section presents the basis for staff's conclusion not to recommend those measures.

Additional Consultation and Review

FWS 10(j) recommendation 12 for the Don Pedro Project and FWS 10(j) recommendation 11 for the La Grange Project, California DFW 10(j) recommendation M3-1, and Conservation Groups recommendation 3 recommend and BLM 4(e) condition 9 specifies the formation or reestablishment of an ecological group for the Don Pedro Project that would meet annually to review federally listed and special-status species (FWS 10(j) recommendation 8), assess newly added species occurring on federal land, and consult with agencies on the effectiveness of implemented license conditions. BLM 4(e) conditions 6 and 32 for the Don Pedro Project also specifies that during the annual meetings, the Districts should discuss any activities related to aquatic invasive species management as well as submit a request for approval of planned use of pesticides for the upcoming year. FWS 10(j) recommendation 11, California DFW 10(j) recommendation M3-1, and Conservation Groups recommendation 3 made similar recommendations and BLM 4(e) condition 6 made similar specifications for the La Grange Project.

As indicated in our analysis in sections 3.3.2.2 *Aquatic Resources, Environmental Effects,* and 3.3.3.2, *Terrestrial Resources, Environmental Effects,* consultation prior to new construction and non-routine maintenance would help protect federally listed species and their habitats over the term of the license; however, we see no specific project-related purpose that would be served by requiring a generic provision for ongoing consultations and review in order to ensure compliance with applicable environmental statutes, such as

the ESA. If ESA issues arise during the term of the license, either based on new listings or availability of new information, post-licensing procedures developed by the Commission and resource agencies (FERC et al., 2000) provide a framework for identifying issues, information gaps, and the need for additional protection measures. Any license issued would contain a fish and wildlife reopener article that could be used to require changes to project facilities or operations upon Commission motion, or as recommended by the state or federal fish and wildlife agencies, after notice and opportunity for hearing. This standard reopener retains authority for the Commission to implement any measures that may be needed to protect threatened or endangered species or other fish and wildlife resources over the term of the license. We also assume that any licensee would be responsible for complying with all federal and state environmental laws, and a license article is not needed to require that compliance. Additionally, the Districts' proposed plans and any additional plans recommended by staff would require agency review and consultation for development of plans and associated reports, prior to filing with the Commission for approval. Implementation of an annual ecological group meeting would be redundant because there would already be mechanisms for agency consultation on a multitude of plans, and it is unclear how the meeting would provide additional benefit to environmental resources within the projects. We conclude that the benefits of an annual consultation meeting and annual review of sensitive species lists are not worth the estimated levelized annual cost of $29,000 because it would duplicate other ongoing consultations. Therefore, we do not recommend including these requirements as part of any licenses issued for the projects. However, we recognize these annual review and consultation measures are included in BLM revised 4(e) conditions 9 and 12 for the Don Pedro Project and in BLM preliminary 4(e) condition 6 for the La Grange Project and therefore would be included as mandatory conditions in any licenses issued for the projects.

Annual Training

Project operation and maintenance activities could require Districts' staff to deal with invasive species or with sensitive resources. To minimize potential for inadvertent effects, the Districts propose to provide routine environmental training for employees. The Districts' proposed TRMP includes protocols for environmental training of project staff and contractors once every two years for the term of the license. This biennial training would include information about the recognition of high-priority invasive or noxious weed species, emphasizing the Districts' noxious weed prevention guidelines and reporting procedures to document any infestations. Additionally, the Districts' proposed TRMP would provide for employee training on western pond turtle identification, with the requirement that incidental observations of western pond turtle by staff and contractors must be recorded, assembled, and made available to BLM and California DFW as part of an annual consultation memo. BLM 4(e) condition 2 for both projects specifies annual employee awareness training to familiarize District staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to the project boundaries. FWS 10(j) recommendation 10 for the Don

Pedro Project and 10(j) recommendation 9 for the La Grange Project also include annual employee awareness training at part of the recommended bald eagle and special-status bird management plans for each project. California DFW (10(j) recommendation M9-1.6 and M9-4.1) recommends annual employee awareness training. There is no justification for this measure. Licensees must comply with the license requirements, including those requirements intended to protect special-status species, and it is the licensee's responsibility to take the necessary steps to comply, including deciding what training they need to provide their employees. We have no basis to conclude that the Districts would be incapable of complying with license requirements intended to protect special-status species. Therefore, we do not recommend incorporating stand-alone training as a license condition, which we estimate would have an annual levelized cost of $2,000 for each project. This measure, however, would be required by BLM 4(e) condition 2 and would be included as a mandatory condition in any licenses issued for the projects.

Coordinated Operations Plan

California DFW 10(j) recommendation M3-2 recommends that the licensees develop a coordinated operations plan to provide for coordination of environmental requirements and actions (i.e., flood control, water storage, and water diversion) between the Districts and other hydroelectric facilities in the San Joaquin River Basin. The coordinated operations plan would include: (1) a list of other participating projects and operators; (2) a description of the roles and responsibilities of participating projects and operators; (3) a list of coordination goals and objectives; (4) a description of the extent of ability to cooperate and coordinate flood control, water storage, and water diversion with other hydroelectric facilities of the San Joaquin River Basin; (5) a description of the roles and responsibilities related to the STM Work Group organized by the Water Board; and (6) a list of voluntary actions aimed at increasing effectiveness of actions, monitoring, and data synthesis.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Coordination of Project Operations*, developing a coordinated operations plan would not be necessary to assure efficient and timely implementation of future license conditions. Furthermore, the measure recommended by California DFW would put the responsibility on the Districts to develop a plan to facilitate coordination of operations among multiple projects and entities in a large river basin that cover a wide range of project purposes, many of which are outside of the Commission's jurisdiction. As noted by the California DFW, the Water Board is considering the establishment of STM Work Group as part of the update to the 2006 Bay-Delta Plan. The Districts' voluntary participation in this type of regional planning effort would be better suited to address basin-wide coordination associated with the range of project purposes identified by California DFW in its recommendation. Therefore, we conclude that development of a coordinated operations plan is not worth the estimated levelized annual cost of $11,180, and do not recommend including this measure as part of any licenses issued for the projects.

Tuolumne Partnership Advisory Committee

On October 2, 2018, FWS filed revised Don Pedro 10(j) recommendation 2 (Spill Management Plan), revised 10(j) recommendation 3 (LTRHIP), and revised 10(j) recommendation 4 (Creation of the TPAC), and withdrew their original 10(j) recommendations 2, 3, 4, and 7 for both the Don Pedro and La Grange Projects. FWS states that this filing resulted from meaningful discussions between the FWS and the Districts subsequent to the January 29, 2018, FWS filing of comments in response to the REA notice. On October 17, 2018, the Districts filed a response to the FWS October 2, 2018, filing. The Districts support the withdrawal of 10(j) recommendations 2, 3, 4 and 7 for both the Don Pedro and La Grange Projects, and support FERC's adoption of the revised 10(j) recommendations 2, 3, and 4 for the Don Pedro Project. We consider FWS's revised 10(j) recommendations 2, 3, and 4 to now be part of the Districts' proposal for the Don Pedro Project.

While creation of the TPAC is included as a separate 10(j) recommendation,[262] FWS envisions the TPAC would be involved in guiding implementation of revised 10(j) recommendation 2 (Spill Management Plan) and revised 10(j) recommendation 3 (LTRHIP). As we describe in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Spill Management Plan*, the Districts would seek recommendations on implementation of the spill management plan from the TPAC. The TPAC would meet monthly or more frequently starting in the first January after any license issuance on or about the 10th of each month to review the Districts' projections of potential spills and discuss use of any identified spill volumes. Further, under 10(j) recommendation 3, habitat improvement projects would be prioritized and recommended to the Districts by the TPAC (see section 3.3.2.2, *Aquatic Resources, Environmental Effects, Floodplain Habitat Restoration*). While the concept of an interagency committee to guide the implementation of a spill management plan and LTRHIP is reasonable, the Commission has no authority to require other agencies to participate in such a committee, and we therefore do not recommend the TPAC. Instead, we recommend that the Districts consult with appropriate federal, state, and local agencies in preparation of the spill management plan and the LTRHIP.

Fish Enumeration and Predator Control

Although not a requirement of the existing license, the Districts have operated a temporary adult salmon counting weir at RM 24.5 during the upstream migration season since 2009. As part of a new license for the project, the Districts propose to construct and operate a small permanent fish counting/barrier weir (less than 5 feet of head at normal flows) at approximately RM 25.5, to enumerate upstream migrating Chinook salmon, allow for broodstock collection, and exclude predatory striped and black bass from migrating into upstream habitats. To further reduce predation on Chinook salmon

[262] TPAC would at a minimum include the Districts, FWS, and CCSF, but other agencies such as NMFS and California DFW would be invited to participate.

by striped and black bass, the Districts propose to implement a predator control and suppression plan that would include active control and suppression of striped bass and black bass upstream and downstream of the proposed fish counting/barrier weir. Control and suppression measures would include, but would not be limited to fishing derbies, reward-based angling, public outreach programs in local communities to promote fishing for black bass and striped bass, and educational programs in locations above and below the fish counting/barrier weir, and removal and/or isolation via electrofishing, seining, fyke netting, and other collection methods.

In its letter filed January 29, 2018, NMFS states that the Districts' proposed predator control suppression plan is not beneficial to salmonids and does not address the problem that juvenile salmonids have very little floodplain refugia in the lower Tuolumne River and that predator fields (e.g., SRPs) are maintained by projects' flows and sediment retention. While NMFS does not recommend any specific predator control measures, it states that the flow and habitat measures included in its 10(j) recommendations are intended to improve habitat and reduce predation. These measures include substantially increasing springtime flows to expedite smolt outmigration, increasing base flows to make water temperatures less suitable for predatory fish, implementing large-scale gravel augmentation to help to fill in the SRPs, implementing floodplain activation flows to increase access to floodplain refugia, and augmenting LWM to provide structural habitat partitioning to provide protection from predation.

California DFW 10(j) measure M6 recommends the Districts revise their proposed predator control and suppression plan to include: (1) recommendations for shaping spring pulse flows, recession flows, and how to best meet temperature requirements consistent with requirements of CWA § 303(d) that favors native fish and dissuades non-native predatory fish; (2) recommendations, priorities, and conceptual designs that would be used to conduct the annual placement of sediment and LWM to minimize predator habitat and to favor cover habitat for salmonids; (3) monitoring activities that can be readily incorporated in other required monitoring activities conducted by the Districts and members of the TREG; and (4) performance measures and monitoring actions to evaluate the outcomes of any recommendations from the revised predator control and suppression plan that are incorporated into on-going FERC required measures. The Conservation Groups commented that they strongly oppose the installation of a permanent fish counting/barrier weir, but support installation of a temporary seasonal fish counting weir and a temporary weir to capture striped bass and black bass in critically dry and super critically dry water years only. Conservation Groups (recommendation 7) recommends that the Districts: (1) annually install a fish counting weir at or near RM 24, from September 15 through at least December 31, with the same basic configuration as the facility that the Districts have deployed since 2009; (2) install a temporary weir in critically dry and super critically dry years, from no later than April 15 to September 1, between RM 25.9 and RM 25 for the purpose of capturing and removing striped bass, black bass, and other non-salmonid predatory fish, with no permanent infrastructure related to the weir; (3) relocate striped bass captured at the temporary weir to San

Francisco Bay, and black bass and other warmwater predatory fish to reservoirs where salmonids are not present and are isolated from the Tuolumne River or other salmonid-bearing waters; and (4) conduct two snorkel surveys between April 20 and June 30 in any year that the weir is installed, both 300 feet upstream and downstream of the temporary weir, as well as monitor the numbers, species and size of fish captured at the weir. In addition, some members of the public who offered oral testimony at the evening public draft EIS meeting held in Modesto, California on March 26, 2019, were local anglers who spoke in opposition to the removal of predatory fish, especially lethal removal.

In the draft EIS, we stated that while the above measures would likely reduce predator abundance in the lower Tuolumne River, and theoretically decrease the amount of predation on juvenile Chinook salmon, it was not known if they would have a measurable project-related benefit to Chinook salmon or *O. mykiss* based on the apparent ineffectiveness of a predator removal program conducted at Clifton Court forebay in the Bay-Delta (California DWR, 2017). Because construction of a fish counting/barrier weir may not achieve its desired objective to exclude predators, while at the same time may result in additional adverse effects on anadromous salmonids, we did not recommend the Districts construct and operate their proposed permanent fish counting/barrier weir at RM 25.5 as a requirement of any license issued. We also did not recommend the measures recommended by the Conservation Groups related to predator control.

In our re-assessment of this issue for the final EIS, we considered the Districts' response to comments on the draft EIS filed on August 16, 2019, which identified several large-scale management programs that are currently being implemented in North America to remove or suppress predatory fish to benefit native fish species and several studies that examined survival responses of Chinook salmon to non-native fish removal in California. The Districts also attached a summary of these programs and studies to their comments on the draft EIS, along with links to multiple sources of information on each program. We also reviewed a recent study entitled "*Limitations of Active Removal to Manage Predatory Fish Populations*" (Michel et al., 2020), which was filed into the record by the Tuolumne River Trust on February 12, 2020. The study was conducted during 2014 and 2015 along a 25-km reach of the San Joaquin River from approximately the highest extent of tidal influence near Mossdale, California, downstream to the Port of Stockton, California. Based on the results of radio tag and predator event recorder monitoring, the authors concluded that the study provided little evidence that reach-specific predator density manipulations affected smolt survival or predation rates, and that further studies are needed to determine the conditions under which physical predator removals could be an effective management tool in the Sacramento–San Joaquin Delta. However, based on issues that we note with the methodology used in the study, the results of this study do not necessarily suggest that the predator control and suppression program proposed by the Districts would be ineffective.

The Districts also note in their comments filed on November 19, 2019, in response to discussion of predation that occurred at the September 19, 2019 10(j) meeting and the Commission staff summary of the meeting, that predation on Chinook salmon smolts in

the Tuolumne River has been identified as a substantial issue by the agencies represented at the meeting. They note that NMFS's filing of terms and conditions state that one of the primary purposes of its section 10(j) recommendations is to reduce predation, and that California DFW's 10(j) recommendation 6 includes a suite of flow and non-flow measures intended to reduce predation and increase juvenile salmon survival. While FWS does not propose a specific predator control plan in its filing of revised 10(j) recommendations, it acknowledges that the Districts' predation management strategy, including a fish counting/barrier weir and predator control and suppression measures, would be beneficial if the predation rate reductions anticipated by the Districts were achieved, and FWS committed to "participate with the License applicants to provide technical assistance as they undertake and refine their predation management strategy." In their comments filed on November 19, 2019, the Districts also note that California DFW's and NMFS's leadership have stated in public testimony the importance of addressing predation in the Tuolumne River.

In response to these filings, we reevaluated our assessment and conclusions made in the draft EIS, and reviewed fish production modeling results filed by the Districts in response to staff's September 17, 2019, AIR. Those modeling results indicate that reducing predator populations by 20 percent upstream of the fish counting/barrier weir and by 10 percent downstream of the weir would result in a 63 to 66 percent increase in the number of Chinook salmon smolts produced per female spawner. These results also indicate that given the potential magnitude of the relative benefits to Chinook salmon from reducing the population of predatory fish, the benefits of the Districts' proposed predator control measures may outweigh any adverse effects associated with the weir (as a potential impediment to salmonid migration) if the congregation of predatory fish below the weir can be minimized.

However, anglers who offered oral testimony at the public meeting were uniformly opposed to the removal, especially lethal removal, of predatory fish as part of the Districts' proposed predator suppression and control plan. Opposition by anglers may be reduced if fish that are removed from the river could be transferred to local water bodies such as Turlock Lake or Modesto Reservoir to augment the fisheries in those waters, although this would be a fisheries management decision that would need to be made by California DFW. Anglers may also be more accepting of removal via sponsoring and promoting black bass and striped bass derbies and reward-based angling compared to other means of removal. These events could help to improve public awareness of the adverse effects of non-native predatory fish on native species, although again these would be fisheries management programs for areas targeted well downstream of the project and unrelated to project effects. While reward-based angling could be particularly effective at addressing predator aggregation downstream of a fish counting/barrier weir and thus enhance certain existing fishery resources, this activity would occur on non-project waters many miles downstream of the project.

The temporary weir recommended by the Conservation Groups for installation in critically dry and super critically dry years for the purpose of capturing and removing

striped bass, black bass, and other non-salmonid predatory fish would only prevent the upstream migration of non-native predatory fish while it is in place, while a permanent weir would provide the potential for their eventual elimination from habitat upstream of the weir. Regarding their recommendation to relocate striped bass captured at the temporary weir to San Francisco Bay, we agree with the Districts that this would provide little benefit because salmon smolts from the Tuolumne River are subject to predation in the bay, and there is nothing to prevent the translocated fish from migrating back into the Tuolumne River. However, as noted above, any predator control and disposition of predatory game fish would take place well downstream of the project, and therefore, would not relate to specific project purposes. In addition, we conclude that we have recommended a sufficient amount of fishery resource enhancement at and proximal to the project such that there is no justification for recommending additional license conditions for predatory control at an annualized cost of $1,502,200. Accordingly, we do not recommend these measures, including construction of a fish counting weir at RM 25.5, as requirements of any license issued. Nevertheless, fishery management decisions on these non-project waters are under the authority of state and federal fish and wildlife agencies, and although we do not recommend license requirements for predatory game fish control at these downstream locations, the Districts could still voluntarily assist the state and federal agencies with predator control activities.

Regarding California DFW's recommended revisions to the predator control and suppression plan, the elements that it recommends are already incorporated into the measures that we recommend. Spring pulse flows would be adaptively managed in coordination with the fisheries agencies, placement of gravel and LWM (as part of the LTRHIP) would be conducted via implementation plans to be developed in consultation with the fisheries agencies, and increased base flows would provide water temperatures that are less favorable to non-native predatory fish. These same measures incorporate most of the 10(j) measures that NMFS states are intended to improve habitat and reduce predation, although we do not recommend the same volume of flows, gravel, and LWM augmentation that NMFS recommends. The justification for our recommendations is provided within section 5.3.2.1, *Rationale for Additional Staff-recommended Measures and Modifications, Minimum Flows and Pulse Flows, Coarse Sediment Management*, and *Floodplain Habitat Restoration*, which includes the LTRHIP.

Fish Stocking and Associated Plans

California DFW stocks trout in Don Pedro Reservoir, while DPRA stocks largemouth bass. No known fish stocking has occurred in the reach of the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam, and no local hatchery supplementation occurs in the reach of river downstream of La Grange Diversion Dam. However, hatchery-raised fall-run Chinook salmon from other San Joaquin River tributaries often stray into the Tuolumne River and crossbreed with native Tuolumne River fall-run Chinook salmon.

To genetically manage the Tuolumne River fisheries, California DFW (10(a) measure M7-1) recommends the Districts develop a fisheries genetic management plan for both projects, in consultation with TREG, as well as a conservation hatchery plan (10(a) measure M7-1). Furthermore, California DFW 10(j) recommendation M7-2 recommends that to mitigate lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities the Districts assume full responsibility for providing reservoir-based recreation, including angling opportunities, at both projects' reservoirs, which are currently or have historically been stocked by California DFW.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Fish Stocking*, we note that California DFW's recommendation is intended to mitigate for lost recreational stream fishing opportunities and to maintain or improve project-induced recreation opportunities. However, the fishery in Don Pedro Reservoir offers substantial recreation opportunities, and there is little basis for requiring the Districts to improve the fishery or to assume the responsibility for stocking the reservoir. Therefore, we do not recommend California DFW's recommended Don Pedro Reservoir fish stocking, which we estimate would have an annual levelized cost of $140,000, be included as a requirement of any license issued for the Don Pedro Project. Regarding California DFW's recommended fisheries genetic management plan and conservation hatchery plan, these recommendations do not contain specific details regarding the contents of their plans or their nexus to the Don Pedro Project. Consequently, we do not recommend California DFW's recommended fisheries genetic management plan and conservation hatchery plan, which we estimate would have a combined annual levelized cost of $1,090,300, be included as a requirement of any licenses issued for either project.

Fish Entrainment

Fish entrained through powerhouses may be subjected to injury or mortality during turbine passage, or may be redistributed into irrigation canal systems, and this entrainment may affect the species composition and recruitment of fish to the reaches both upstream and downstream of the diversion facilities.

The Districts do not propose any measures to reduce the entrainment potential of their facilities. California DFW 10(j) measure M8-1 recommends that the Districts develop a facilities salmonid protection and monitoring plan for both projects, that includes provisions for: (1) assessments of all diversions from the Tuolumne River and of all gates where the Districts' canal systems enter the San Joaquin, Merced, Tuolumne, and Stanislaus River for potential access by salmonids; (2) proposed solutions to prevent salmonids from accessing the diversions and canal systems; (3) a monitoring program to determine entrainment rates at the diversions and canal systems at locations where return flow is spilled; (4) a reporting plan for annual and incidental notification requirements; and (5) a financial assurance plan to provide for the implementation of the facilities salmonid protection and monitoring plan.

FWS 10(j) recommendation 12 recommends the Districts develop a fish rescue plan for the La Grange Project that would include provisions for rescuing fish that are entrained into the MID Diversion Tunnel from April 1 through June 15 and tagging and releasing rescued fish into the Tuolumne River downstream of La Grange Diversion Dam. The measure would also require the Districts to perform rescues weekly until 10 or more fish are rescued during a rescue attempt, after which, rescue attempts would be performed daily. Rescue attempts could return to a weekly frequency when 10 or fewer fish are rescued per day and could cease entirely for the remainder of that year, if by May 16 less than 2 fish per day are rescued, for 3 consecutive sampling dates.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Fish Entrainment*, we conclude there is little need for a facilities salmonid protection and monitoring plan, as recommended by California DFW for both projects. California DFW states that the objective of its 10(j) recommendation M8-1 is to create the conditions necessary for healthy resident trout and anadromous salmonid populations throughout the Tuolumne River to achieve self-sustaining, viable populations. However, there are no anadromous species upstream of La Grange Diversion Dam, so anadromous species would not be exposed to entrainment at Don Pedro Dam or La Grange Diversion Dam. While resident trout and other species in Don Pedro Reservoir may be entrained through the power tunnel, considering the low number of fish occurring in deep water and susceptible to entrainment, operating the Don Pedro Powerhouse is not likely to adversely affect populations of resident trout and other species of fish in Don Pedro Reservoir. Additionally, resident fish species collected by the Districts in the Tuolumne River between Don Pedro Dam and La Grange Diversion Dam exhibited multiple age classes, indicating successful reproduction and population sustainability in this reach. Furthermore, Tuolumne River salmon do not ascend past the La Grange Dam so anadromous fish cannot enter the canal systems via the TID/MID intakes at the La Grange Diversion Dam. Salmon can, however, enter the MID and TID canal systems through other diversions along the lower river. However, the MID and TID canal systems are used for water supply, are non-project facilities not associated with hydropower generation, and extend well beyond the La Grange Project boundary. Furthermore, the MID canal system is also connected to the Stanislaus River, which may allow salmonids access to the canal completely independent of La Grange Project operations or conditions in the Tuolumne River. Additionally, 26 non-project diversions, owned by a variety of entities, are located downstream of the La Grange Diversion Dam to the Tuolumne River's confluence with the San Joaquin River. Therefore, we do not recommend including California DFW's recommended facilities salmonid protection and monitoring plan, which we estimate would have an annual levelized cost of $75,000, or FWS's recommended rescue plan, which we estimate would have an annual levelized cost of $150,000, in any licenses issued for either project.

Anadromous Fish Passage and Reintroduction

Barriers to upstream fish passage can be natural or human-caused and often delay migrations and movements, fragment populations, or prevent access to critical habitat necessary to sustain populations. Under existing conditions, both La Grange and Don Pedro Dams completely block upstream fish migration and impede downstream fish passage. Historic accounts indicate salmon were present in the upper Tuolumne River, perhaps as far upstream as Preston Falls, and in the lower Clavey River.

The Districts do not propose to evaluate or provide fish passage facilities at La Grange and Don Pedro Dams; however, the Districts did implement a series of workshops and technical studies (required and voluntary) during the Integrated Licensing Process to evaluate the feasibility of reintroducing spring-run Chinook salmon and steelhead to the upper Tuolumne River.

In its preliminary section 18 fishway prescription, NMFS reserves its authority to prescribe the construction, operation, and maintenance of fishways at the projects, including measures to determine, ensure, or improve the effectiveness of such prescribed fishways, pursuant to section 18 of the FPA. NMFS (10(j) recommendation 5) recommends the Districts develop a fish passage program plan for providing safe, timely, and effective passage of juvenile and adult fish at the projects. To ensure that fishway design and operations can best accomplish safe, timely and effective fish passage, NMFS recommends the development of a phased fish passage program plan that assesses the feasibility and design of fishways and procedures for effective up and downstream passage. The fish passage program plan would include several fish passage actions that are intended to proceed in phases and use an adaptive management approach. The ultimate goal is to create facilities and operations that provide successful fish passage. The main phase consists of short-term actions within seven years from the issuance of licenses. Within this phase, actions could occur concurrently as new information is gained, evaluated, and adaptively managed. These short-term actions are outlined in table 3.3.2-47. In their recommendation 2, the Conservation Groups advocate that NMFS should reserve its FPA section 18 authority to require fish passage for spring-run Chinook salmon and possibly steelhead to the upper Tuolumne River after 2025.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Anadromous Fish Passage/Reintroduction*, we conclude that both La Grange and Don Pedro Dams completely block upstream access to as much as 18.17 miles of accessible and 31.26 miles of potentially accessible anadromous fish habitat in the upper Tuolumne River Basin, and also prevent or impede downstream fish passage. Upstream passage would be feasible at La Grange Diversion Dam via a CHTR facility evaluated by the Districts in its pre-application studies. CHTR represents a relatively proven technology, with numerous similar facilities in operation that, in general, exhibit high overall fish passage performance characteristics meeting resource agency performance criteria. When sited and designed to accommodate the unique site-specific conditions exhibited at La Grange Diversion Dam, this alternative would likely meet performance

criteria. The feasibility of providing successful downstream passage, however, is less likely. One alternative that is currently in use at other hydroelectric projects (a floating surface collector, which could be deployed near Don Pedro Dam) would not be likely to provide safe, timely or effective downstream fish passage for out-migrating anadromous salmonids. The high head of the dam combined with the dramatic (i.e., up to 213 feet) fluctuations in reservoir surface elevation in Don Pedro Reservoir and associated seasonal changes in temperature and velocity, along with an abundance of predator fish in the reservoir, would create challenging conditions for fish collection. No existing forebay collection facilities currently operate under such dynamic conditions, and operation of a juvenile downstream collection facility at the head of the reservoir (a second alternative) would similarly be challenging and experimental in nature (HDR, 2017e). Inflows ranging from about 100 to 10,000 cfs during the outmigration period, unstable channel conditions, and an existing Wild and Scenic River designation immediately upstream would likely prohibit the construction and operation of a permanent in-river collector upstream of Don Pedro Reservoir.

Given the technical challenges that would need to be overcome to provide effective downstream passage past the project reservoirs, we consider it to be highly unlikely that implementing NMFS's recommended fish passage program plan would lead to the establishment of viable populations of anadromous salmonids in the upper Tuolumne River Basin. Therefore, we conclude that development and implementation of NMFS's recommended fish passage program plan is not worth the estimated levelized annual cost of $412,230 (split equally between the two projects; $206,110 each) and do not recommend including this measure as part of any licenses issued for the projects. However, any licenses issued would include an article reserving NMFS's authority to prescribe the construction, operation, and maintenance of fishways at the projects, pursuant to section 18 of the FPA.

Salmonid Monitoring

NMFS recommends (10(j) recommendation 4) that the Districts develop a salmonid monitoring plan within the first year of any new licenses issued for the projects. The plan would cover resident and anadromous salmonids with the option for green sturgeon to be added to the plan once NMFS has determined their presence in the lower Tuolumne River. Under NMFS's plan, monitoring would include: (1) annual snorkeling, pre-spawning mortality, and carcass surveys in the following reaches (a) downstream of La Grange Diversion Dam to Basso Bridge (RMs 52.0 to 47.5), (b) from Basso Bridge downstream to Roberts Ferry (RMs 47.5 to 39.5), (c) from Roberts Ferry downstream to Santa Fe Bridge (RMs 39.5 to 36.3), and (d) from Santa Fe Bridge to the Tuolumne River's confluence with the San Joaquin River (RMs 36.3 to 0); (2) annual juvenile emergence and outmigration monitoring from at least mid-January through the end of May, using a paired RST at RM 5.3 (Grayson RST) and one at RM 29.8 (Waterford RST); (3) operation of a seasonal counting weir at RM 24.5 to estimate Central Valley Chinook salmon and California Central Valley steelhead escapement and provide data on

the percentage of females and migration timing; (4) annual otolith analysis to estimate the contribution of naturally produced fry-, parr-, and smolt-sized migrants to the adult population; and (5) supervision of all work by California DFW and NMFS field staff in consultation with TRTAC.

FWS recommends (10(j) recommendation 5) the Districts develop a salmonid monitoring plan in consultation with FWS, NMFS, California DFW, and the Water Board, within the first three years of any new licenses issued for the projects. Under FWS's plan, salmonid monitoring would include at a minimum: (1) measurement of fall-run Chinook salmon escapement by conducting annual carcass surveys, from October 1 through December 31; (2) morphometric measurements[263] of 100 percent of the Chinook salmon carcasses downstream of the existing seasonal fish counting weir at RM 24.5; (3) morphometric measurements of the first 500 Chinook salmon carcasses found upstream of the fish counting weir, plus morphometric measurements of 5 percent of the next 500 to 1,000 Chinook salmon carcasses found upstream of the fish counting weir; (4) annual paired RST surveys from February 1 through June 15 at RM 5.3 (Grayson RST) and at RM 29.8 (Waterford RST); (5) the operation and maintenance of the existing seasonal counting weir at RM 24.5; (6) snorkel surveys prior to each LWM placement action, within the area of the LWM placement and 10 meters upstream and downstream of the placement; two snorkel surveys should occur in the placement area following LWM placement (the first during the second week following placement and the second prior to spring flows returning to minimum instream flows in the calendar year following LWM placement); and (7) annual reporting of the results of salmonid monitoring to FWS, NMFS, and California DFW.

California DFW recommends (10(j) recommendation M11) a similar plan as FWS, however, with the provision that if STM Work Group is established by the Water Board, as part of the update to the 2006 Bay-Delta Plan, then TREG would work with the STM Work Group, to further the goals and objectives of the California DFW's recommended salmonid monitoring plan.

Based on our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Salmonid Monitoring,* while the agency-recommended salmonid monitoring measures would provide valuable information on annual anadromous salmonid escapement, pre-spawning mortality, spawning success, juvenile outmigration and abundance, and other parameters, we do not see how this information would specifically relate to project operations or how the data could be used to inform any future changes in these operations. Furthermore, the annual abundance of adult salmon and steelhead entering any river system can be highly variable and is influenced by ocean and estuary conditions, annual hatchery augmentation, state and federal fishery management, and the

[263] FWS recommend the morphometric measurements include: scale, otolith, and coded wire-tag collections; length; sex; egg-count in females; and pre-spawn mortality.

operation of other dams and diversions in the watershed. All these factors are outside the Districts' control and unrelated to the projects. Therefore, we do not recommend including a stand-alone plan to monitor salmonids in the Tuolumne River, such as those recommended by NMFS (annual levelized cost of $915,300), FWS (annual levelized cost of $885,300), and California DFW (annual levelized cost of $800,300), as a requirement in any licenses issued for either project. However, we note that some of the components recommended by NMFS and California DFW are included in measures that we include in the staff alternative. These include: (1) adult salmon migration monitoring (at the temporary fish counting weir) to guide fall pulse flow implementation; (2) multiple monitoring elements to guide spring pulse flow implementation (RST monitoring, timing of redd construction, and modeling of juvenile development verified via fish seining); (3) monitoring of redd construction at gravel augmentation sites to guide further gravel augmentation efforts; (4) *O. mykiss* spawning and redd surveys in areas planned for gravel cleaning prior to commencing any gravel cleaning; and (5) effectiveness monitoring of projects implemented through the LTRHIP.

Rapid Large Woody Debris Removal

California DFW 10(j) recommendation M4-4 and FWS Don Pedro 10(j) recommendation 9 recommend that the Districts revise the Woody Debris Management Plan filed October 11, 2017, to address safe and expeditious wood removal from Don Pedro Reservoir when the volume exceeds 5,000 cubic yards of woody debris entering Don Pedro Reservoir in any one year. Specifically, the agencies recommend that the revised plan include: (1) removing wood from Don Pedro Reservoir using an excavator placed on dry land and loading the wood from the water onto trucks; (2) promptly transporting wood off-site to a lumber yard, chipping facility, or temporary storage area for wood that would be used in lower Tuolumne River salmonid habitat restoration projects; and (3) making available 200 key pieces of LWM to entities conducting salmonid restoration actions in the lower Tuolumne River whenever the volume of LWM in Don Pedro Reservoir exceeds 5,000 cubic yards and during or immediately following rapid LWM removal. The Districts would not use this material to meet other requirements of any licenses issued for the projects.

In the draft EIS, we did not adopt FWS and California DFW's recommendations for rapid removal of woody material. In its non-concurrence letter, FWS notes that the draft EIS did not address avoidance or minimization measures to protect California red-legged frog during the movement or burning of woody debris accumulated in Don Pedro Reservoir. FWS states that woody debris can provide habitat for California red-legged frog and bullfrog and that disposal activities could injure or kill frogs. FWS recommends rapid removal of this debris to eliminate habitat.

As discussed in the draft EIS in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects, California Red-legged Frog*, we concluded that the limited potential for California red-legged frog to occur in the project area did not warrant additional mitigation measures. This conclusion was based on statements in the

California red-legged frog recovery plan indicating the species has been extirpated from the Tuolumne River and the results of the Districts' habitat surveys. However, we inadvertently omitted discussion of this topic in section 5 of the draft EIS.

In their reply comments, the Districts report that removing LWM from Don Pedro Reservoir for use in enhancement projects is not feasible because of the steep shorelines and inadequate access, and we modified the staff alternative to allow the use of LWM from other sources for enhancement projects to be implemented through the LTRHIP. We estimate FWS's rapid removal recommendation would have a levelized annual cost of $23,500, and because of the remote location where woody debris collects in Don Pedro Reservoir, the potentially difficult logistics in removing LWM, and the likelihood that California red-legged frog do not occur in the project area, we conclude that the potential benefits do not justify the cost.

Recreational Enhancements at La Grange Reservoir

California DFW (10(j) recommendation M7-3-1) recommends that the Districts develop recreation opportunities at the La Grange Reservoir by: (1) providing angler access (both by foot and boat) to the reservoir; (2) providing the necessary facilities to support angler activities; and (3) meeting all health and safety requirements of the FPA at La Grange Reservoir.

Based on our analysis in section 3.3.5.2, *Recreation, Environmental Effects, Recreation Resource Management,* we conclude that such a recommendation would encourage boating and swimming in the reservoir, which would constitute high risk recreational activities that could be unsafe for the public because of the potential for rapid changes in water velocity in the area. Therefore, we do not recommend including California DFW (10(j) recommendation M7-3-1), which would have an annual levelized cost of $17,000, in any licenses issued for the projects.

Boating Facilities

The Districts' proposal to construct a new boat launch near old Don Pedro Dam would allow boating access to Don Pedro Reservoir when the water surface elevation is at or below 600 feet. In terms of the boating access that would be needed to accommodate the new proposed minimum pool of 550 feet, simulations of the various operational scenarios proposed by the Districts and recommended by the agencies/other stakeholders found that the minimum water surface elevation would not fall to below 600 feet in the 42-year period of record that was analyzed. Consequently, we do not recommend construction of the proposed boat launch near old Don Pedro Dam, which we estimate would have an annual levelized cost of $41,360 because it would seldom, if ever, be necessary to provide boating access to Don Pedro Reservoir at elevations less than 600 feet. The potential exists for elevations less than 600 feet to occur during hydrologic conditions drier than those that occurred during the 42-year period of record that was analyzed, but those conditions would likely be infrequent.

Ward's Ferry Access and Facility Improvements

Ward's Ferry Bridge, located at the upstream end of Don Pedro Reservoir, serves as the take-out location for the Meral's Pool whitewater boating run on the Tuolumne River. In the amended final license application, the Districts propose to design and construct improvements at Ward's Ferry Bridge, including an improved boat take-out facility upstream of the bridge to improve public safety during river egress. However, the Districts would not be responsible for the long-term operation or maintenance of the facility because it would not be a project recreational facility.[264] Although the stakeholder recommendations that would require developing a take-out facility differ slightly in terms of specific capacity and types of amenities, each of these conditions and recommendations, including BLM Don Pedro revised 4(e) condition 13, describe extensive construction to provide vehicular access and a lifting platform for extracting watercraft at all water levels, restrooms, trails, parking, and day-use facilities, and indicate the Districts should also be responsible for operating and maintaining the facility.

The Districts installed a restroom to address sanitation concerns near this point of public access to Don Pedro Reservoir under the current license. However, the restroom is subject to frequent destructive vandalism. Requiring the Districts to expend time and funding to maintain this site would not likely provide a safe, functional, suitable restroom at this location. With regard to public safety concerns about congestion on the county road, Tuolumne County owns and maintains the Ward's Ferry Road, including the bridge, and because it is a county road used primarily for public purposes, it does not meet the Commission's definition of a project road.

In the draft EIS, we determined that congestion at Ward's Ferry Bridge was a result of peaking flows from the (non-project) Holm Powerhouse concentrating whitewater boating use in a short period and the large number of boating permits issued by the Forest Service, so we concluded that this congestion was not a project effect. Comments on the draft EIS received from numerous entities stated that Don Pedro Reservoir level fluctuations complicate river access in the Ward's Ferry area, and that inundation of the original take-out site by Don Pedro Reservoir left Ward's Ferry as the only take-out point for boaters on the Lumsden to Ward's Ferry segment of the Tuolumne Wild and Scenic River. Commission staff visited the Ward's Ferry site during an environmental site review held on March 27, 2019, and observed that water level fluctuations affect the level of effort that is required to hand-carry rafts from the river,

[264] Exhibit E, page 3-292 states, "the Districts are proposing to enhance river recreation and help ameliorate bridge and road safety concerns by improving the take-out." However, the Districts' November 27, 2017, AIR response states, "the Districts are not proposing the Ward's Ferry rafting take-out improvement as a project facility, but as an off-license enhancement."

and the narrowness and uneven footing of the trails on both sides of the river make manual egress more difficult. However, as described in section 3.3.5.2, *Recreation, Environmental Effects, Recreation Management at Ward's Ferry Bridge,* we are concerned that the construction of a lifting platform would not address safety concerns related to hoisting heavy rafts in a confined area where they could be blown into each other while being hoisted and potentially swing into or fall on recreationists in the narrow river canyon area below the platform. We maintain that improving the existing trails and prohibiting the use of boom trucks for lifting rafts from the river would be the most appropriate approach to reduce congestion while improving public safety, and conclude that the benefits of the proposed and recommended lifting platforms, which we estimate would have annualized costs ranging between $405,750 and $850,600, would not justify the costs.

5.2 UNAVOIDABLE ADVERSE EFFECTS

The continued operation of the Don Pedro and La Grange Projects would result in some minor, unavoidable, adverse effects on geologic, soil, geomorphic, water quality, aquatic, and terrestrial resources. Effects on geologic and soil resources would include some minor continued erosion associated with project operation, the renovation of recreation facilities, and interruption of sediment transport at project reservoirs. Most of these effects would be reduced by recommended resource enhancement measures, including implementation of the following plans: (1) soil erosion and sediment control plan; (2) spill prevention control and countermeasure management plan, (3) coarse sediment management program, (4) LWM management plan, (5) TRMP, (6) bald eagle and special-status bird management plan, and (7) fire prevention and response management plan.

Construction of new facilities and project maintenance have the potential to adversely affect aquatic habitat by introducing silt through erosion or via the accidental release of fuels, lubricants, and other hazardous substances into the aquatic environment. However, the extent of proposed new construction is limited, and implementation of soil erosion and sediment control and spill prevention, control, and countermeasures plans would limit the potential for adverse effects.

Project operations would continue to affect fishery resources. Reservoir storage, manipulation of flow releases for power production, and the provision of water for consumptive use would continue to cause fluctuations in river flow and aquatic habitat downstream of the projects, potentially affecting the production of resident and anadromous species. Provision of increased instream flows, pulse flows, and ramping/recession rates as proposed, however, would mitigate many of these effects and would allow these species to successfully complete their life history requirements in the lower Tuolumne River. The La Grange Project would continue to block the upstream movement of anadromous fish, which once migrated upstream of both the La Grange and Don Pedro Project sites. While this blockage to migration would continue, habitat enhancement measures in the lower Tuolumne River would enhance production of

anadromous species and at least partially mitigate for the loss of habitat upstream of the dams. Resident trout and other fish species in the project reservoirs may be entrained through the powerhouses and be subjected to stress, injury, and mortality. However, considering the low number of fish occurring at depth in Don Pedro reservoir, the low levels of fish entrainment at the intakes, and the relatively high survival rate of fish entrained through the project powerhouses, it is likely that the number of fish that are subject to entrainment mortality would be relatively low. However, some minor levels of mortality would still be likely to occur.

For terrestrial resources, unavoidable adverse effects could include limitation of riparian vegetation due to flow fluctuations downstream of the projects and some loss of vegetation and wildlife habitat from the construction, repair, and maintenance of existing or new project facilities and recreation facilities that may require permanent removal of vegetation. Effects on vegetation and wildlife habitat, however, would be reduced by implementation of the many components of the terrestrial resources management and bald eagle and special-status bird management plans, and by implementation of a flow regime and recession rates that would act to enhance establishment and growth of riparian vegetation.

Under the proposed action, the continued operation of the project would continue to adversely affect some archaeological sites by exposure, erosion, scouring, deflation, hydrologic sorting, and the horizontal and vertical movement of artifacts. Proposed construction activities, including recreational enhancements also have the potential for unavoidable adverse effects on cultural resources, particularly in areas that have not yet been surveyed. The execution of a PA and implementation of the associated HPMP would ensure proper protection and management of significant cultural resources within the project's APE and would provide satisfactory resolution of any project-related adverse effects.

5.3 SUMMARY OF SECTION 10(j) RECOMMENDATIONS AND 4(e) CONDITIONS

5.3.1 Fish and Wildlife Agency Recommendations

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency will attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

In response to our November 30, 2017, notice accepting the application to license the Don Pedro Project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, FWS filed 12 recommendations under section 10(j) of the FPA on January 29, 2018. However, on October 2, 2018, FWS filed a letter supplementing its January 29, 2018, filing, by withdrawing its Don Pedro 10(j) conditions 2, 3, 4, and 7, and replacing them with revised 10(j) conditions 2, 3, and 4, resulting in 11 recommendations. We found 7 of the 11 recommendations to be within the scope of 10(j). Of these seven recommendations, we determined that two may be inconsistent with the purpose and requirements of the FPA or other applicable law. Table 5.3.1-1 lists each of these recommendations and whether they are adopted in the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) are considered under section 10(a) and addressed in the specific resource sections of this document and the previous section.

In response to our November 30, 2017, notice accepting the application to license the La Grange Project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, FWS filed 12 recommendations under section 10(j) of the FPA on January 29, 2018. However, on October 2, 2018, FWS filed a letter supplementing its January 29, 2018, filing, by withdrawing its La Grange 10(j) conditions 2, 3, 4, and 7, resulting in eight recommendations. We found six of the eight recommendations to be within the scope of 10(j). Of these six recommendations, we determined that two may be inconsistent with the purpose and requirements of the FPA or other applicable law. Table 5.3.1-2 lists each of these recommendations and whether they are adopted in the staff alternative. Environmental recommendations that we consider outside the scope of section 10(j) are considered under section 10(a) and addressed in the specific resource sections of this document and the previous section.

On February 11, 2019, the Commission issued a draft EIS for the projects. In the draft EIS, we noted that although NMFS and California DFW's January 29, 2018, filings stated generally that they were submitting measures pursuant to both section 10(j) and section 10(a) of the FPA, the agency's letters did not specify which of the recommendations were submitted specifically for section 10(j) consideration and which of the recommendations were submitted specifically for section 10(a) consideration. Therefore, as is our practice in instances where an agency does not specify which FPA section applies to each recommendation, we considered all of NMFS's and California DFW's recommendations under section 10(a) of the FPA.

On February 12, 2019, we sent FWS a letter regarding our preliminary determinations of inconsistency for the recommendations and requesting concurrence, comments, or alternative recommendations.

NMFS and California DFW filed letters on March 6, 2019, and March 7, 2019, respectively, stating that their intent was that all their recommendations were filed

pursuant to both sections 10(a) and 10(j), and staff should have also considered all the recommendations as section 10(j) recommendations.

On March 21, 2019, the Commission issued letters to NMFS and California DFW revising the assessment of which recommendations were found to be within the scope of section 10(j) and whether they were adopted in the draft EIS. For both the Don Pedro and La Grange Projects,[265] out of five multiple-element recommendations filed by NMFS,[266] we consider all of them within the scope of section 10(j). In the draft EIS, we did not fully adopt all the elements included in three of the recommendations that were subsequently found to be within the scope of section 10(j), but many of the NMFS-recommended elements are included in other measures that we do adopt. Out of 12 multiple-element recommendations filed by California DFW,[267] we considered 10 to be within the scope of section 10(j) and two not to be within the scope of section 10(j) because they are not specific fish and wildlife measures. In the draft EIS, we did not fully adopt all the elements included in five of the California DFW's recommendations that were found to be within the scope of section 10(j), but many of the recommended elements are included in measures that we do adopt.

By letters filed April 4, 2019, NMFS and California DFW requested a meeting to attempt to resolve inconsistencies. By letter filed April 12, 2019, FWS also requested a meeting to attempt to resolve inconsistencies.

To attempt to resolve the inconsistencies between the agencies' recommendations and the purposes and requirements of the FPA or other applicable law, we conducted a section 10(j) meeting with NMFS, FWS, and California DFW on September 19, 2019, in Sacramento, California. In addition to addressing the section 10(j) recommendations, this meeting (which was publicly noticed and open to all interested parties) also served as a forum to discuss the recommendations we found to be outside the scope of section 10(j). The following text provides a summary of the meeting discussions and other section 10(j) process filings for each of the recommendations filed by NMFS, FWS, and California

[265] Both NMFS and California DFW indicated that their recommended section 10(j) measures apply to both the Don Pedro and La Grange Projects.

[266] Because each of NMFS recommendations had multiple elements, a total of six NMFS recommendations appear in table 5.3.1-1.

[267] Because each of California DFW's recommendations had multiple elements, a total of 14 California DFW recommendations appear in table 5.3.1-1.

DFW that are within the scope of section 10(j) but found to be inconsistent or partially inconsistent with the purpose and requirements of the FPA or other applicable law.[268]

5.3.1.1 Minimum Instream Flows and Pulse Flows

In the draft EIS, we did not adopt NMFS's and California DFW's recommended minimum flows, spring floodplain activation flows, fall-run Chinook salmon attraction flows, and geomorphic flood pulse flows in the lower Tuolumne River. As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we found the agencies' recommended minimum flows would more closely mimic an unregulated hydrograph in the Tuolumne River downstream of La Grange Diversion Dam and likely help restore more normative ecological processes in the river. However, the agencies' recommended minimum flows would have a substantial negative effect on the water supplies of the Districts and CCSF, and any incremental ecological benefits of these flow regimes over those proposed by the Districts would not justify the cost of water used. With regard to fall attraction flows, in the draft EIS we concluded there was not enough evidence presented in the record to indicate that the benefits of this measure would outweigh the costs. In the case of geomorphic flood pulse flows, we concluded the Districts' proposed gravel mobilization flows would provide the intended channel maintenance. Because the goal is to initiate gravel movement that would flush fines, we concluded a flow duration longer than two days was not warranted and may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

During the section 10(j) meeting we discussed our analysis of the Districts' models and noted that we were requesting additional information from the Districts, including model results to support analysis that separates the effects of flow and non-flow measures. California DFW and NMFS presented weir passage data indicating a strong correlation between fall pulse flows and attraction of Chinook salmon in the lower Tuolumne River. We also discussed spring floodplain activation flows and how to best manage the timing and magnitude of flows in the years where spills would occur. The Districts noted that recession rates would need to maintain flows below 9,000 cfs at Modesto and, at times, would need to reduce flows rapidly to meet flood control purposes. The Districts stated that the resource agencies' recommended ramping rates would not always allow them to meet those needs. NMFS noted that flood storage guidelines are typically implemented in April and floodplain recession would occur in May, but the Districts stated that the timing would depend on snowpack and flood storage concerns and could extend into July. It was also noted that while not specific to spring

[268] On September 10, 2019, FWS filed additional information related to implementation of the recommended LTRHIP. On September 26, 2019, the agencies filed visual materials that their staff presented at the 10(j) meeting. On October 18, 2019, NMFS and California DFW filed a response to the 10(j) meeting.

pulse flows, FWS's spill management plan would provide for operational flexibility to provide spring pulse flows.

The Districts filed their response to staff's AIR on December 11, 2019. Following review of this supplemental information, the draft Voluntary Agreement, the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, we have modified several of the flow-related recommendations included in the draft EIS (see section 5.1.2, *Additional Measures Recommended by Staff*).

Based on our review of this new information, it is apparent that the Districts' proposed, the draft Voluntary Agreement's suggested, and the NMFS' and California DFW's recommended flow regimes would all likely increase the production of *O. mykiss* and Chinook salmon in the Tuolumne River compared to the base case. Our analysis of the effects of each proposed flow regime on water temperatures and physical habitat availability indicate that each of these flow regimes would provide similar amounts of improvement in habitat conditions for *O. mykiss* and Chinook salmon, and the results of the Districts' fish production model results for each flow scenario indicate that each of these minimum flow regimes would result in similar adult replacement rates for both species. However, there is a large difference between flow regimes in their effects on the amount of water that would be available for consumptive uses, with the flows recommended by NMFS and California DFW being projected to cause losses in agricultural production and supply deficits to the CCSF that are several times larger than the losses that would occur under the minimum flows in the draft Voluntary Agreement, which we recommend. Because the minimum flows included in the draft Voluntary Agreement would provide similar environmental benefits to the minimum flows recommended by NMFS and California DFW with a much smaller economic impact, we conclude that the minimum flows included in the draft Voluntary Agreement represents a better balance between these competing uses. Therefore, there is no resolution of this issue.

5.3.1.2 Streamflow Compliance Monitoring

In the draft EIS, we adopted most of FWS and California DFW's recommendations for the Districts to develop a plan to monitor compliance with flow and water level requirements specified in any licenses issued for the projects. However, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we did not adopt the recommendations from NMFS, FWS, and California DFW that the compliance monitoring plan include a new gage downstream of the Districts' proposed infiltration galleries. We concluded that because we did not consider the proposed infiltration galleries to be project facilities, a gage downstream of the project would not be necessary to monitor project-related flows in the lower Tuolumne River. We, therefore, made a preliminary determination that recommendations by NMFS, FWS, and California DFW for a new gage downstream of the proposed infiltration galleries may be inconsistent with

the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

During the 10(j) meeting, we discussed our rationale for not including the infiltration galleries as project facilities, noting that while we agree the infiltration galleries would facilitate the Districts' release of their proposed minimum flows and provide an environmental benefit, they would also be used to withdraw water for irrigation. We explained that the Commission has not typically considered irrigation infrastructure as project facilities unless a direct power generation component is part of the flow line. Furthermore, constructing the infiltration galleries would require various permitting approvals, making the ultimate construction uncertain at this time.

Following review of the agencies' responses to our section 10(j) preliminary determination, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, if the Commission finds that the infiltration galleries are appropriate to include in the projects as licensed facilities, we recommend that flow compliance downstream of the infiltration galleries be determined using the method proposed by the Districts (i.e., the flow downstream of the infiltration galleries would be estimated by subtracting the flows measured at the proposed infiltration gallery pipeline gage from the flow measured at the La Grange gage). However, if the Commission does not include the infiltration galleries as part of the license, we recommend requiring that the Districts install an instream flow gage downstream of the infiltration galleries. As a result, the inconsistencies with the agencies' recommendations and sections 4(e) and 10(a) of the FPA remain unresolved.

5.3.1.3 Water Temperature Monitoring and Compliance Plan

In the draft EIS, we did not adopt FWS's and California DFW's recommendations that the Districts develop a water temperature monitoring plan that includes the projects' reservoirs and project-affected reaches of the lower Tuolumne River. As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we found the Districts' modeling results indicate that project operations are not likely to adversely affect temperature in stream reaches. We, therefore, made a preliminary determination that recommendations by FWS, and California DFW for water temperature monitoring in the Tuolumne River may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

. However, we did recommend the Districts develop a plan to monitor temperature in Don Pedro Reservoir when reservoir elevations drop below 600 feet to monitor the reservoir's cool-water storage pool.

During the 10(j) meeting, we discussed the presence of the old Don Pedro Dam with a crest elevation of 609 feet that was inundated following construction of the new Don Pedro Dam. California DFW noted that waiting to monitor until the 600-foot elevation is reached may not allow the Districts enough time to manage the remaining coldwater pool and recommended that monitoring start when the reservoir is drawn down

to an elevation of 700 feet. FWS discussed the importance of instream temperatures on fish and highlighted that temperature monitoring is needed to confirm temperature simulations and guide the potential to use water available to maximize benefits to salmonids in the lower Tuolumne River. California DFW stressed that simulated water temperatures from models are not an adequate substitute for field-collected water temperature data.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, evaluation of Don Pedro Reservoir outflow temperatures provided by the Districts with their comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we recommend monitoring water temperatures at five sites in the lower Tuolumne River, including real-time monitoring at the La Grange gage and a site downstream of the infiltration galleries, plus periodic monitoring in Don Pedro Reservoir near the dam whenever the reservoir elevations are lower than 700 feet, which would have a levelized annual cost of $37,360. Our recommendation, however, does not support monitoring temperatures in La Grange Reservoir or specify locations for three lower Tuolumne River sites that would be determined in consultation with the agencies, because the incremental benefit of this monitoring would provide very little benefit and is not expected to lead to any additional alteration of project operations and therefore does not justify the additional $322,640 levelized annual cost. As a result, the inconsistencies with the agencies' recommendations and sections 4(e) and 10(a) of the FPA are resolved for developing the plan and reporting schedule, but remain unresolved regarding monitoring within La Grange Reservoir, the specific locations for all monitoring sites, and including life-stage location-specific temperature performance objectives.

5.3.1.4 Coarse Sediment Enhancements

Although we recommended development of a gravel augmentation program for the lower Tuolumne River in the draft EIS, we did not adopt a program of the scale recommended by NMFS and California DFW. NMFS recommended a total volume of 752,000 cubic yards of coarse gravel augmentation, and California DFW recommended at least 1,950,824 cubic yards of additional sediment be placed in the river primarily to fill SRPs. As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we agreed that the projects have reduced the amount of coarse sediment entering the lower Tuolumne River and that without some form of ongoing gravel augmentation over the term of the licenses, the river channel would slowly degrade and eventually become gravel limited. Therefore, we recommended the Districts develop a coarse sediment management plan, in consultation with NMFS, FWS, California DFW, and the Water Board, that would extend throughout the term of any new licenses issued for the projects.

However, our recommended plan did not include the specific quantities of gravel augmentation recommended by the agencies. We noted that a major component of NMFS's and California DFW's recommendations was to add sufficient gravel to refill SRPs created during historical in-river gravel and gold mining, but that there was no

nexus between the SRPs and proposed project operations. We, therefore, made a preliminary determination that the volume of gravel augmentations recommended by NMFS, and California may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

Instead we recommended the plan focus on providing high-quality spawning habitat for anadromous salmonids in those reaches that have the greatest potential for increasing salmon and steelhead production. To mitigate for the effects of the projects, we recommended the coarse sediment management plan add about 1,000 cubic yards of coarse gravel per year to appropriate locations.

During the September 19, 2019, 10(j) meeting, staff and meeting attendees discussed the differences between the volumes of gravel recommended by the resource agencies and those proposed by the Districts. We noted that the resource agencies' recommendations may be in excess of what is needed to address known project effects. FWS provided additional information to justify its recommendation, noting that gravel has benefits in addition to spawning, including hydraulic diversity, thermal diversity, organic matter retention, and BMI production. FWS also presented data that showed from 2014 to 2018, from 27 to 42 percent of Chinook salmon redds were constructed downstream of RM 39 to as far downstream as RM 24.5, indicating that gravel augmentation should occur farther downstream than RM 39, the downstream limit recommended by staff in the draft EIS. NMFS requested that staff determine a volume for gravel augmentation to include in the license article. We also discussed the SRPs created as a result of historical instream aggregate mining. NMFS recognizes that these are not project effects but noted that the gravel captured in Don Pedro Reservoir prevents the recovery of these reaches. Also, the reduction of high flows due to reservoir storage has reduced recruitment of gravel from the floodplain. California DFW also noted that riffles created by past gravel augmentation efforts often are removed by high-flow events and require continued augmentation to compensate for the lack of gravel transported from upstream sources.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies in the section 10(j) meeting, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we revised our analysis in section 3.3.2.2 of this final EIS. We now conclude that the 75,000 cubic yards of gravel augmentation proposed by the Districts' in the 13-mile-long primary spawning reach downstream from La Grange Dam would approximate the gravel loss that would occur in this reach over a 40-year license term, based on the loss rate that was observed over eight years in the 6.7-mile-long study reach used by Stillwater Sciences (2013d). However, based on recent information that an average of about 36 percent of Chinook salmon redds were constructed downstream of RM 39 to as far downstream as RM 24.5, we are recommending that the Districts expand the gravel augmentation program to include this reach. Thus, we now recommend the Districts modify their proposed coarse sediment management program to: (1) expand the reach where potential gravel augmentation sites

would be located to extend downstream to RM 24.5; (2) include 75,000 tons of gravel to be placed at sites between RM 52 and RM 39, and 25,000 tons of gravel to be placed at sites between RM 39 and RM 24.5, for a total not to exceed 100,000 tons for the duration of the license; (3) file an implementation plan for the first group of gravel augmentation sites within one year of license issuance, after review and input from California DFW, NMFS and FWS; (4) file a report with the Commission in year 12 after license issuance, presenting monitoring, mapping, and evaluation of projects conducted in the first 10 years, and evaluate the need for additional gravel augmentation at the initial sites or new augmentation sites; and (5) file an implementation plan for any new gravel augmentation sites identified in the year 12 report. However, we maintain that the annualized cost of the gravel augmentation volumes recommended by NMFS and California DFW, which are $3,132,330 and $12,206,340, respectively, would not be justified by the limited benefits, and would not be in the public interest; therefore, there is no resolution of this issue.

5.3.1.5 Large Woody Material Augmentation

In the draft EIS, we adopted NMFS's and California DFW's recommendations for LWM enhancements downstream of Don Pedro Reservoir. However, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we did not adopt the agency-recommended volumes of LWM and recommended increasing the size of LWM pieces considered suitable for providing the desired habitat benefits. We, therefore, made a preliminary determination that NMFS's and California DFW's recommended LWD volumes may be inconsistent with the substantial evidence standard of section 313(b) of the FPA. We concluded that the staff-recommended LWM management plan would increase the amount of LWM downstream of the La Grange Diversion Dam by guiding the placement of LWM collected from Don Pedro Reservoir, monitoring enhanced sites, and revising the plan over time based on monitoring data.

In the section 10(j) meeting, we discussed the importance of LWM for providing cover, refuge, habitat complexity, and floodplain roughness and the virtual absence of it in the Tuolumne River downstream of the projects. We also discussed potential sources for LWM material, if the source should be limited to Don Pedro Reservoir, and the volume of LWM needed to mitigate for project effects. The resource agencies continued to recommend their earlier recommended volume of LWM for placement, but the Districts questioned whether LWM enhancement would provide any habitat benefits in a river the size of the lower Tuolumne River, because much of the LWM would likely pass through the lower river during high flows, noting that habitat formation related to LWM usually decreases with increasing channel width. The Districts also commented that it would not be feasible to recover LWM from Don Pedro Reservoir where it currently is collected and corralled because of the difficult logistics (i.e., steep shoreline terrain and lack of roads along the shoreline), so the staff-recommended plan to collect LWM only from the reservoir would not be possible.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we conclude that both the NMFS and California DFW recommendations for LWM loading are substantially higher than observed in the 19 streams known to support Chinook salmon in the California Central Valley surveyed by Albertson et al. (2013) and Stillwater Sciences (2017a) in the lower Tuolumne River. We therefore developed alternative LWM loadings for use in habitat enhancement, which we recommend be included as part of the implementation of the LTRHIP. We recommend the Districts introduce 6,535 cubic feet of LWM upstream of RM 24 and focus on areas most likely to benefit from additional LWM and the construction of ELJs.[269] We estimate this quantity would contribute enough material for 13 to 26 ELJs, which should be clustered in target areas with the greatest potential for habitat enhancement.

Using the number and size criteria specified in their recommendations, we estimated that volume of wood that would be placed under NMFS and California DFW's recommendations would be 25 to 35 times the volume that was found in the 19 streams surveyed by Albertson et al., (2013) that Chinook salmon, and we see no evidence that such a large amount of wood is needed to provide suitable habitat conditions for this species. Therefore, there is no resolution of this issue.

We agree with the NMFS recommendation that the Districts first map the LWM in the lower Tuolumne River, to inventory all LWM in lower Tuolumne River restoration reaches to prioritize the initial LWM augmentation efforts and update the inventory as LWM is augmented each year. Additionally, we recommend the Districts and other parties to the LTRHIP obtain LWM for habitat enhancement from any available feasible sources and no longer recommend limiting supply to Don Pedro Reservoir. As a result, inconsistencies related to LWM collection are resolved.

5.3.1.6 Salmonid Monitoring Plan

In the draft EIS, we did not adopt NMFS's, FWS's, or California DFW's recommendations for the development of a salmonid monitoring plan. We concluded that while the agency-recommended salmonid monitoring measures would provide valuable information on annual anadromous salmonid escapement, pre-spawning mortality, spawning success, juvenile outmigration and abundance, and other parameters, we did not see how all this information would specifically relate to project operations or how the data could be used to inform future changes in those operations. Therefore, we made a preliminary determination that NMFS's, FWS's, or California DFW's

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[269] In a large river such as the Tuolumne, secure anchoring is needed to ensure that LWM will remain in place during the hydraulic forces that occur during flood flows. ELJs are designed to withstand these forces by placing LWM in clusters that include multiple large logs driven deep into the substrate to serve as pilings.

recommendations for salmonid monitoring may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

During the 10(j) meeting, the resource agencies discussed how (1) monitoring data may be useful for providing information about project effects on various life stages of Chinook salmon in relationship to various environmental factors (e.g., hydrology and ocean conditions), and (2) understanding these effects could inform future operations and the implementation of measures included in the license. California DFW discussed the potential benefits of information gained from monitoring escapement via seasonal counting weir and carcass surveys, and noted that carcass surveys provide data about fish escapement in years when weirs are not operational due to high flows and information about spawning distribution, fish condition, and pre-spawn mortality. California DFW also stated that if fall pulse flows were included as a license article, counting weirs and carcass surveys would be essential for effectiveness monitoring. Staff encouraged the resource agencies to provide recommendations specific to project management actions that could be reasonably implemented and measured and could result in recommendations for how to better operate the projects or guide ongoing enhancement measures to provide environmental benefits. For example, staff pointed to the monitoring component of the spring pulse flow plan that focuses on informing future project operation by requiring the Districts to file with the Commission an annual report that defines when the pulse flows would be most effective.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we have added several salmonid monitoring elements associated with implementation of specific measures included in the staff alternative. Our recommended monitoring includes: (1) adult salmon migration monitoring (at the temporary fish counting weir) to guide fall pulse flow implementation; (2) multiple monitoring elements to guide spring pulse flow implementation (RST monitoring, timing of redd construction, and modeling of juvenile development verified via fish seining); (3) monitoring of redd construction at gravel augmentation sites to guide further gravel augmentation efforts; (4) *O. mykiss* spawning and redd surveys in areas planned for gravel cleaning prior to commencing any gravel cleaning; and (5) effectiveness monitoring of projects implemented through the LTRHIP. We conclude these monitoring measures are directly tied to project effects and would inform project operations subsequent to the analysis of monitoring results. However, we maintain that there is insufficient evidence that the many measures included in NMFS's, FWS's and California DFW's recommended salmonid monitoring plans would have a specific project-related benefit that would justify an annual cost of $915,300, $885,300, and $800,300, respectively. These measures include the following: annual pre-spawning mortality, carcass surveys, and otolith analysis and other morphometric data collection. We maintain that that these activities are not directly tied to informing project operations and results would be

heavily influenced by non-project variables outside the Districts' control. We further conclude it would be difficult or impossible to isolate the relative contribution of the projects' influence on observations compared to non-project variables. As a result, the inconsistencies with the agencies' recommendations and sections 4(e) and 10(a) of the FPA remain unresolved.

5.3.1.7 Fish Passage Plan

In the draft EIS, we did not adopt NMFS's recommendation for a fish passage program plan. As discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we concluded that while upstream passage may be feasible at the La Grange Diversion Dam, downstream passage would not be feasible at Don Pedro Dam. The high head of Don Pedro Dam, high fluctuations in reservoir surface elevation, and seasonal changes in temperature and velocity, along with an abundance of predator fish in the reservoir, would create challenging conditions for fish collection. We found NMFS's recommendation was not justified, based on our analysis of the feasibility of establishing viable populations of anadromous salmonids in the upper Tuolumne River Basin. Therefore, we made a preliminary determination that NMFS's recommendation for a fish passage program plan may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

Following review of the agencies' responses to our section 10(j) preliminary determination, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we maintain that NMFS's 10(j) recommendation for a fish passage program plan is not justified because establishing viable populations of anadromous salmonids in the upper Tuolumne River Basin does not appear to be feasible at this time. Therefore, there would be no project-related benefits to justify an annualized cost of $206,110, and the inconsistencies with the NMFS recommendation and sections 4(e) and 10(a) of the FPA remain unresolved. However, any licenses issued would include an article reserving NMFS's authority to prescribe the construction, operation, and maintenance of fishways at the projects, pursuant to section 18 of the FPA.

5.3.1.8 Lower Tuolumne River Habitat Improvement Program

In the draft EIS, we did not adopt FWS's recommendation that the Districts develop the LTRHIP, including the $38 million capital fund and oversight of the program by the TPAC. As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we concluded the LTRHIP could improve salmonid habitat in the lower Tuolumne River. However, we found FWS provided few specifics as to how the $38 million capital fund would be spent, and whether this would mitigate project effects or serve as project-related enhancement. For the TPAC, while the concept of an interagency committee to guide the implementation of an LTRHIP is reasonable, we concluded the Commission has no authority to require other agencies to participate in such a committee, and therefore did not recommend the TPAC. We, therefore, made a preliminary

determination that FWS's recommended LTRHIP may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

Prior to the section 10(j) meeting, the Districts provided additional information about four instream and floodplain habitat improvement projects to be implemented under the LTRHIP in the first five years after license issuance. During the meeting, FWS presented slides detailing additional information on these projects. FWS noted that these four projects have a high likelihood of being implemented and achieving successful outcomes, and that state agencies are also committed to funding and permitting these projects. Discussion ensued on whether this would satisfy Commission staff's information needs for the LTRHIP and the question of nexus to the projects.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we now recommend adopting the LTRHIP. We conclude that potential habitat restoration under the LTRHIP could exceed our estimated average of 44 acres of floodplain habitat reduced due to reservoir storage. However, any additional floodplain habitat restored under the LTRHIP can be considered habitat enhancement that would increase fry to smolt survival and go hand in hand with the recommended flow regime for the project. Additionally, we conclude that information the Districts filed on December 11, 2019, in response to staff's September 17, 2019, AIR indicates that the LTRHIP would have a beneficial effect on salmon and *O. mykiss* populations in the lower Tuolumne River. However, we still do not adopt the $38 million capital fund as a pre-determined funding source, because the Commission is concerned with protecting resources and having specific enforceable provisions towards that end rather than requiring a licensee to provide a general funding source to be used at least in part, by entities over which the Commission has no authority, and to fund unspecified measures and actions to which the Commission may or may not have control through a license. We continue not to recommend the TPAC for the same reasons cited in the draft EIS. However, we recommend that appropriate state and federal agencies be consulted in preparation of specific plans and budgets for projects to be implemented under the LTRHIP, and that these plans and budgets be filed with the Commission for approval. As a result, the inconsistency with FWS's recommendation for the LTRHIP and sections 4(e) and 10(a) of the FPA is partially resolved, except for the $38 million capital fund and the TPAC, which remain unresolved.

5.3.1.9 Predator Control and Suppression Plan for the Lower Tuolumne River

In the draft EIS, we did not adopt the Districts' proposed predator control and suppression plan or California DFW's recommendations to revise the proposed plan.

During the 10(j) meeting, we discussed California DFW's recommended modifications to the predator control and suppression plan, which pertain to shaping

spring pulse flows and recession flows, meeting temperature requirements, implementing coarse sediment and LWM augmentation, and monitoring in conjunction with similar measures recommended by NMFS and FWS. Details of those discussions are provided in other subsections in this section of the final EIS.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we still do not adopt the Districts' proposed predator control and suppression plan. We conclude that most of the measures under the Districts' plan are fishery management actions that are the responsibility of state and federal agencies. Although we also did not adopt California DFW's recommended elements into a predator control and suppression plan, all the elements are incorporated into the overall suite of measures that we recommend be included into the project licenses. Spring pulse flows and floodplain pulse flows would be adaptively managed in coordination with the fisheries agencies, placement of gravel and LWM (as part of the LTRHIP) would be conducted via implementation plans to be developed in consultation with the fisheries agencies, and increased base flows would provide water temperatures that are less favorable to non-native predatory fish. While these modifications are incorporated into the staff alternative, we did not adopt them as modifications of the predator control and suppression plan as recommended by California DFW. As a result, the inconsistencies with the California DFW's recommendations and sections 4(e) and 10(a) of the FPA remain unresolved.

5.3.1.10 Fisheries Genetic Management Plan and Conservation Hatchery Plan

In the draft EIS, we did not adopt California DFW's recommended fisheries genetic management plan and conservation hatchery plan. As discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we concluded the fishery in Don Pedro Reservoir offers substantial recreation opportunities, and there is little basis for requiring the Districts to improve the fishery or to assume the responsibility for stocking the reservoir. We, therefore, made a preliminary determination that California DFW's recommended fisheries genetic management may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

During the 10(j) meeting, California DFW stated that the Districts should be responsible for replacing the fishing opportunity lost due to dam construction. Staff

responded that the project provides a bass fishing resource that would not exist without the project.[270]

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we continue to find, pursuant to section 10(a) of the FPA, no project-related benefit for a fisheries genetic management plan and conservation hatchery plan to justify the annual cost of $1,230,000. As a result, the inconsistencies with the California DFW's recommendations and sections 4(e) and 10(a) of the FPA remain unresolved.

5.3.1.11 Fish Entrainment in Canals and Diversions

In the draft EIS, we did not adopt California DFW's recommended facilities salmonid protection and monitoring plan or FWS's fish rescue plan. As discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we concluded salmonids were not likely to be entrained in project facilities. We noted that while salmonids could access the Districts' canal systems through other diversions along the lower river, these canal systems are used for water supply, are non-project facilities not associated with hydropower generation, and extend well beyond the La Grange Project boundary. We, therefore, made a preliminary determination that California DFW's recommended facilities salmonid protection and monitoring plan may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

During the 10(j) meeting, NMFS stated that while the canal systems are not project facilities, they would not function without the project. Staff indicated that the Commission would not likely support fish rescues associated with fish entering the canals via non-project facilities.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we continue to find the canals are non-project facilities unassociated with hydropower generation, and therefore, there is no project-related benefit to the measure to justify the annual cost of $151,580 to implement the measure. Therefore, pursuant to section 10(a) of the FPA, we do not recommend including California DFW's recommended facilities salmonid protection and monitoring plan. As a result, this issue remains unresolved.

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[270] We note that the current proposed licensing action is not dam construction, but rather continued operation and maintenance of the projects. Therefore, there is no basis for mitigating the effects of dam construction as part of the current licensing process.

5.3.1.12 Protection Measures for Golden Eagle

While we adopted most of the California DFW's recommendations for a stand-alone bald eagle management plan in the draft EIS, we did not adopt California DFW's recommendation to include protection measures for golden eagle in the plan because we concluded that there was not sufficient evidence that golden eagle occurred at the project with enough regularity to warrant protection measures. We, therefore, made a preliminary determination that California DFW's recommendation to monitor golden eagle at the projects may be inconsistent with the substantial evidence standard of section 313(b) of the FPA.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we have reconsidered this issue and determined that over the course of the license period, there is potential for golden eagles and other sensitive raptors to visit the project area. Therefore, we now recommend that the Districts record and report incidental observations of all raptor species observed during bald eagle surveys and consult with agencies as needed to determine whether additional protection measures are needed. As a result, the inconsistencies with California DFW's recommendations and sections 4(e) and 10(a) of the FPA regarding golden eagle are resolved.

5.3.1.13 Rapid Large Woody Debris Removal

In the draft EIS, we did not adopt FWS's and California DFW's recommendations for the Districts to revise their proposed Woody Debris Management Plan for rapid removal of large woody debris from Don Pedro Reservoir. When the volume exceeds 5,000 cubic yards of woody debris entering Don Pedro Reservoir in any one year, the agencies recommend that the revised plan include the following measures: (1) removing wood from Don Pedro Reservoir using an excavator placed on dry land and loading the wood from the water onto trucks; (2) promptly transporting wood off-site to a lumber yard, chipping facility, or temporary storage area for wood that would be used in lower Tuolumne River salmonid habitat restoration projects; and (3) making available 200 key pieces of LWM to entities conducting salmonid restoration actions in the lower Tuolumne River whenever the volume of LWM in Don Pedro Reservoir exceeds 5,000 cubic yards and during or immediately following rapid LWM removal. The agencies suggest that woody debris flows in Don Pedro Reservoir or debris from hazard tree removal could provide habitat for California red-legged frogs. If frogs occupy these areas, subsequent removal or burning could cause frog injury or mortality. However, we concluded in the draft EIS that the plan would have no benefit to justify the plan's cost due to the limited potential for California red-legged frog to occur in the project area. Therefore, we made a preliminary determination that FWS's and California DFW's recommendations for rapid removal of woody debris to protect California red-legged frog may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we maintain that the benefits of the measure do not justify the costs. This species is reported to be extirpated from the project area, and no evidence suggests that management of LWM would affect this species so that the implementation of the measures would have project-related benefits. In addition, the Districts report in their reply comments that removing LWM from Don Pedro Reservoir for use in enhancement projects is not feasible because of the steep shorelines and inadequate access. We modified the staff alternative to allow the use of LWM from other sources for enhancement projects to be implemented through the LTRHIP. As a result, this issue remains unresolved.

5.3.1.14 Terrestrial Resources Management Plans

While we adopted many of FWS's recommended modifications to the TRMP in the draft EIS, we did not adopt FWS's recommendation for annual bat surveys at all project facilities, because once facilities with bat access are identified and exclusion measures implemented, we conclude that additional annual surveys of all facilities would not be cost effective. We, therefore, made a preliminary determination that the FWS recommended annual bat surveys may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

Instead, we recommended the Districts complete a comprehensive survey of project facilities at both projects during the first year of any new license to identify areas where exclusion devices are needed to prevent adverse interactions between bats and humans. We adopted the Districts' proposed annual inspection of facilities with exclusion devices to ensure the devices are properly installed, and surveys of facilities with exclusion devices every two years to identify any new entrance points. Additionally, we recommended surveys of all project facilities every five years to determine whether any previously unoccupied facilities show signs of bat use and to install new exclusion devices at these facilities as needed. We concluded these survey frequencies would protect special-status bats from adverse human interactions. In the draft EIS, we also did not adopt California DFW's recommendation to monitor presence of WNS at the projects. Our analysis concluded WNS was not known to occur in the state of California, there minimal risk of project activities spreading WNS, because project staff and recreationists do not regularly interact with bats at the projects, and therefore, there would be no project-related benefit to implementing the measure at an annual cost of $10,000

During the 10(j) meeting, FWS presented new information about the recent detection of WNS fungus in Plumas County, California. FWS noted this was the first time the fungus was recorded in the state and recommended the Districts follow decontamination protocols when entering areas with potential for bat occurrence and for

reporting any sick or dead bats found at the projects. There were no comments or discussions about our recommended survey frequencies for bat use of project facilities.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we conclude survey activities could potentially spread WNS if decontamination protocols are not in place. Therefore, we recommend the Districts incorporate FWS's recommended decontamination protocols in the TRMPs for both projects. We also recommend the Districts follow FWS protocols for reporting any sick or dead bats found at the projects to assist with tracking the spread of WNS in California. Therefore, the inconsistencies with the agencies' recommendations and sections 4(e) and 10(a) of the FPA related to WNS are resolved, and inconsistencies associated with survey frequencies remain unresolved.

Additionally, in the draft EIS, we did not adopt the following FWS-recommended additions to the TRMPs: (1) suppression or control of bullfrogs; management of chytrid fungus; and provisions for hazard tree and slash removal to protect California red-legged frog; (2) wildlife-friendly road crossings or other unspecified provisions to minimize effects of roads on San Joaquin kit fox, western burrowing owl, California tiger salamander, and California red-legged frog; (3) measures to discourage raptor use of transmission lines as perches when within suitable habitat for the San Joaquin kit fox and western burrowing owl; and (4) habitat surveys every three years for the San Joaquin kit fox, western burrowing owl, special-status bat species, California red-legged frog, and California tiger salamander. We did not recommend the Districts conduct surveys for chytrid fungus because there is little the Districts would be able to do to remove the presence of the fungus if it is identified and therefore there would be no benefit to justify the costs of the surveys. We did adopt FWS's recommendation for decontaminating equipment in accordance with appendix B of FWS (2005) during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus. We did not recommend the construction of wildlife-friendly road crossings because we are unaware of any evidence to suggest that project roads have had adverse effects on these species and therefore there would be no benefit to justify the costs. We did not recommend raptor controls on transmission lines because the Districts do not own or maintain transmission lines as part of the project facilities. Finally, we did not recommend species and habitat monitoring surveys because the agencies provide no information for how these surveys would be used to modify project operations or how any observed changes in habitat would be tied to project effects and therefore there would be no project-related benefit to justify the costs. We, therefore, made a preliminary determination that FWS's recommended additions to the TRMPs may be inconsistent with the public interest standard of section 4(e) and the comprehensive planning standard of section 10(a) of the FPA.

During the 10(j) meeting, FWS deferred discussions related to federally listed species to the formal consultation process under section 7 of the ESA.

Following review of the agencies' responses to our section 10(j) preliminary determinations, comments on the draft EIS, and our attempts to resolve the inconsistencies, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we note (1) the recovery plan for California red-legged frog states the species is extirpated from the Tuolumne River basin; (2) the Districts' habitat surveys indicate potential habitat with potential for project effects is unsuitable; and (3) the agencies have not provided any information to indicate the frogs are present in any location within the dispersal distance or evidence of plans to reintroduce the species to the project area. Additionally, we conclude commonly used bullfrog control measures are not likely to be successful at the scale of the Don Pedro Reservoir because of bullfrog's high potential for recolonization. Similarly, because of the limited potential for occurrence, we do not recommend implementation of special protocols for the removal of debris following hazard tree removal or slash from fire fuels reduction activities. No new evidence was presented to justify surveys for chytrid fungus, construction of wildlife-friendly road crossings, or raptor controls on transmission lines, so we maintain that there would be no project benefits to justify the costs of these measures. Therefore, the inconsistencies with the agencies' recommendations and sections 4(e) and 10(a) of the FPA remain unresolved.

Sections 5.1.2, *Additional Measures Recommended by Staff*, and 5.1.3, *Other Measures Not Recommended by Staff*, discuss the reasons we do or do not recommend adopting measures that we have determined are within the scope of section 10(j). Table 5.2.1-1 lists our determinations and recommendations for measures that were submitted by FWS for the Don Pedro Project and those submitted by NMFS and California DFW under section 10(j) for both projects, and table 5.2.1-2 lists our determinations and recommendations for measures that were submitted under section 10(j) by FWS for the La Grange Project.

Table 5.3.1-1. FWS, NMFS, and California DFW preliminary section 10(j) recommendations for the Don Pedro Hydroelectric Project (Source: staff).[a]

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
1. Provide minimum instream flows and pulse flows, with provisions for determining the applicable water year type, establishing flow compliance points, annual reporting, modifying operations in accordance with a drought plan, and specified up-ramping and down-ramping rates.	NMFS (Recommendation 1.1–1.3 and 1.6-1.7)	Yes	$-1,037,770	No (see section 5.1.2)
2. Provide minimum instream flows and pulse flows with minimum pool storage, spring floodplain activation flows, spring flow recession rates, geomorphic flood pulses, with provisions for determining the applicable water year type, establishing flow compliance points, a streamflow and reservoir level compliance monitoring plan, and specified ramping rates.	California DFW (Recommendation M1-1–M1-9)	Yes	-$1,330	No (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
3. Develop a streamflow and reservoir level compliance monitoring plan.	FWS (Recommendation 1)	Yes	$300	Yes, except that we do not recommend the addition of a new flow gage downstream of the infiltration galleries, unless the Commission determines that the infiltration galleries are not project facilities
4. Develop a spill management plan.	FWS (Revised Recommendation 2)	Yes	$9,650	Yes
5. Implement coarse gravel enhancement within four reaches of the lower Tuolumne River in the first 15 years of the license and monitor the effectiveness of sediment management.	NMFS (Recommendation 2.1–2.2)	Yes	$3,132,330	Yes, in part (see section 5.1.2)
6. Develop an LTRHIP and associated capital fund and annual funding accounts.	FWS (Revised Recommendation 3)	No, not a specific measure to protect fish and wildlife	$2,707,820	Yes, except that we do not recommend including the funding account (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
7. Large woody debris enhancement and management, including collection and storage, mapping and guidelines for placement of LWM for habitat enhancement.	NMFS (Recommendation 3.1–3.4)	Yes	$75,300	Yes, in part, as a staff modification to the LTRHIP (see section 5.1.2)
8. Create a TPAC.	FWS (Revised Recommendation 4)	No, not a specific measure to protect fish and wildlife	$25,000	No (see section 5.1.3)
9. Establish a TREG and prepare a coordinated operations plan with other San Joaquin River Basin water resource projects.	California DFW (Recommendation M3-1–M3-2)	No, not a specific measure to protect fish and wildlife	$50,180	No (see section 5.1.3)
10. Develop a salmonid monitoring plan.	FWS (Recommendation 5); NMFS (Recommendation 4.1–4.2); California DFW (Recommendation M11-1–M11-3)	Yes	$885,300 (FWS) $915,300 (NMFS) $800,300 (California DFW)	No (see section 5.1.3), although many of the recommended elements are included in measures that we do adopt (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
11. Prepare a plan for providing safe, timely, and effective passage of juvenile and adult fish at projects.	NMFS (Recommendation 5.1–5.2)	Yes	$206,110	No (see section 5.1.3)
12. Develop a water temperature monitoring and compliance plan.	FWS (Recommendation 6); California DFW (Recommendation M2-1–M2-3) NMFS (Recommendation 1.4–1.5)	Yes	$360,000	Yes, in part (see section 5.1.2)
13. Prepare a draft BA to correct the deficiencies identified in the applicant-prepared BA for terrestrial species by addressing potential project impacts on the San Joaquin kit fox, California red-legged frog, California tiger salamander, and Valley elderberry longhorn beetle, Layne's butterweed, and Red Hills vervain.	FWS (Recommendation 8)	No, not a specific measure to protect fish and wildlife	$120	No – the threatened and endangered species section of this EIS serves as our BA
14. Implement coarse sediment and gravel placement, gravel augmentation and LWM management.	California DFW (Recommendation M4-1–M4-6)	Yes	$12,281,640	Yes, in part (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
15. Prepare and implement a floodplain rearing habitat restoration plan, with monitoring at each restoration site.	California DFW (Recommendation M5-1–M5-3)	Yes	$4,556,520	Yes, in part (see section 5.1.2)
16. Update and revise the Predator Control and Suppression Plan for the Lower Tuolumne River, with monitoring and reporting.	California DFW (Recommendation M6-1–M6-2)	Yes	$207,520	No (see section 5.1.3), although some recommended elements are included in measures we do adopt (see section 5.1.2)
17. Develop a fisheries genetic management plan, a conservation hatchery plan, implement reservoir fish stocking, develop recreational opportunities at the La Grange Headpond, and develop a Ward's Ferry Bridge Development Plan.	California DFW (Recommendation M7-1–M7-3)	Yes (M7-1 and M7-2 only)	$1,230,000	No (see section 5.1.3)
18. Prepare a facilities salmonid protection and monitoring plan, and implementation of a fish passage program related to section 18.	California DFW (Recommendation M8-1–M8-2)	Yes	$151,580	No (see section 5.1.3)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
19. Revise the Woody Debris Management Plan to include rapid LWM removal.	FWS (Recommendation 9); California DFW (Recommendation M4-4)	Yes	$23,500	No (see section 5.1.3)
20. Develop a bald eagle management plan.	FWS (Recommendation 10)	Yes	$20,890	Yes
21. Include golden eagle in bald eagle management plan, with bald and golden eagle protection guidelines, annual training of District employees, annual meetings and reporting.	California DFW (Recommendation M9-1)	Yes	$20,890	Yes, in part (see section 5.1.2)
22. Revise the TRMP to include protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, California tiger salamander, Layne's butterweed, and Red Hills vervain.	FWS (Recommendation 11); California DFW (Recommendation M9-2–M9-4)	Yes	$5,190	Yes, in part (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
23. Implement an Aquatic Invasive Species (AIS) Management Plan, including developing BMPs for individual project activities, collaboration with other regional and statewide efforts, reporting and updating the plan as needed.	California DFW (Recommendation M10-1–M10-6)	Yes	$0	Yes
24. Organize ecological group and host annual meeting.	FWS (Recommendation 12)	No, not a specific measure to protect fish and wildlife	$25,000	No (see section 5.1.3)
25. California DFW reserves the right to modify these recommendations, if necessary.	California DFW (Recommendation M12)	No, not a specific measure to protect fish and wildlife	$0	No, administrative measure (see section 5.1.3)

[a] Both California DFW and NMFS indicated that their recommended section 10(j) measures apply to both the Don Pedro and La Grange Projects.

Table 5.3.1-2. FWS preliminary section 10(j) recommendations for the La Grange Hydroelectric Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
1. Develop a streamflow compliance monitoring plan for the lower Tuolumne River.	FWS (Recommendation 1)	Yes	$1,300[a]	Yes, except that we do not recommend the addition of a new flow gage downstream of the infiltration galleries, unless the Commission determines that the infiltration galleries are not project facilities
2. Develop a salmonid monitoring plan.	FWS (Recommendation 5)	Yes	$885,300	No, although many of the recommended elements are included in measures that we do adopt (see section 5.1.3)
3. Develop a water temperature monitoring plan.	FWS (Recommendation 6)	Yes	$360,000	Yes, in part (see section 5.1.2)
4. Prepare a draft BA for the San Joaquin kit fox, California red-legged frog, California tiger salamander, and Valley elderberry longhorn beetle.	FWS (Recommendation 8)	No, not a specific measure to protect fish and wildlife	$120	No – the threatened and endangered species section of this EIS serves as our BA

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
5. Develop a bald eagle management plan.	FWS (Recommendation 9)	Yes	$5,590	Yes
6. Revise the TRMP to include protective measures for the San Joaquin kit fox, western burrowing owl, special-status bats, California red-legged frog, California tiger salamander, and western pond turtle.	FWS (Recommendation 10)	Yes	$28,340	Yes, in part (see section 5.1.2)
7. Organize ecological group and host annual meeting.	FWS (Recommendation 11)	No, not a specific measure to protect fish and wildlife	$10,000	No (see section 5.1.3)
8. Develop a fish rescue plan for the MID Diversion.	FWS (Recommendation 12)	Yes	$150,000	No (see section 5.1.3)

5.3.2 Land Management Agencies' Section 4(e) Conditions

In this final EIS, we analyze revised conditions filed by BLM in response to the REA notice. In section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, we list the 4(e) conditions submitted by BLM, and note that section 4(e) of the FPA provides that any license issued by the Commission "for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation." Thus, any 4(e) condition that meets the requirements of the law must be included in any license issued by the Commission, regardless of whether we adopt the condition in our staff alternative.

Of the 43 revised conditions filed by BLM for the Don Pedro Project,[271] we consider 26 conditions (conditions 1, 5, 10, 19 through 31, 33, 34, 36 through 42, and 44) to be administrative or legal in nature and not specific environmental measures. Therefore, we do not analyze these conditions in this EIS. Table 5.3.2-1 summarizes our conclusions with respect to the 17 revised 4(e) conditions that we consider to be environmental measures. We include in the staff alternative nine conditions as specified by the agency, modify three conditions to adjust the scope of the measure, and do not recommend five conditions; the measures not adopted in total are discussed in more detail in section 5.1.3, *Other Measures Not Recommended by Staff*.

Table 5.3.2-1. BLM revised section 4(e) conditions for the Don Pedro Hydroelectric Project (Source: staff).

Condition	Annualized Cost	Adopted?
No. 2. Provide annual employee training.	$2,000	No (see section 5.1.3)
No. 3. Implement a soil erosion and sediment control plan.	$300	Yes
No. 4. Obtain and maintain a BLM-approved burn plan for any LWM stored and burned on BLM-administered lands and make all reasonable efforts to prevent large woody debris from interfering with accessible take-out areas for whitewater boaters at Ward's Ferry.	$75,300	Yes
No. 6. Implement a BLM-approved Aquatic Invasive Species Management Plan.	$25,300	Yes, in part (see section 5.1.2)

[271] BLM withdrew preliminary condition 12 when it filed its revised conditions on August 23, 2018.

Condition	Annualized Cost	Adopted?
No. 7. Implement a BLM-approved TRMP.	$11,150	Yes, in part (see section 5.1.2)
No. 8. Implement a BLM-approved Bald Eagle Management Plan.	$20,890	Yes
No. 9. Annually review special-status species.	$2,000	No (see section 5.1.3)
No. 11. Hold annual recreation coordination meetings.	$2,000	Yes
No. 13. Implement a Ward's Ferry Take-out Management Plan.	$791,560	No (see section 5.1.3)
No. 14. Implement a BLM-approved RRMP.	$5,740	Yes, in part (see section 5.1.2)
No. 15. Implement the amended HPMP.	$201,380	Yes
No. 16. Implement a BLM-approved transportation system management plan.	$45,300	Yes
No. 17. Implement a BLM-approved Fire Prevention and Response Management Plan.	$2,300	Yes
No. 18. Implement a BLM-approved visual resources management Plan.	$1,300	Yes
No. 32. Implement pesticide-use restrictions on BLM lands.	$0	No (see section 5.1.3)
No. 35. Consult on ground-disturbing activities not addressed in the NEPA process.	$0	No (see section 5.1.3)
No. 43. Implement a BLM-approved hazardous substances plan.	$590	Yes

Of the 35 preliminary conditions filed by BLM for the La Grange Project, we consider 25 conditions (conditions 1, 4, 10 through 22, 24, 25, 27 through 33, and 35) to be administrative or legal in nature and not specific environmental measures. Therefore, we do not analyze these conditions in this EIS. Table 5.3.2-2 summarizes our conclusions with respect to the 10 preliminary 4(e) conditions that we consider to be environmental measures. We include in the staff alternative five conditions as specified by the agency, modify one condition to adjust the scope of the measure, and do not

recommend four conditions; the measures not adopted in total are discussed in more detail in section 5.1.3, *Other Measures Not Recommended by Staff.*

Table 5.3.2-2. BLM preliminary section 4(e) conditions for the La Grange Hydroelectric Project (Source: staff).

Condition	Annualized Cost	Adopted?
No. 2. Provide annual employee training.	$2,000	No (see section 5.1.3)
No. 3. Implement a BLM-approved soil erosion and sediment control plan.	$300	Yes
No. 5. Implement a BLM-approved TRMP.	$17,670	Yes, in part (see section 5.1.3)
No. 6. Annually review special-status species.	$2,000	No (see section 5.1.3)
No. 7. Implement the amended HPMP.	$8,000	Yes
No. 8. Construct and maintain a trail from La Grange Headquarters to the Tuolumne River, a kiosk sign, and two picnic tables.	$12,510	Yes, but to be included as a Don Pedro Project facility
No. 9. Implement a BLM-approved Bald Eagle Management Plan.	$5,590	Yes
No. 23. Implement pesticide-use restrictions on BLM lands.	$0	No (see section 5.1.3)
No. 26. Consult on ground-disturbing activities not addressed in the NEPA process.	$0	No (see section 5.1.3)
No. 34. Implement a BLM-approved hazardous substances plan.	$590	Yes (see section 5.1.3)

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed the following 27 comprehensive plans that are applicable to the Don Pedro and La Grange Projects, located in California. No inconsistencies were found.

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to implement actions to benefit winter-run Chinook salmon in the Sacramento River Basin. Sacramento, California. May 20, 1988.

California Department of Fish and Game. 1990. Central Valley Salmon and Steelhead Restoration and Enhancement Plan. Sacramento, California. April 1990.

California Department of Fish and Game. 1993. Restoring Central Valley Streams: A Plan for Action. Sacramento, California. November 1993.

California Department of Fish and Game. 1996. Steelhead Restoration and Management Plan for California. Sacramento, California. February 1996.

California Department of Fish and Game. 2000. Habitat Restoration Plan for the Lower Tuolumne River Corridor. Sacramento, California. March 2000.

California Department of Fish and Game. 2003. Strategic Plan for Trout Management: A Plan for 2004 and Beyond. Sacramento, California. November 2003.

California Department of Fish and Game. 2007. California Wildlife: Conservation Challenges, California's Wildlife Action Plan. Sacramento, California. 2007.

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California State Water Resources Control Board. 2018. Water Quality Control Plan for Sacramento and San Joaquin River Basins and Appendices. Sacramento, California. May 2018.

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National Park Service. 1993. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C.

U.S. Fish and Wildlife Service. 1990. Central Valley Habitat Joint Venture Implementation Plan: A Component of the North American Waterfowl Management Plan. February 1990.

U.S. Fish and Wildlife Service. 2001. Final Restoration Plan for the Anadromous Fish Restoration Program. Department of the Interior, Sacramento, California. January 9, 2001.

U.S. Fish and Wildlife Service. n.d. Fisheries USA: The Recreational Fisheries Policy of the U.S. Fish and Wildlife Service. Washington, D.C.

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7.0 LIST OF PREPARERS

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American Rivers

American River Touring Association, Inc.

American Whitewater

ARTA Rafting

Bay Area Water Supply and Conservation Agency

California Department of Fish and Wildlife

California Sportfishing Protection Alliance

Central Sierra Environmental Resource Center

City and County of San Francisco

Committee to Save the Kings

County of Tuolumne

Friends of the River

Golden West Women Flyfishers

Hanson Bridgett

JMR Energy Infra LLC

Merced River Conservation Committee

Modesto Irrigation District

National Marine Fisheries Service

OARS, Inc.

Office of the Governor of California

Restore Hetch Hetchy

San Francisco Bay Area Water Users Association

SierraMac Rafting

Stillwater Sciences

The Bay Institute

Trout Unlimited

Tuolumne River Conservancy

Tuolumne River Expeditions, Inc.

Tuolumne River Preservation Trust

Tuolumne River Trust

Turlock Irrigation District

U.S. Army Corps of Engineers

U.S. Fish & Wildlife Service

U.S. House of Representatives

U.S. Senate

APPENDIX A

Comments on Draft Environmental Impact Statement

ACRONYMS AND ABBREVIATIONS

7DADM	7-day average daily maximum
ACEC	Area of Critical Environmental Concern
AIRs	additional information requests
base case	model scenario for environmental baseline (no action)
Basin Plan	Water Quality Control Plan for the Sacramento and San Joaquin Basins
BAWSCA	Bay Area Water Supply and Conservation Agency
BLM	U.S. Department of the Interior, Bureau of Land Management
BMPs	best management practices
°C	degrees Celsius
California DFW	California Department of Fish and Wildlife
California DWR	California Department of Water Resources
CCSF	City and County of San Francisco
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
Conservation Groups	California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, Central Sierra Environmental Resource Center and Tuolumne River Conservancy
Delta	Sacramento-San Joaquin River Delta
Districts	Turlock Irrigation District and Modesto Irrigation District
DO	dissolved oxygen
DPP-1r	model scenario for the Districts' preferred proposed project operations
DPP-1r-NoIG	model scenario for the Districts' proposed project operations with interim minimum instream flows
EIS	environmental impact statement
ELJ	engineered log jams
EPA	U.S. Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
Forest Service	U.S. Department of Agriculture, Forest Service
FPA	Federal Power Act
FWS	U.S. Department of the Interior, Fish and Wildlife Service
Hetch Hetchy System	Hetch Hetchy Water and Power System
HPMP	Historic Properties Management Plan
LTRHIP	Lower Tuolumne River Habitat Improvement Program

LWM	large woody material
mgd	million gallons per day
mg/L	milligrams per liter
MWh	megawatt-hour
NEPA	National Environmental Policy Act
NGO	non-governmental organization
NMFS	National Marine Fisheries Service
PHABSIM	physical habitat simulation system
RM	river mile
RRMP	Recreation Resource Management Plan
RST	rotary screw trap
RWS	Regional Water System
SFPUC	San Francisco Public Utilities Commission
SRP	special-run pool
TPAC	Tuolumne Partnership Advisory Committee
TRMP	Terrestrial Resources Management Plan
Water Board	California State Water Resources Control Board

COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE DON PEDRO AND LA GRANGE HYDROELECTRIC PROJECTS

Don Pedro Hydroelectric Project—FERC Project No. 2299-082–California

La Grange Hydroelectric Project—FERC Project No. 14581-002–California

The Federal Energy Regulatory Commission (Commission or FERC) issued its draft environmental impact statement (EIS) for relicensing the Don Pedro Hydroelectric Project and licensing the La Grange Hydroelectric Project on February 11, 2019. Comments were due by April 12, 2019. In addition, Commission staff conducted two public meetings in Modesto, California, on March 26, 2019, to take oral comments on the draft EIS. Statements made at the meetings were recorded by a court reporter and incorporated into the Commission's public record for the proceeding.[1]

In this appendix, we summarize the written comments received on the draft EIS that pertain to our analysis; provide responses to those comments; and indicate, where appropriate, how we revised the final EIS. We group the comment summaries and responses by topic for convenience. Although we do not summarize comments that point out minor corrections to the draft EIS, we revised the final EIS to include these revisions. We do not summarize comments that only express opinions either for or against the proposed projects or the staff alternative or simply reiterate a stakeholder position or recommendation previously provided. These entities listed below filed comments on the draft EIS:

Commenting Entity	Filing Date
Central Sierra Environmental Resource Center	April 04, 2019
Tuolumne County Board of Supervisors	April 08, 2019
Tuolumne River Conservancy, Inc.	April 08, 2019
Sierra Club California	April 10, 2019
ECHO: The Wilderness Company	April 11, 2019
U.S. Department of Commerce, National Oceanic and Atmospheric Administration Fisheries, West Coast Region	April 11, 2019
Restore Hetch Hetchy	April 11, 2019
City of Sunnyvale	April 11, 2019
California State Water Resources Control Board	April 12, 2019
Stanislaus County Department of Environmental Resources	April 12, 2019
Turlock Irrigation District and Modesto Irrigation District	April 12, 2019

[1] See transcripts of the March 26, 2019, scoping meetings, eLibrary accession nos. 20190503-4000 and 20190503-4001.

Commenting Entity	Filing Date
City and County of San Francisco	April 12, 2019
California Department of Fish and Wildlife	April 12, 2019
Conservation Groups	April 12, 2019
U.S. Environmental Protection Agency	April 12, 2019
Modesto Chamber of Commerce	April 12, 2019
Bay Area Water Supply and Conservation Agency	April 12, 2019
U.S. Department of the Interior	April 12, 2019
The Bay Institute	April 12, 2019
U.S. Department of Agriculture, Forest Service	April 12, 2019
American River Touring Association, Inc.	April 12, 2019
Sierra Mac River Trips, Inc.	April 12, 2019
Alameda County Water District	April 12, 2019
Stanford University	April 12, 2019
City of Santa Clara	April 12, 2019
City of Burlingame	April 12, 2019
City of Daly City	April 12, 2019
City of Hayward	April 12, 2019
Mid-Peninsula Water District	April 12, 2019
City of Palo Alto	April 12, 2019
Coastside County Water District	April 12, 2019
City of Foster City and Estero Municipal Improvement District	April 12, 2019
City of Menlo Park	April 12, 2019
California Water Service	April 12, 2019
City of Millbrae	April 12, 2019
City of Redwood City	April 12, 2019
City of Modesto	April 15, 2019
California State Assembly member Adam Gray, 21st District	April 16, 2019
Westborough Water District	April 24, 2019
Town of Hillsborough	April 29, 2019
North Coast County Water District	April 29, 2019
City of East Palo Alto	April 29, 2019
Purissima Hills Water District	April 29, 2019
City of Brisbane	May 14, 2019
City of San Bruno	May 14, 2019

In addition, 75 individuals filed comments on the draft EIS.

A. GENERAL

Comment G1: The National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) and the Turlock Irrigation District and Modesto Irrigation District (collectively, the Districts or applicants) agree that the infiltration galleries (IG-1 and IG-2) should be incorporated into the license for the Don Pedro Project as project facilities. NMFS notes that the Districts believe the infiltration galleries are necessary to release their preferred minimum flow regime. For its part, NMFS believes that the Commission should include the infiltration galleries as project facilities because they are intended to mitigate project impacts. The Districts state that if the primary purpose of the instream flows withdrawn at the infiltration galleries were for water supply, they would have no reason to release these flows into the river at the La Grange Diversion Dam and pump them out of the river 25 miles downstream at a much greater cost (because of the cost of pipelines, pump station, and power) compared to diverting water at La Grange Diversion Dam for water supply purposes. They also state that the infiltration galleries are multi-purpose facilities consistent with section 10(a)(1) of the Federal Power Act (FPA), which requires the Commission to, in its judgment, adopt a project plan that is best adapted to a comprehensive plan for the river, including measures for the adequate protection, mitigation and enhancement of fish and wildlife, and other beneficial public uses, including water supply. Finally, the Districts state that the analysis in the EIS cannot be based on the additional flows that would be facilitated by the deployment of the infiltration galleries and the Commission cannot require information about the Districts' operation of the infiltration galleries unless they are included in the license for the Don Pedro Project.

Response: We modified our recommended flow regime to adopt the Districts' proposed interim minimum flows until the infiltration galleries are operational, which would be monitored at the La Grange gage, and the proposed with-infiltration galleries' minimum flows reflected in the draft Voluntary Agreement, which includes two sets of minimum flows—one to be provided at the La Grange gage and another to be provided downstream of the infiltration galleries. We agree that the infiltration galleries would facilitate the Districts' release of their proposed minimum flows and that withdrawing part of the water needed for consumptive use at the infiltration galleries instead of at La Grange Diversion Dam would substantially enhance the most important habitat for Chinook salmon and *O. mykiss* in the Tuolumne River. However, the Commission's long-standing practice has been to exclude water supply infrastructure as part of a licensed project unless power would be generated from the water that is withdrawn by it, and we see no reason why the infiltration galleries must be included as project facilities for the Districts to release and monitor their proposed flow regime. The Commission will decide whether to include the infiltration galleries as project facilities in the license orders for the projects, based on the public record available at that time. If any stakeholders have new information on this issue, they should file that information with the Commission prior to its final action on the project.

Comment G2: The Districts disagree with staff's rejection of various measures that they propose in the amended final license application for the Don Pedro Project. Each of the Districts' measures is based on the site-specific studies conducted on the Tuolumne River, is supported by the record, forms an integrated resource management plan, is consistent with FPA section 10(a) enhancements, and represents a best adapted plan for the Tuolumne River. The Districts request that Commission staff reconsider those measures not included in the staff alternative.

Response: We reconsidered our recommendations pertaining to several of the Districts' proposed measures based on comments received on the draft EIS; discussion that occurred at the September 19, 2019, 10(j) meeting; and additional information filed on the record including the Districts' response to staff's September 17, 2019, request for additional information. We augmented our analysis in the final EIS based on this information and now recommend the following proposed measures that were not included in the staff alternative in the draft EIS: (1) base flows proposed to go in effect after the infiltration galleries are operational; (2) adaptive management of spring pulse flows; (3) the Coarse Sediment Management Program (with modification); (4) the experimental gravel cleaning program; and (5) the Lower Tuolumne River Habitat Improvement Program (LTRHIP).

Comment G3: The Conservation Groups[2] comment that the draft EIS does not accurately establish baseline conditions or identify appropriate mitigation measures based on baseline conditions. They state that the draft EIS fails to accurately describe baseline consumptive use and consumptive demand for Tuolumne River water and does not provide defensible reasoning for the Commission's decision to not analyze the over-appropriation of the Tuolumne River Watershed. They further state that to comply with the National Environmental Policy Act (NEPA), the final EIS should supplement the analysis of the proposed action's baseline. They state that the final EIS should accurately evaluate the appropriation of the Tuolumne River's water resources, including the general condition of the over-appropriation of these water resources and adjacent groundwater basins.

Response: We revised section 3.3.2.1, *Aquatic Resources, Affected Environment, Water Quantity*, in the final EIS to include an updated value for total consumptive water demand and total yearly water demand of Tuolumne River water in normal water years. For other baseline conditions presented in the draft EIS, the Affected Environment sections for each resource (section 3.0, *Environmental Analysis*), and elsewhere, describe,

[2] The Conservation Groups comprise the California Sportfishing Protection Alliance, Tuolumne River Trust, Trout Unlimited, American Rivers, American Whitewater, Merced River Conservation Committee, Friends of the River, Golden West Women Flyfishers, Central Sierra Environmental Resource Center, and Tuolumne River Conservancy.

reference, and analyze numerous empirical study results and modeling conducted by the Districts and other parties and together characterize the baseline conditions of the projects and affected environment. The no-action alternative also describes the model scenario for the environmental baseline (i.e., base case) for purposes of the NEPA analysis.

Comment G4: The U.S. Department of the Interior, Bureau of Land Management (BLM), comments that the NEPA analysis is inadequate because the preferred alternative in the draft EIS does not contain all of BLM's mandatory 4(e) conditions and therefore is not a viable alternative.

Response: As we note in section 5.1 of the EIS, sections 4(e) and 10(a)(1) of the FPA require that: (1) the Commission give equal consideration to the power development purposes and to the purposes of energy conservation; the protection of, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreation opportunities; and the preservation of other aspects of environmental quality; and (2) any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. Accordingly, we must independently evaluate the benefits and costs of each environmental measure, including environmental measures stipulated by BLM's mandatory 4(e) conditions, and make recommendations to the Commission on whether the measure would contribute to a license that would be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. The staff alternative includes those measures recommended by staff pursuant to sections 4(e) and 10(a) of the FPA. Regardless, this NEPA document includes an environmental analysis of BLM's 4(e) conditions, and section 2.2.5, *Modifications to Applicants' Proposal—Mandatory Conditions*, clearly states that the Commission is required to include all valid section 4(e) conditions in any licenses issued for the projects.

Comment G5: BLM states that the draft EIS does not provide a rationale for not recommending BLM's preliminary 4(e) condition 2 that would require the Districts to provide annual employee awareness training to familiarize the Districts' operations and maintenance staff with special-status species, non-native invasive plants, and sensitive areas known to occur within or adjacent to both project boundaries.

Response: Section 5.1.3, *Other Measures Not Recommended by Staff, Annual Training*, of the draft EIS explains that there is no justification for the measure. Licensees must comply with the license requirements, including those requirements intended to protect special-status species, and it is the licensee's responsibility to take the necessary steps to comply, including deciding what training they need to provide their employees. We have no basis to conclude that the Districts would be incapable of complying with license requirements intended to protect the special-status species.

Comment G6: The U.S. Department of the Interior, Fish and Wildlife Service (FWS) along with NMFS, the California State Water Resources Control Board (Water Board), BLM, and the Conservation Groups support the formation of an ecological group that

would hold annual meetings to facilitate communication between the Districts and stakeholders. BLM adds that an annual meeting is an important way to ensure that the projects comply with current laws, policy, and regulations. Further, the Conservation Groups comment that, while they value collaboration with agency staff, their interests are not represented through the Districts' consultation with appropriate federal, state, and local agencies, particularly not over the term of a 30- to 50-year license.

Response: We do not recommend the formation of an ecological group as a condition of any license issued because it appears that this group would be duplicative of the consultation process recommended as part of implementing many of our recommended measures for any licenses issued. Moreover, we cannot compel non-licensees to participate in the group; we only have jurisdiction over a licensee.

Comment G7: BLM is unclear why Commission staff does not recommend adoption of its 4(e) condition 35 for the Don Pedro Project. This condition would provide BLM an opportunity to determine that actions taken on BLM-managed public lands are in compliance with federal laws, such as NEPA.

Response: This condition is not recommended for any license issued because it appears to be an internal BLM administrative measure outside of the Commission's purview; however, all mandatory 4(e) conditions will be included in any license issued.

Comment G8: The Conservation Groups comment that the draft EIS fails to analyze a reasonable range of alternatives for the proposed projects. Specifically, the Conservation Groups state that: (1) the alternatives in the draft EIS are not sufficiently distinct to allow for a reasoned analysis, (2) the staff alternative with mandatory conditions is not a complete alternative, (3) the draft EIS does not analyze alternatives to mitigate effects on water supply from increased flow requirements for the lower Tuolumne River, (4) the draft EIS does not analyze a reduced export alternative, and (5) the final EIS should include as a complete alternative the Conservation Groups' recommendations made in response to the environmental analysis notice that the applications were ready for review.

Response: The EIS analyzes only those alternatives over which the Commission has the jurisdiction to authorize. In addition, the EIS analyzes all recommendations filed by the stakeholders in their responses to the Commission's notice of ready for environmental analysis and recommends an alternative for licensing the projects that, pursuant to section 10(a) of the FPA, would be best adapted to a comprehensive plan for developing or improving the waterway. The EIS also considers how mandatory conditions would affect the staff alternative. This analysis does not require that recommendations made by stakeholders be defined as stand-alone alternatives.

Comment G9: The City and County of San Francisco (CCSF) comments that because the staff alternative recommends the Districts' proposed interim flows and boating flows but does not include the Districts' infiltration galleries in any licenses issued for either project, the staff alternative would substantially and adversely affect the San Francisco Public Utilities Commission's (SFPUC's) Regional Water System (RWS). CCSF

analyzed the water supply effects of each scenario using the Hetch Hetchy/Local Simulation Model and SFPUC's water supply planning methodology and comments that the staff alternative would result in substantial increases in dry year rationing in the base year and at the estimated levels of demand of 238 million gallons per day (mgd) (normalized 2010 demand), 265 mgd (estimated average-year demand in 2040), and 287 mgd (estimated dry-year demand in 2040). For these reasons, CCSF indicates that Don Pedro Project draft License Article 419, *Boating Flows*, should not be recommended in the final EIS. The Districts comment that the flows required by this license article would significantly reduce the amount of water available for consumptive use and are much higher than needed for recreational boating purposes in the lower Tuolumne River, and they also ask that this article be removed. They state that adhering to requirements of the license article would increase the required instream flows to be provided by the Districts from an average of 241,000 acre-feet per year (using the 1971–2012 period of record) to 262,000 acre-feet per year. These increased flows would represent a 9 percent increase over the Districts' flows and a 21 percent increase over the current license conditions, which would reduce the water supply available to the Districts and CCSF.

Response: We modified our recommendation to include the Districts' proposed interim and with-infiltration galleries' flows, as modified in the draft Voluntary Agreement, including appropriate compliance points. The boating flows included in the Districts' proposed flows have been incorporated into Don Pedro Project draft License Article 409, Minimum Flows below La Grange Diversion Dam; therefore, a separate license article specifying boating flows (i.e., Don Pedro Project draft License Article 419 in the draft EIS) is no longer needed and is not included in the staff alternative in this final EIS.

Comment G10: CCSF comments that the 1995 Side Agreement between the Districts and CCSF is critical in ensuring a secure source of water to CCSF; however, the agreement remains in effect only until the Commission issues a new license for the Don Pedro Project. CCSF states that it continues to negotiate with the Districts for an extension of the 1995 Side Agreement, but in the unlikely event that an extension cannot be reached, CCSF requests that the Commission include a license article for the Don Pedro Project that would require the Districts to provide at least the same level of minimum flows as the 1995 Flow Side Agreement. CCSF states that it will continue to keep the Commission informed about the progress of these negotiations, and if an agreement is reached prior to issuance of a license, CCSF would file the agreement with the Commission, and the recommended flow allocation agreement license article would no longer be needed.

Response: Although we appreciate CCSF's updates on the negotiations between CCSF and the Districts about an extension of the 1995 Side Agreement, we do not recommend including a special license article that would require the Districts and CCSF to enter into an agreement regarding each party's obligations to provide water to satisfy minimum flows required under any licenses issued. The text of the recommended license article appears to require CCSF to enter into this agreement, and the Commission has no jurisdiction over CCSF to require its participation. However, if a new agreement has not

been negotiated by the time the Commission is ready to take final action on these licenses, we would examine this issue and take appropriate action in any final license orders, based on the public record available at that time.

Comment G11: Numerous parties support CCSF and the Bay Area Water Supply and Conservation Agency's (BAWSCA's) comments on the draft EIS pertaining to the potential effects of flow requirements that may be included in the project licenses on regional water supply.[3] Twenty-two commenters[4] request that the Commission continue to evaluate flow effects on the Bay Area's water supply, economy, and environment.

Response: The final EIS includes an updated analysis of the effects of proposed project operations on the regional water supply, economy, and environmental resources.

Comment G12: The U.S. Environmental Protection Agency (EPA) and Central Sierra Environmental Resource Center comment that the draft EIS includes preliminary section 4(e) conditions submitted by BLM but does not include similarly submitted 10(j) conditions from NMFS or California DFW. These entities recommend that the final EIS include all submitted section 4(e) and section 10(j) conditions.

Response: We initially considered the NMFS and California DFW recommendations as filed under section 10(a) because those agencies did not specify which of their recommendations were filed under section 10(j); however, we still analyzed their recommendations. Based on clarifications in their comments filed on the draft EIS, we now consider the NMFS and California DFW recommendations as filed under section 10(j) and treat them as such in the final EIS.

B. GEOLOGY AND SOILS

Comment GS1: CCSF comments that the statement on page 3-6 of the draft EIS (section 3.3.1.1, *Geologic Resources, Affected Environment, Stream Geomorphology*) that reads: "Upstream of Don Pedro Reservoir, CCSF's reservoirs in the Hetch Hetchy System trap a large volume of sediment, leading to downstream bed coarsening, narrowing, and straightening" is not accurate. CCSF adds that while its impoundments in the upper Tuolumne River Watershed likely trap much of the incoming fine sediment, unique factors of the physical setting of the upper Tuolumne River Watershed indicate that collectively CCSF's impoundments are unlikely to trap large volumes of coarse sediment and would not (and could not) result in the coarsening, narrowing, and straightening of the upper Tuolumne River. On the main stem of the upper Tuolumne

[3] Twenty commenters (13 cities/towns, 6 water districts, and Stanford University) support CCSF's comments on the draft EIS, and 21 commenters (14 cities/towns, 6 water districts, and Stanford University) support BAWSCA's comments on the draft EIS.

[4] These comments are made by 14 cities/towns, 7 water districts, and Stanford University.

River, both the pre-dam Hetch Hetchy Valley and the Poopenaut Valley (downstream of Hetch Hetchy) likely naturally trapped much of the coarse sediment arriving from the river above Hetch Hetchy Valley because of the low gradient and downstream valley constrictions. Coarse and fine sediment originating from the watershed downstream of Poopenaut Valley is allowed to pass through Early Intake Dam via sluice gates, thus Early Intake Dam is unlikely to trap either coarse or fine sediment for significant periods. On Eleanor Creek, Eleanor Dam likely does not contribute to the capture of any additional coarse sediment compared to pre-dam conditions because Lake Eleanor was a natural lake prior to enlargement by Eleanor Dam and would have naturally trapped all coarse sediment under pre-dam conditions. CCSF states that it is reasonable to conclude that only Cherry Valley Dam, which impounds Cherry Creek above the Eleanor Creek confluence, could meaningfully change pre- vs. post-dam coarse sediment delivery below CCSF's impoundments and conceivably show a downstream geomorphic response because there are no known natural coarse sediment sinks within pre-dam Cherry Valley.

Response: We revised section 3.3.1.1, *Geologic and Soil Resources, Affected Environment, Stream Geomorphology*, in the final EIS to indicate that the Tuolumne River Watershed upstream of CCSF's reservoirs does not appear to generate large amounts of sediment because of the extensive presence of exposed granitic bedrock and that the volume of sediment that accumulates in the reservoirs of the Hetch Hetchy Water and Power System (Hetch Hetchy System) is low. We also revised the same section in the final EIS to no longer indicate that CCSF's reservoirs in the Hetch Hetchy System, other than Cherry Creek, contribute to downstream bed coarsening, narrowing, or straightening.

Comment GS2: Steven White comments that the nature of silt/sediment is poorly characterized in the draft EIS and that the Sierra has historically been an area exploited by many mining interests, yet the draft EIS presents no elemental analysis to monitor for the presence of toxic heavy metal salts.

Response: Information regarding historical mining in the project areas is adequately presented in section 3.3.1.1, *Geologic and Soil Resources, Affected Environment*, of the final EIS. Mercury is highlighted as being a legacy contaminant in the Don Pedro Project area and in the lower Tuolumne River. However, we do not recommend legacy contaminant testing in the final EIS because we already have sufficient information for our NEPA analysis on the matter.

Comment GS3: The Districts comment that high flows sufficient to mobilize channel substrate and flood overbanks occur with frequency on the Tuolumne River, at least along the upper 15 miles of the river below La Grange. The Tuolumne River has also been subject to significant levee construction along the lowermost river reaches that has contained the river to the stream channel except under the highest flows. Leveed reaches are predominantly found along the lower 25 miles of the river. The Districts indicate that the final EIS should mention the occurrence of extensive levee construction along the lowermost reaches of the river.

Response: In the draft EIS, we point out that levee construction has occurred along the lower Tuolumne River between Modesto and the confluence with the San Joaquin River. This information has been added to the geology and soil section. Information regarding high flows sufficient to mobilize channel substrate below La Grange Diversion Dam is presented in section 3.3.1.1, *Geologic and Soil Resources, Affected Environment, Sediment Processes in Tuolumne River downstream of La Grange Diversion Dam*, and figure 3.3.1-1 in the final EIS.

Comment GS4: The Districts comment that no citation is provided to support the statement on page 3-8 of the draft EIS that "… riffles throughout the gravel-bedded zone have progressively diminished in size" and state that detailed studies found the opposite to be the case. They state that this mischaracterization of existing conditions of riffles should be corrected in the final EIS.

Response: The passage indicated above is in section 3.3.1.1, *Geology and Soils, Affected Environment, Sediment Processes in Tuolumne River downstream of La Grange Diversion Dam*, of the draft EIS and was cited from McBain and Trush (2004). In the final EIS, we added this citation and additional information presented by the Districts in the amended final license application for the Don Pedro Project, indicating that riffle habitat in this section of the lower Tuolumne River has increased by 21 percent between 1988 and 2012.

Comment GS5: The Districts comment that draft EIS section 3.3.1.1 incorrectly states that "7,800 to 11,300 cubic yards" of coarse bed material eroded from the lower Tuolumne River. These values should be "4,600 to 6,700 cubic yards" based on using the factor of 1.3 tons per cubic yard.

Response: We corrected these values in the final EIS.

Comment GS6: EPA comments that the draft EIS does not address whether section 404 of the Clean Water Act would apply to the projects. While the draft EIS acknowledges that some of the recreation construction activities may cause erosion in project-affected waters, it does not state whether these activities would meet the definition of fill and would require section 404 permits.

Response: Section 1.3, *Statutory and Regulatory Requirements*, of the draft EIS only describes the federal statutes applicable to the licensing process. A section 404 permit is not a prerequisite to a licensing decision.

C. WATER QUANTITY

Comment WR1: Regarding the statement on page 3-103 of the draft EIS that operation of the projects affects the seasonal flow pattern of the lower Tuolumne River between Don Pedro Dam and its confluence with the San Joaquin River, NMFS notes that the Commission previously determined in the scoping documents for the project that the geographic scope for water quality, water quantity, and aquatic resources extends upstream to Hetch Hetchy Dam and downstream to San Francisco Bay.

Response: We modified this statement in the final EIS to note that project effects on flow patterns in the Tuolumne River also affect flows in the San Joaquin River downstream of the confluence, where flows are also affected by inflows from other major tributaries. We address project effects on flow in the San Joaquin River as cumulative effects.

Comment WR2: The Bay Institute comments that the Districts and Commission staff assert that The Bay Institute's flow recommendations would result in 90 percent rationing in the SFPUC service area; however, this value does not accurately reflect The Bay Institute's recommendations or how they were modeled. Detailed assumptions made by The Bay Institute in its modeling regarding diversions to storage, to the SFPUC service area, to agriculture, and for water bank purposes are explained in its comment letter.

Response: Information presented in the draft EIS regarding rationing in the SFPUC service area is based on the results of the Districts' Tuolumne River Daily Operations Model and SFPUC's Hetch Hetchy Local Simulation Model, both of which have been used extensively throughout the licensing process for the projects. In the draft EIS, these models were used to determine percent rationing for the base case, the Districts' proposed flows, six flow schedules recommended by other stakeholders, and the flow schedule recommended by The Bay Institute. Based on supplemental model data filed by the Districts on December 11, 2019, we revised the final EIS (table 3.3.8-8) to reflect that The Bay Institute's flow recommendations would result in rationing up to 40 percent in the SFPUC service area, rather than 90 percent as previously indicated.

Comment WR3: EPA comments that it is unclear how the staff-recommended drought management plan would be implemented and recommends clarifying the final EIS to describe how flow releases for environmental purposes would be prioritized during droughts, including thresholds for action and monitoring frequency. The Conservation Groups also comment that the draft EIS evaluates the effects of the flows proposed by the Districts and recommended by the Conservation Groups on water supply without reference to a default off-ramp under a drought. Thus, in each case, EPA and the Conservation Groups state that the draft EIS overstates the water supply effects of various proposals.

Response: The staff-recommended drought management plan would be implemented only in rare situations where the dry-year relief mechanisms proposed by the Districts (e.g., lower minimum flows for dry and critically dry water years, a reduction in spring pulse flows during sequential-year droughts and in any dry/critical water year that follows a dry or critical water year, and a lower minimum operating elevation of Don Pedro Reservoir from 600 feet to not less than 550 feet) are not sufficient to minimize adverse effects on water supply. The staff-recommended drought management plan is meant to apply in extreme circumstances that are not considered in the Districts' modeling to support the recommended instream flows.

Comment WR4: The Districts provide proposed revisions to Don Pedro Project draft License Article 406, Drought Management Plan, to ensure that it applies in extreme

circumstances that have not been accounted for in the modeling to support the recommended instream flows (i.e., exclude the dry-year relief component that addresses sequential dry and critical years). In addition, the proposed revisions to draft License Article 406 are meant to ensure that the plan contemplates a potential reduction in flows (not an increase in flows) to avoid interfering with the Districts' respective comprehensive drought management plans applicable to their service districts.

Response: The Districts proposed revisions to draft License Article 406, including a definition of drought conditions that would trigger implementation of the plan and operating conditions in the event the plan is enacted, are included in the final EIS. The drought management plan would be used only in extreme drought conditions where the Districts may need to request variances from license conditions to reduce adverse effects on water supply.

Comment WR5: The Districts comment that the Commission should revise section 3.3.2.2 of the draft EIS to describe the flood control purposes of the Don Pedro Project, which contains a flood storage capacity of 340,000 acre-feet based on a contract with the U.S. Army Corps of Engineers and operates the project during the stated April through June period for flood control purposes and water supply management.

Response: We updated section 3.3.2.2, *Aquatic Resources, Environmental Effects, Streamflows and Reservoir Levels*, in the final EIS to include flood control as a project purpose, flood storage capacity, and the period during which flood control operations occur.

Comment WR6: The Conservation Groups comment that Don Pedro Project draft License Article 409 does not state when the licensees will determine the water year type for any given period. It is unclear whether the water year type will be determined once a year (and if so, when), updated each month from February through May based on California Department of Water Resources (California DWR) Bulletin 120, or whether the water year type for October through January will be updated based on California DWR's final water year determination in October based on actual inflow.

Response: We modified our recommendation to include the proposed Districts' interim and with-infiltration galleries' flows, as modified in the draft Voluntary Agreement, including appropriate compliance points. Included in the draft Voluntary Agreement is the process by which the Districts would make water year determinations. We revised draft License Article 409 in the final EIS to state that the Districts would make preliminary water year determinations on February 1, March 1, and April 1 of each year using a 90 percent flow exceedance, consistent with the draft Voluntary Agreement. California DWR would make the final water year determination on May 1 of each year using a 75 percent flow exceedance. If California DWR does not make the water year determination by May 1, the Districts would make the final water year determination on May 7 using a 75 percent exceedance.

Comment WR7: The Districts comment that the very high flows recommended by staff for boating purposes are far in excess of flows necessary for boating (approximately 175 cubic feet per second [cfs], based on the Districts' Lowest Boatable Flow Study) and would have significant adverse effects on water supplies of the Districts and CCSF. The draft EIS does not compare the water supply impacts of these flows against the small incremental effect on recreational boating. The interim flows would provide substantial boating opportunities, including 100 percent of the time in all water years from April 1 through May 31, and 100 percent of the time in all but critical water years from July 1 through October 15. The specific measures proposed by the Districts to accommodate boating in the lower Tuolumne consist of (1) providing a boatable flow of 200 cfs for the entire 52-mile lower Tuolumne River one weekend in June in wet, above normal, and below normal water years, and (2) providing 200 cfs over the three-day July 4 and Labor Day holidays and two pre-scheduled weekends in either July or August in all but critical water years.

Attachment B of the Districts comments, filed on April 12, 2019, provides the results of modeling the staff alternative including the interim flows and the flows identified in Don Pedro Project draft License Article 419. As shown in these model results, including these boating flows as license requirements would increase the required instream flows from 261,000 acre-feet under the interim flow schedule to more than 290,000 acre-feet. The water supply impacts to the Districts and CCSF would also be substantial as shown in these model results. Including the boating flows detailed in draft License Article 419 as overriding the interim flows would increase the project's required minimum flows 35 percent over current conditions. Using the estimate included in the draft EIS for replacement water of $3,000/acre-foot, the economic impact of the boating flows would average $90 million annually.

Response: We modified our recommendation to include the Districts' proposed interim and with-infiltration galleries' flows, as modified in the draft Voluntary Agreement and including appropriate compliance points. The boating flows proposed by the Districts have been incorporated into Don Pedro Project draft License Article 409; therefore, a separate license article specifying boating flows is no longer needed and is not included in the final EIS.

Comment WR8: The Districts recommend that the Commission revise Don Pedro Project draft License Article 409 to include the specific language about instream minimum flow compliance proposed by the Districts, which would require the minimum flows to be equaled or exceeded over monthly time frames with no deficits of more than 10 percent below the minimum for more than 60 minutes and no instantaneous deficits of more than 20 percent below the proposed minimum flows. Any requirement to provide instantaneous minimum flows would require the Districts to provide a flow significantly greater than the required instantaneous value to ensure compliance. The Districts state that their proposed compliance formulation would have no measurable adverse impact on aquatic resources compared to an instantaneous compliance metric.

Response: We agree that the minor variations in flow that would be allowed using the compliance standards recommended by the Districts would have no measurable adverse effect on aquatic resources and have incorporated them into draft License Article 409.

Comment WR9: The Districts request that the Commission revise Don Pedro Project draft License Article 408, Operation Compliance Monitoring Plan, to minimize the ambiguity in the article by acknowledging the location of the existing gages and their operation and maintenance by the U.S. Department of the Interior, Geological Survey. In addition, because Commission staff has not recommended including the infiltration galleries as licensed Don Pedro Project features, the Districts recommend revising the article to reflect the fact that the Commission would not have jurisdiction over the operation of the infiltration galleries, including the quantity of flow diverted at the infiltration galleries. The Districts also propose minor revisions to Don Pedro Project draft License Article 409 to clarify how compliance will be measured.

Response: We revised Don Pedro Project draft License Article 408 in the final EIS to identify the gages to be used as compliance points for minimum flows downstream of La Grange Diversion Dam and water levels in Don Pedro Reservoir. In addition, we identified the need for this plan to describe the licensee's planned compliance monitoring procedures below the infiltration galleries. We also modified our recommendation and Don Pedro Project draft License Article 409 to include the Districts' proposed interim and with-infiltration galleries' flows, as modified in the draft Voluntary Agreement, including appropriate compliance points. The method for monitoring flow compliance downstream of the infiltration galleries after they are operational would depend on whether the Commission includes the infiltration galleries as part of the license. If the infiltration galleries are included as licensed facilities, we recommend that flow compliance be monitored as proposed by the Districts, with compliance measured by subtracting flow diverted into the galleries from the flow measured at La Grange. If the Commission does not include the infiltration galleries as part of the license, we recommend requiring that the Districts install an instream flow gage in the Tuolumne River downstream of the infiltration galleries. Both of these options are described in revised Don Pedro Project draft License Article 408 in the final EIS. We also revised Don Pedro Project draft License Article 409 to include the compliance standards recommended by the Districts.

Comment WR10: CCSF and SFPUC comment that Commission staff incorrectly describe the Districts' use of the San Joaquin River Index in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, on page 3-60 of the draft EIS. The Districts currently use the San Joaquin Index, which is based on all major tributaries to the San Joaquin Basin, not just the Tuolumne, but with different water year types as defined in amended License Article 37 of the original Don Pedro Project license.

Response: We revised section 3.3.2.2, *Aquatic Resources, Environmental Effects, Streamflows and Reservoir Levels*, in the final EIS to match the description of the water

supply index provided in the Commission Order Amending License and Dismissing Rehearing Requests for the Don Pedro Project, issued July 31, 1996.

Comment WR11: CCSF comments that figure 3.3.2-12, *Simulated Tuolumne River Flow Downstream of La Grange Diversion Dam for the Districts' No-Action and Proposed Project Scenario for Representative Dry (2002) Water Year*, appears to omit dry year reduction in a second sequential dry year. The simulated flow for the proposed project scenario without infiltration galleries should have a spring pulse identical to the proposed project scenario with infiltration galleries because 2002 was a sequential dry year with a spring pulse flow of 45,000 acre-feet. However, the no-infiltration galleries scenario has a longer duration pulse flow than the with-infiltration galleries scenario. The Districts comment that figure 3.3.2-12 misrepresents their outmigration pulse flow proposal under the no infiltration galleries scenario, which is the same as under the with-infiltration galleries scenario.

Response: In their May 14, 2018, response to the February 16, 2018, request for additional information, the Districts note that the input to the operations model incorrectly applied 35,000 acre-feet, instead of the proposed 45,000 acre-feet, for spring pulse flows in sequential dry water years. The Districts reported that this only affected simulated flows in 2002. We revised this figure (figure 3.2.2-13 in the final EIS) to reflect a different representative dry water year (2001) from the project record.

Comment WR12: CCSF comments that the Commission should revise Don Pedro Project draft License Article 410, Spring Pulse Flow Release Plan, so that the Districts' dry-year relief mechanism applies in any dry year that follows a dry or critical year and in all critical years that follow a dry or critical year to better protect CCSF's stored water supply. The Districts comment that the dry-year relief mechanism proposed by CCSF improves protection of water supplies in extended dry-year sequences and agree with the CCSF comment. The Districts also propose minor revisions to Don Pedro Project draft License Article 410 to clarify their proposed dry-year relief mechanism and how compliance would be measured.

Response: The Districts' proposed outmigration pulse flow dry-year relief mechanism would reduce pulse flows in sequential dry and critical water years. For example, under this proposal, flow volumes would be reduced under the hypothetical drought sequence—C, D, C, D, C, D—in the second and third dry and critical water years (i.e., the last four years). Based on the water year classifications for 1971 to 2016, the original dry-year relief mechanism would have been implemented in 11 of the 45 years under the Districts' initial proposal. Under CCSF's recommended revision, the dry-year relief mechanism would apply in any dry year that follows a dry or critical year, and the dry-relief mechanism would have been triggered in 12 of the 45 years.

We note that while this proposal would result in one more year of reduced spring pulse flows, the sequencing outlined by CCSF is a rare occurrence. CCSF's proposal would provide additional benefits (e.g., a reduction in additional Bay Area water rationing) to socioeconomic resources in the Bay Area in multiple dry and critical water year

sequences, while not incurring a large effect on aquatic resources in the lower Tuolumne River. Therefore, we revised recommended Don Pedro Project draft License Article 410, which reflected the Districts' original proposal, and the staff alternative in the final EIS to match CCSF's recommended measure regarding the spring pulse flow dry-year relief mechanism.

Comment WR13: California DFW comments that the draft EIS indicates that, except in years with high flows, the infiltration galleries would operate from June 1 through October 15. However, the water rights request for the infiltration galleries states that a year-round water transfer would occur. California DFW requests that Commission staff explain the rationale for this temporal discrepancy.

Response: While the Districts' existing water rights allow them to withdraw water on a year-round basis, we recommend that the Commission require the Districts to limit water withdrawals at the proposed infiltration galleries to June 1 through October 15 of each year, consistent with the Districts' proposal in the draft Voluntary Agreement.

Comment WR14: California DFW is concerned that the infiltration galleries are not considered part of the Don Pedro Project because California DFW's modeling, which assumes the same withdrawals as the Districts' modeling and includes the infiltration galleries, indicates the Tuolumne River shows negative values for instream flows below river mile (RM) 25 (see table 1 in California DFW draft EIS comment letter, filed on April 12, 2019). California DFW requests that Commission staff include a license condition specifying that any flows removed at the infiltration galleries would be in addition to Commission-mandated flows to avoid inadequate streamflow below the infiltration galleries.

Response: We modified our recommendation to include the Districts' proposed interim and with-infiltration galleries' flows, as modified in the draft Voluntary Agreement, including appropriate compliance points. We do not recommend a special license article because it would not be necessary. The Commission will decide whether the infiltration galleries should be made part of the Don Pedro Project in the license order.

Comment WR15: The Conservation Groups comment that page 3-16 the draft EIS does not cite a basis for the statement: "The Hetch Hetchy System delivers an average of 265,000 acre-feet of water each year. . . " that they state is contrary to information in the record. The Conservation Groups request that the Commission reevaluate its analysis of the effects of increased flow requirements on water supplies available to SFPUC and BAWSCA using a 200 mgd demand scenario for these entities.

Response: We modified section 3.3.2.1, *Aquatic Resources*, *Affected Environment*, *Water Quantity*, *Project-affected Stream Reaches*, in the final EIS to reflect an updated CCSF water delivery amount of 250,000 acre-feet each year. This value reflects RWS water deliveries of 238 mgd and represents the base year demand figure for the Districts' Don Pedro operations model (W&AR-02), which serves as the first model in a chain of analyses to compare the effects of alternative flow schedules with the base conditions on

the Tuolumne River and the water supply effects analyzed in the draft EIS. In addition, 238 mgd is also close to the five-year average from fiscal year 2006–2007 through fiscal year 2010–2011 (240 mgd). Although our analysis reflects RWS water deliveries of 238 mgd, we recognize that CCSF's 2008 Final Socioeconomic Report indicates variability exists in water demand throughout the CCSF RWS service area. We understand that conservation efforts in the RWS service area resulted in a decrease in water use from 1987 to 2013, despite a population increase. In addition, we recognize that the recent rate increase to RWS customers resulting from the Water System Improvement Program could act to further reduce customer water demand.

Comment WR16: The Conservation Groups comment that the 1.5 million acre-feet total consumptive demand estimate presented on page 3-21 of the draft EIS is not accurate and that based on the Conservation Groups' analysis of the Don Pedro operations model, as detailed in footnote 52 of their draft EIS comment letter, a total consumptive demand of 1.2 million acre-feet is more accurate.

Response: Based on a review of the Districts' Operations Model and a review of additional resources that outline water usage in the Tuolumne River Basin, we updated section 3.3.2.1, *Aquatic Resources, Water Quantity, Water Rights and Water Supply Deliveries*, in the final EIS to include the Conservation Groups' value of 1.2 million acre-feet for total consumptive demand of Tuolumne River water in normal water years.

Comment WR17: CCSF comments that Commission staff's use of 220 mgd as an estimated base year demand level for the SFPUC RWS is not accurate and has no precedent in prior analyses filed in the projects' records. CCSF states that the final EIS should be corrected to use 238 mgd as San Francisco's base year retail and wholesale water demand.

Response: We originally chose RWS water deliveries of 220 mgd during fiscal year 2010–2011 (an above normal water year) for the base year because it occurred before the recent drought period and is about the same as the 223 mgd RWS water deliveries during fiscal year 2012–2013 (a dry water year). We agree that RWS water deliveries of 238 mgd are more appropriate and use this value in the final EIS because it represents the base year demand figure for the Districts' Don Pedro operations model (W&AR-02). In addition, 238 mgd is also close to the five-year average from fiscal year 2006–2007 through fiscal year 2010–2011 (240 mgd).

Comment WR18: The Conservation Groups comment that the draft EIS does not analyze the over-appropriation of the Tuolumne River Watershed, including groundwater resources, as a baseline condition. Therefore, it improperly presents incremental improvements as substantive improvements.

Response: For baseline conditions presented in the draft EIS, the affected environment sections for each resource (section 3.0, *Environmental Analysis*), and elsewhere, describe, reference, and analyze numerous empirical study results and modeling conducted by the Districts and other parties, and together provide a characterization of the baseline

conditions of the projects and the affected environment. The no-action alternative also describes the baseline condition (i.e., base case) for purposes of the NEPA analysis.

D. WATER QUALITY

Comment WQ1: The Districts comment that table 3.3.2-3 in the draft EIS mischaracterizes the designated beneficial uses of the Tuolumne River in the Water Quality Control Plan for the Sacramento and San Joaquin Basins (Basin Plan). They recommend using the May 2018 version of the Basin Plan without modifying the Water Quality Control Plan table or interpreting the intent of the specific beneficial uses. The Districts comment that the draft EIS is confusing the beneficial use of the water with the species being protected by the beneficial use and state that species not enumerated may be present as well.

Response: We revised table 3.3.2-3 to clarify the beneficial uses.

Comment WQ2: The Districts comment that table 3.3.2-8 in the draft EIS incorrectly reports the adult fall-run migration as January through May and state that adult fall-run migration is from late September through early January. The Districts also state that footnote c to this table incorrectly identifies the adult fall-run Chinook migration as occurring from late September through early May. Peak migration normally occurs from mid-October through late November, and less than 2 percent of the upmigration occurs either before October 1 or after December 31 based on 2009–2018 records from the adult counting weir at RM 24.5. The time between upmigration and spawning generally varies depending on the time of entry to the spawning grounds but can generally be estimated as 2 weeks.

Response: We revised the referenced table and footnote c to clarify that we are referring to the dissolved oxygen (DO) monitoring periods, not life-stage periods.

Comment WQ3: The Districts comment that the final EIS would benefit from a more robust discussion of river temperatures and the effects of the projects on river temperatures and provided outflow temperature records at 15-minute intervals for 2015 and 2016 and an evaluation of this data. The Districts specifically note that October is a transition month when water temperatures change relatively rapidly, and they compare Tuolumne River temperature regimes for "with dams" and "without dams" in the watershed. The Districts also comment that in the with-infiltration galleries scenario, river temperatures are significantly cooler than current conditions from May through September down to RM 25.9 and requests that draft EIS section 3.3.2.2 be corrected.

Response: We expanded the discussion of existing conditions and incorporated an evaluation of the Districts' 2015–2016 Don Pedro outflow temperatures into section 3.3.2.1, *Aquatic Resources*, *Affected Environment*, *Water Quality*. In addition, we revised our analysis in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Water Temperature Monitoring*, by adding a discussion of the general seasonal temperature trends including rapid cooling in October, comparison of simulated temperatures for the without-dams scenario to the baseline, and discussion of simulated daily average

temperatures for the Districts' with-infiltration galleries scenario frequently being cooler than the baseline scenario in May–September.

Comment WQ4: The Districts comment that the draft EIS analysis of temperature suitability appears to rely on water temperatures listed in table 3.3.2-22, which presents differing temperature metrics proposed by various resource agencies that do not have regulatory authority to establish actual water temperature criteria or standards.

Response: Table 3.3.2-22 in the draft EIS (table 3.3.2-24 in the final EIS) is intended to provide California DFW- and NMFS-recommended temperatures for life stages and time periods. As explained on page 3-92 of the draft EIS, our temperature analysis was based on the temperature targets for life stages and time periods specified in table 3.3.2-23 in the draft EIS.

Comment WQ5: The Districts comment that the statement on page 3-102 of the draft EIS regarding the Districts' modeling "captures the issues that would influence temperature in the lower Tuolumne River with the exception of not adequately representing conditions that could occur in sequential low-flow years" should be appropriately qualified. They state that the Districts' modeling captures significant drought conditions that occurred from October 1, 1970, to September 30, 2012 (i.e., in water year 1971 to 2012), and that their proposed "dry-year relief" plan of reduced outmigration pulse flows in sequential critical and dry years reflects a response to extended droughts.

Response: In the final EIS, we revised section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Temperature Monitoring,* to clarify that the model simulations include the severe multi-year drought that occurred in 1987–1992 and incorporated a discussion of the Districts' proposed dry-year relief plan. We also added a footnote to table 3.3.2-17 in the final EIS to make it clear that simulations of the Districts' proposals include lower pulse flows in sequential dry and critical years than in the initial dry and critical years.

Comment WQ6: The Districts comment that the statement made on page 3-86 of the draft EIS that "Under current conditions, warm water temperatures reduce habitat suitability for Chinook salmon and *O. mykiss* downstream of the La Grange Diversion Dam, particularly for spawning and egg incubation" should be deleted because it is unsupported in the record. They point out that current temperature conditions in the salmonid spawning reach of the lower Tuolumne River are cooler when compared to the "without dams" conditions through the upmigration period of mid-September through late October.

They also state that the available information demonstrates a healthy *O. mykiss* population, directly rebutting the applicability of EPA (2003) temperature guidance as a suitable metric for Tuolumne River *O. mykiss*. All relevant evidence, including Nichols (2013) provided as attachment D to the Districts' comments, points to a similar conclusion for Tuolumne River fall-run Chinook salmon. The Districts note that tables

3.3.2-24 through 3.3.2-25[5] in the draft EIS demonstrate that all the flow proposals result in unsuitable habitat conditions at nearly all locations evaluated and that this result confirms that EPA (2003) may not be an appropriate measure of temperature suitability. The Districts discuss fall-run Chinook salmon life-cycle periodicity in the Tuolumne River and its representation in the production model, and they state that the obvious conclusion is that water temperatures under current conditions fully support egg incubation of fall-run Chinook and *O. mykiss*.

Regarding spawning habitat suitability, the Districts note that river temperatures in October upstream of RM 46 are less than 16 degrees Celsius (°C) 90 percent of the time, especially in the mid-to-late October period when fall-run Chinook spawning activity begins. Tuolumne River *O. mykiss* spawn from December through mid-April when river temperatures at and above RM 43 are less than 15°C 99 percent and 95 percent of the time in March and April, respectively.

In addition, the Districts note that fall-run Chinook salmon ascending to the Tuolumne River must first pass through the Sacramento-San Joaquin River Delta (Delta) and then through 30 miles of the San Joaquin River, both of which contain temperatures that are warmer than the Tuolumne River in September and October. The Districts agree that Don Pedro Project operation is one of several factors that "affect" water temperatures in the Tuolumne River. However, the statement on draft EIS page 3-86 makes it appear that the entire lower river is warmed during the "irrigation season." Water temperature modeling shows that under base case conditions, 7DADM temperatures are relatively cool with little variability year-round immediately below Don Pedro Dam (RM 54); summer 7DADMs climb to 20°C but are still 5°C below without-dam conditions at RM 46; and the highest summer 7DADM is around 24°C (i.e., very close to the 7DADM without-dam conditions) at RM 34. The project's releases cool much of the reach inhabited by salmonids during the "irrigation season," relative to what they would be in the absence of the project.

Response: We revised the final EIS to clarify that (1) warm water limits habitat suitability for spawning and egg incubation in the lower Tuolumne River, and (2) the rate of flow released from the Don Pedro Project affects water temperatures in the main channel of the Tuolumne River downstream of Don Pedro Dam. We also added a footnote that describes the differences between temperature model results for the base case and without-dams scenarios.

We reevaluated available information on life-stage periodicity and have revised the periodicity for Chinook salmon in the final EIS to be consistent with that used in the Districts' Chinook salmon model. No changes were made to steelhead periodicity, which

[5] We interpreted the Districts' reference to table 3.3.2-2 to be a typographical error and, therefore, provide the table number for the first of two tables in our analysis of simulated water temperatures to target 7DADMs.

was consistent with the *O. mykiss* population model. However, we revised species life-stage designations in tables 3.3.2-23 and 3.3.2-24 from the draft EIS (tables 3.3.2-26 and 3.3.2-27 in the final EIS) to clarify references for steelhead and resident *O. mykiss*. The periodicity used in the final EIS for both species are provided below, along with our supporting rationale.

Chinook Salmon

- Spawning in October–December based on California DFW redd count data for 1992–2010; this is consistent with the Chinook salmon population model (Stillwater Sciences, 2017b).
- Emigration in January–May based on 0.5 percent or less of rotary screw trap (RST) captures occurring before June 1 and most June captures occurring in high-flow years when lower Tuolumne River water temperature is cool compared to other water year types. The January–May period is consistent with the Chinook salmon population model (Stillwater Sciences, 2017b).
- Adult upstream migration in September–December based on timing of passage at the lower Tuolumne River RM 24.5 weir in 2009–2012 (Stillwater Sciences, 2017b).

Steelhead

- Smoltification in January–June based on timing from the Stanislaus River, as is the case for the *O. mykiss* population model (Stillwater Sciences, 2017a).
- Adult upstream migration in July–March based on timing from the Stanislaus River, as is the case for the *O. mykiss* population model (Stillwater Sciences, 2017a).

In addition, we revised the final EIS by adding analysis of the effects of daily average temperature on salmonids in the lower Tuolumne River. These additions are in appendix G, Analysis of Simulated Daily Average Temperature in the Lower Tuolumne River, and the *Minimum Flows and Pulse Flows* subsection in section 3.3.2.2, *Aquatic Resources, Environmental Effects*.

Comment WQ7: The Districts state that the list of examples of peer-reviewed studies that support the ability of salmonids to adapt to warm conditions provided in the draft EIS (page 3-91) should include Poletto et al. (2017), which tested juvenile fall-run Chinook from the Central Valley Mokelumne River hatchery.

Response: In the final EIS, we expanded the referenced discussion of peer-reviewed studies supporting adaptation of salmonid populations to warm conditions by including Chinook salmon and citing Poletto et al. (2017).

Comment WQ8: EPA comments that the draft EIS does not appear to analyze salmonid population-level effects from water temperature or effects of water temperature on life stages other than juvenile rearing (e.g., spawning, egg incubation, fry emergence, and

smoltification). Additionally, EPA recommends that the Commission consider a robust suite of data and endpoints that broadly addresses thermal physiological and ecological effects, both acute and chronic, when determining scientifically sound temperature values that can influence salmonid health. EPA also comments that potential negative effects of competition, disease, and predation under a warmer thermal regime should be included.

Response: Our analysis in the draft EIS recognizes that both short-term high temperatures and long-term moderate temperatures can affect salmonid production levels. We analyze instream temperature effects on salmonids by (1) determining the frequency that simulated lower Tuolumne River 7DADM temperatures are too warm to protect a total of 11 life stages of fall-run-Chinook salmon, Central Valley steelhead, and *O. mykiss*,[6] and (2) evaluating the effects of the proposal and recommendations on Chinook salmon and *O. mykiss* using the results of the Districts' production models in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Minimum Flows and Pulse Flows*. These production models incorporate a wide range of daily average temperature indices, including temperature triggers to indicate spawning ceasing and cause the death of embryos, fry, juveniles, smolts, and adults; accumulation of thermal units to determine the timing of *O. mykiss* fry emergence from the gravels; and identification of temperature-dependent probabilities for habitat use by *O. mykiss* adults.

To provide readers a better understanding of how temperature can affect salmonids, we added a discussion of the effects of temperature on the physiology and behavior of salmonids to the final EIS in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Water Temperature Monitoring*. We also added a frequency analysis of simulated lower Tuolumne River daily average temperatures (appendix G in the final EIS) and incorporated temperature into our discussion of the effects on Chinook salmon and *O. mykiss* habitat (weighted usable area). However, we note that the overall effect of the projects is that the lower Tuolumne River remains cooler than natural conditions in the summer (refer to the response to comment WQ3).

Comment WQ9: The Districts comment that page 3-92 of the draft EIS is not clear about which "core/non-core" locations would apply or the biological basis for differentiation between "steelhead" and *O. mykiss*. The draft EIS should explain the biological difference between "core" and "non-core" and whether this is a reference to the NMFS Recovery Plan.

[6] Table 3.3.2-24 of the draft EIS provides exceedance frequencies for fall-run Chinook salmon spawning and egg incubation, juvenile rearing and emigration, and adult upstream migration; Central Valley steelhead spawning and egg incubation, smoltification, juvenile rearing and emigration for core and non-core, juvenile over-summer rearing, adult upstream migration, and adult rearing; and *O. mykiss* juvenile rearing and emigration.

On May 18, 2017, as part of the licensing of the La Grange Project, licensing participants, including all the resource agencies, agreed on a suite of temperature indices applicable to the Tuolumne River for *O. mykiss* and Chinook salmon. As a result, the Districts recommend that draft EIS table 3.3.2-23 adopt the upper tolerable water temperature targets for the assessment in tables 3.3.2-24 and 3.3.2-25. The final EIS should identify a temperature above the agreed-upon upper tolerable water temperature indices as an appropriate metric for the "suitable range for survival" referred to in several locations of the draft EIS.

In addition, based on the data on the Tuolumne River in the record, the following corrections should be made to the periodicities in table 3.3.2-23:

- September is not a spawning and egg incubation period for fall-run Chinook salmon; while a small number of salmon pass the adult counting weir in September, there is no evidence that these fish spawn in September.
- Very little fall-run Chinook emigration from the Tuolumne River occurs in June.
- There is no evidence of a "steelhead" population occurring in the Tuolumne River; therefore, it is unknown and unknowable when Tuolumne River "steelhead" smoltify or when adult upstream migration occurs. Based on the data from the Tuolumne River counting weir and redd surveys, a small number of *O. mykiss* large enough to be "steelhead" have been counted. Based on this, upstream migration on the Tuolumne River would be from December through April.

Response: We designed our temperature analysis in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Water Temperature Monitoring*, with the goal of matching the general approach used by the Water Board and EPA for determining 303(d) listings. In the draft EIS, the notes that accompany table 3.3.2-23 are intended to communicate that we apply the same definition for "core" and "non-core" as EPA (2011) does in its analysis that led to the lower Tuolumne River 303(d) listing. We revised these notes to clarify that the "core" temperature value is for protection of moderate to high density; whereas, the non-core temperature values are intended to protect low to moderate densities and recognize that fish will use warmer water than their optimal range (EPA, 2003). We also revised the table (table 3.3.2-26 in the final EIS) to clarify if each 7DADM temperature target provided for steelhead applies to anadromous and/or resident *O. mykiss*.

Based on the approach used by EPA for its analysis that led to 303(d) listing of the lower Tuolumne River (EPA, 2011) and the temperature indices used for the most recent (2014 and 2016) 303(d) listings (Water Board, 2017b), we analyze the frequency of exceeding life-stage-specific 7DADM temperature indices that were set with the goal of protecting potential salmonid use (EPA, 2003, 2011). To provide a more robust analysis, we also analyze the frequency of exceeding a 22°C 7DADM based on the Districts' evaluation of thermal suitability of *O. mykiss* obtained from the lower Tuolumne River (Farrell et al., 2017). We believe that our analysis in the draft EIS provides adequate insight into the

effects of proposed and recommend flow regimes on the lower Tuolumne River thermal regime and subsequent effects of the thermal regimes on potential use by the life stages of Chinook salmon and *O. mykiss*.

Upper tolerable temperatures are indirectly evaluated in our analysis of results from the Districts' Chinook salmon and *O. mykiss* population models (refer to the response to comment WQ8).

Comment WQ10: The Districts comment that using the phrase "suitable water temperatures" (draft EIS, page 3-228) absent a finding of exactly what those temperatures might be in the lower Tuolumne River is misleading and presumes that current temperatures are not suitable. There is no evidence in the record that current temperatures in the lower Tuolumne River are not suitable for fall-run Chinook and *O. mykiss*. In fact, the opposite is true as shown by the growing population of *O. mykiss* and the healthy condition of in-river fall-run Chinook.

Response: We changed the word "suitable" to "optimal" in the final EIS. However, we note that page 3-153 of the Districts' amended final license application for the Don Pedro Project states "Suitable water temperatures for smolt emigration are available in the San Joaquin River at Vernalis as late as mid-May in most years, and it is likely that Delta conditions are suitable for smolt emigration as late as June in some years. Unsuitable temperature conditions in excess of 25°C (77°F) are likely exceeded at Vernalis by late June in most years, limiting successful emigration or any Delta rearing opportunities during summer." Pages 4-105 and 4-106 of the Districts' amended final license application (exhibit E) also states "Based on assessments of seasonal water temperatures and typical spawning periods, fall-run Chinook salmon in San Joaquin River basin tributaries are unlikely to encounter unsuitable water temperatures leading to reduced egg viability (TID/MID, 2013b), and Myrick and Cech (2001) suggested that only the earliest spawners arriving in San Joaquin River basin tributaries during September might encounter unsuitable temperatures."

Comment WQ9: The Districts request that the sentence "The Districts do not propose water temperature targets or monitoring for either project." on draft EIS page 5-21 be deleted. Specific temperature targets were put forward in their *in-situ* testing of the thermal capacity of wild *O. mykiss* juveniles in the lower Tuolumne River (W&AR-14), and specific temperature targets were established in their production models for fall-run Chinook and *O. mykiss*. The Districts did not "propose" specific temperature targets in the lower Tuolumne River at specific river miles because there is no evidence that such targets are warranted as a matter of compliance and there is little agreement on what those targets should be to be meaningful. As the EPA stated in its letter to Turlock Irrigation District dated June 27, 2018, as referenced in the draft EIS, there is evidence of river-specific temperature adaptation.

The Districts state that the following facts all point to the existence of suitable water temperatures in the Tuolumne River to support native salmonids: (1) *O. mykiss* populations are expanding in the Tuolumne, (2) *O. mykiss* growth rates are equal or

greater than other Central Valley streams, (3) resource agencies theorize that the lack of a steelhead run in the Tuolumne River may be due to preference for a resident life history, (4) every assessment of Tuolumne River fall-run Chinook smolt condition conducted by the FWS shows these fish to be healthy and in good condition, and (5) there are very low levels of fall-run Chinook pre-spawn mortality.

Response: Although the Districts explain how they used water temperature targets in studies and modeling, they state that they "did not 'propose' specific temperature targets in the lower Tuolumne River at specific river miles because there is no evidence that such targets are warranted as a matter of compliance and there is little agreement on what those targets should be to be meaningful." We revised the final EIS to explain the Districts reasoning for not officially proposing water temperature targets.

Comment WQ12: With regard to a statement on page 5-22 of the draft EIS, the Districts comment that they modeled river temperatures occurring during the six-year drought from 1987 through 1992.

Response: We revised the final EIS to note that the modeling represents most conditions that would occur, including the 1987–1992 multi-year drought. However, the period that was modeled does not adequately represent the variability in conditions that could occur in sequential low-flow years, especially when Don Pedro Reservoir is drawn down to a level that results in the powerhouse drafting warm water from the reservoir's epilimnion.

Comment WQ13: The Districts state that there is no justification for the Commission to require temperature monitoring because there are no specific temperature compliance criteria and no site-specific scientific evidence indicating temperatures are unsuitable for native salmonids in the lower Tuolumne River. The Districts note that they have maintained an extensive network of temperature monitoring gages in the lower Tuolumne River for many years (provided as attachment E of the Districts comments on the draft EIS), including locations at or near the locations recommended by Commission staff on draft page 2-24). The Districts plan to continue this temperature monitoring program and agree to relocate monitoring points to enable temperature monitoring at the precise locations recommended by staff in the draft EIS (i.e., Don Pedro Reservoir near the dam and in the lower river at the gage below La Grange [RM 51.7], Basso Bridge [RM 47.5], Roberts Ferry [RM 39.5]).

The Districts state that they do not object to a temperature monitoring program when reservoir elevations approach 600 feet, as proposed in the draft EIS. The final EIS should be clear that the staff recommendation in the draft EIS to develop an approach for monitoring the change in Don Pedro Reservoir's available cool-water storage and temperature monitoring at each lower river location applies only when Don Pedro Reservoir elevations begin to approach an elevation of 600 feet.

Response: Since issuance of the draft EIS, resource agencies have clarified their concerns about effects of the old dam on Don Pedro Reservoir temperatures, the goals of their recommended water temperature monitoring, and how results of the temperature

monitoring program would be used to guide project operations.[7] As a result, we revised our recommendation for temperature monitoring in the final EIS to include: (1) year-round temperature monitoring at five sites in the lower Tuolumne River primarily to guide and evaluate the schedule for pulse flows to benefit upstream and downstream migration of salmonids, and (2) monitoring temperature vertical profiles in Don Pedro Reservoir near the dam whenever the reservoir elevation is less than 700 feet NGVD[8] to guide management of the reservoir's cool-water storage. The temperature results for the instream monitoring would also be used for periods when Don Pedro Reservoir is below 700 feet to aid in managing the available cool-water storage. Revisions to the final EIS include our analysis addressing this new information in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Temperature Monitoring*, and our revised recommendation for temperature monitoring in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications, Water Temperature Monitoring*.

Nothing in our temperature monitoring recommendation would prevent the Districts from continuing to implement their temperature monitoring program.

Comment WQ14: The Districts state that the Commission staff's recommended flows (interim flows) would maintain average daily summer temperatures at RM 43 below 20°C almost 100 percent of the time and are therefore protective of *O. mykiss*. However, the Districts' preferred plan with infiltration galleries would maintain average daily summer temperatures at RM 39 below 20°C 90 percent of the time; thereby potentially extending habitat for *O. mykiss* by 40 percent (RMs 43 to 39). The Districts' proposal with infiltration galleries also would provide protection against changing climate over the term of the new license.

Response: We acknowledge that the Districts' proposed operation of the infiltration galleries would result in a more favorable thermal regime for salmonids in the lower Tuolumne River.

Comment WQ15: The Bay Institute comments that the statements made on pages 3-89, 3-90, and 5-22 of the draft EIS about The Bay Institute not recommending water temperature targets or criteria are incorrect. Because of its lack of temperature modeling capacity, The Bay Institute used available information to translate its temperature objectives into flows with the intention for either the temperature or the flow to be the controlling criterion at various points and times in the river.

[7] These clarifications were communicated at the September 19, 2019, section 10(j) meeting (accession nos. 20191024-4000, 20191024-4001, and 20190926-5155), agency filings in response to this meeting (accession nos. 20191018-5162 and 20191018-5284), and in agency comments on the draft EIS.

[8] National Geodetic Vertical Datum of 1929.

Response: We revised the final EIS to clarify that The Bay Institute incorporated 7DADM temperature objectives into its recommended flow regime.

Comment WQ16: In response to the statement on page 3-90 of the draft EIS that reads: "The Bay Institute does not indicate which species its temperature recommendations are intended to protect, define their temperature objectives (e.g., mean daily, maximum daily, or 7DADM), or provide the goal for its suitable release temperatures (60.8ºF at La Grange) objective in July, August, and September," The Bay Institute comments that while not provided previously, its proposed temperature criteria have a biological basis as shown in table E-1 of its comment letter.

Response: We revised text and added table 3.3.2-25 in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Temperature Monitoring*, in the final EIS to clarify The Bay Institute's temperature objectives and their biological basis.

Comment WQ17: Commenting on the statement on page 3-91 of the draft EIS that reads: "However, NMFS's estimates of the upper Tuolumne River's capacity for steelhead and Chinook salmon (Boughton et al., 2018) incorporate increased temperature tolerance based on results of the lower Tuolumne River swim tests (Verhille et al., 2016)," NMFS states that it is erroneous to conflate "temperature tolerance" with protective "temperature criteria."

Response: We revised the final EIS to clarify that NMFS's recommended 18°C 7DADM temperature objective is to protect steelhead juvenile rearing and that NMFS used average daily temperature indices for optimum and tolerable conditions to estimate the upper river's capacity for steelhead and spring Chinook salmon.

Comment WQ18: In response to the statement on page 3-90 of the draft EIS that The Bay Institute had not filed revised flow recommendations as of January 30, 2019, despite saying it would do so following the Districts' revised modeling results, The Bay Institute included additional data with its comment letter and states that the data should allow improved temperature modeling for its proposal. The Bay Institute also states that because of errors by Commission staff in characterizing diversions associated with its proposal in the draft EIS, it assumes that the temperature modeling in the draft EIS does not correctly characterize its proposal. The Bay Institute acknowledges that applying its time series "may go too far or not far enough" and would like to refine its recommendations to optimize flow and temperature management by working iteratively with temperature modelers using the detailed model results.

Response: On September 17, 2019, the Commission issued an additional information request (AIR) for the Districts to conduct modeling to resolve errors in their representation of The Bay Institute's recommended flow regime. The Districts consulted The Bay Institute to ensure it was satisfied with the Districts' updated scenario for The Bay Institute's recommendation and subsequently filed results of this modeling on December 11, 2019; and we incorporated them into the final EIS. We also revised the

final EIS to express The Bay Institute's preference for working iteratively with temperature modelers to optimize flow and temperature management.

Comment WQ19: The Water Board and FWS comment that in addition to the water temperature monitoring locations included in the staff-recommended water temperature monitoring plan, monitoring locations downstream of RM 26 and to the San Joaquin River confluence are necessary. FWS comments that the geomorphic characteristics of this lower reach are different than those found upstream, so it would not be appropriate to assume that the temperature profile immediately upstream is applicable downstream of RM 24.5. While the Water Board supports the idea of diversified monitoring locations, it states that the proposed locations do not capture the full extent of the projects' potential effects of the impounded water above Don Pedro Dam and on the lower Tuolumne River. The Water Board indicates that additional monitoring locations from RM 26 to the confluence with the San Joaquin River would be necessary to measure and track changes in water temperature throughout affected reaches.

Response: Staff-recommended temperature monitoring in the draft EIS was intended to provide insight into the availability of cool-water storage in Don Pedro Reservoir and temperature in the lower Tuolumne River to inform potential changes in project operations to benefit salmonids and other aquatic resources during extended droughts. As discussed in our response to comment WQ13, we revised our recommendation for a temperature monitoring plan to include collecting temperature data to aid in scheduling pulse flows to benefit salmonids and evaluating instream temperature linkages to salmonid growth and migration. The scope of this new recommendation, discussed in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications, Water Temperature Monitoring*, has been expanded to include year-round temperature monitoring at five sites, including a real-time site near the temporary counting weir (located downstream of the infiltration galleries) and three sites to be determined through consultation with the resource agencies.

Comment WQ20: FWS, California DFW, and the Water Board comment that the 600-foot Don Pedro Reservoir elevation trigger to begin monitoring water temperature is too low. FWS recommends including water temperature monitoring in any licenses issued for the projects, regardless of Don Pedro Reservoir's elevation. California DFW comments that waiting until the reservoir has reached 600 feet before monitoring water temperature could skew data collection to a limited time when temperatures are already detrimental (e.g., in October 2015 water temperatures downstream of La Grange Dam were 18.7ºC when the Don Pedro Reservoir was being drawn down to approximately 670 feet) and recommends water temperature monitoring occur when reservoir elevations fall below 700 feet. The Water Board states that Don Pedro Project's lowest reservoir elevation during the worst drought since record-keeping began is 70 feet higher than the trigger elevation at which the staff alternative is requiring the Districts to begin temperature monitoring. Data gathered under this monitoring effort would not offer a representative sample of project operations at normal operating reservoir levels and water

year types and would not provide data important to informing biological goals or adaptive implementation of flow objectives.

Response: At the September 19, 2019, 10(j) meeting, there was a discussion of similarities between conditions in Don Pedro Reservoir and the New Melones Reservoir, on the Stanislaus River. Each of these reservoirs was enlarged by constructing a large dam that submersed another dam a short distance upstream. G. Murphey of California DFW and C. Shutes of the California Sport Fishing Protection Alliance stated that the last drought on the Stanislaus River resulted in a New Melones Reservoir pool level that approached the crest of the old submersed dam. They stated that this caused inflow to the development's forebay to be provided primarily by surface water from up-reservoir of the old dam and limited access to the reservoir's cold-water pool. Concerns were expressed that similar conditions would likely occur in Don Pedro Reservoir as its pool level approaches the top of the old dam.[9]

To further evaluate the relationship between the Don Pedro Reservoir elevation and its outflow temperature, we plotted the 2015–2016 outflow temperatures, which the Districts submitted with their comments on the draft EIS, with Don Pedro Reservoir elevations. This plot shows that daily mean temperature of Don Pedro outflow tends to exceed the typical range of 9.5 to 12°C when the reservoir elevation is lower than 700 feet in June through December. Therefore, we revised section 3.3.2.1, *Aquatic Resources, Affected Environment, Water Quality*, of the final EIS by adding this plot (figure 3.3.2-4) and a discussion of outflow temperature exceeding 12°C during June through December when the reservoir elevation is below 700 feet.

We also agree that as the Don Pedro Reservoir pool is drawn down closer to the crest of the old dam it would have an increasing influence on hydraulics of water moving from up-reservoir of the old dam to between the old and new dams. The effect of the old dam is likely minimal when the reservoir is near full pool because the warm epilimnion layer is well above the crest of the old dam. However, reservoir drawdown would cause the epilimnion to thicken and get closer to the crest of the old dam, which would reduce the flow of cool water from up-reservoir to the area between the old and new dams.

We revised section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Temperature Monitoring*, of the final EIS to include a discussion of the old dam's effects on hydraulics and temperature. For the reasons discussed above, we revised our recommendation in the final EIS to monitor Don Pedro Reservoir temperature whenever the reservoir elevation is below 700 feet.

Comment WQ21: The Conservation Groups comment that the draft EIS does not evaluate the effects on instream resources of lowering the operating pool of Don Pedro Reservoir from 600 feet to 550 feet stage elevation. The Conservation Groups further

[9] The old dam in Don Pedro Reservoir has a crest at 596.5 feet and is located about 1.5 miles up-reservoir of the current dam.

comment that the Commission should analyze the drawdown of storage at different levels within the 600 to 550 stage height range in Don Pedro Reservoir in the fall of a drought year, such as 1990, using the Don Pedro operations model. The Commission should then evaluate the effects on water supply, instream flow, and water temperature in the following water year and report the results of this analysis in the final EIS. Commission staff should also evaluate carryover storage requirements for Don Pedro Reservoir of 400,000 and 500,000 acre-feet.

Response: Although the Districts propose to reduce the minimum pool level in Don Pedro Reservoir from 600 feet to 550 feet, reservoir drawdowns below the current 600-feet minimum elevation would most likely occur only in and immediately following successive dry years, so frequency of use would be low. In general, the Districts' operations model results filed on May 14 and July 30, 2018, suggests that Don Pedro Reservoir water levels would remain similar to existing conditions under proposed operation (table 3.3.2-21 in the draft EIS and table 3.3.2-23 in the final EIS). However, based on comments received on the draft EIS, we recommend that the Districts notify the Commission and appropriate stakeholders when they expect the Don Pedro Reservoir to drop below an operating elevation of 600 feet. Therefore, we revised Don Pedro draft License Article 403, Minimum Pool at Don Pedro Reservoir, in the final EIS to include the requirement for prior notification of such an elevation drop.

Comment WQ22: The Water Board and EPA comment that the Commission-recommended water quality monitoring plan is inadequate. EPA recommends that the monitoring period should be longer than five years to capture sufficient year-to-year variability. The Water Board recommends that the water quality monitoring plan should include monitoring sites in affected river reaches throughout the lower Tuolumne River and Don Pedro Reservoir, not just at locations near La Grange Dam and La Grange Reservoir, as well as monitoring needed to inform assessment of biological goals, recreation-related water quality, and bioaccumulation monitoring components, in addition to DO and temperature.

Response: We revised section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quality Management and Compliance*, of the final EIS to show we recognize that DO conditions vary from year-to-year based on a number of factors including weather, runoff in the basin, and project operations. However as stated on page 5-21 of the draft EIS, the goals of the water quality monitoring plan recommended by staff "would be to determine the extent of project-caused low DO concentrations in the La Grange Powerhouse tailrace and effectively mitigate any low DO concentrations." Under staff-recommended draft License Article 408 for the La Grange Project (pages B-6 and B-7 of the draft EIS), the Commission would determine whether and to what extent the Districts are responsible for ongoing monitoring and mitigation for project-caused DO concentrations that do not meet the DO objective of the Basin Plan.

We analyze the water-quality effects of implementing new FERC licenses for the projects in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Quality Management and Compliance*, of the draft and final EIS. Our analysis reveals:

- Water quality in the reservoirs and project releases would remain similar to existing conditions because project operations would not substantially change the flow of water through the project reservoirs.

- In the lower Tuolumne River, DO of less than the applicable water quality objective is generally localized to the La Grange Powerhouse tailrace channel.

- Low DO near the bottom of Don Pedro Reservoir would likely continue and may contribute to the release of mercury from sediments and subsequently lead to bioaccumulation in aquatic organisms, some of which may be consumed by humans. However, there is no indication of how bioaccumulation monitoring results could be used to modify project operations to alleviate concerns associated with fish consumption.

- Project operations would not measurably influence recreation-related water quality (i.e., the concentration of coliform bacteria, oils, or grease), and as discussed in the draft EIS in section 3.3.5.2, *Recreation, Environmental Effects*, the Districts would periodically assess each project's recreational use and any need for recreational facility upgrades to maintain a safe environment for recreational use during any license term.

Neither our analysis nor the Water Board's comments on the draft EIS justifies requiring the Water Board's requested additional monitoring locations for the staff-recommended water quality monitoring plan, recreation-related water quality, or bioaccumulation monitoring.

Comment WQ23: The Conservation Groups comment that water temperature modeling used to support the staff alternative does not model the interim flows proposed to become license conditions as shown in the far-right column of table 3.3.2-20 in the draft EIS. Instead, staff modeled the higher summer flows the Districts recommended, assuming the operation of the infiltration galleries. The water temperature modeling for July through October 15, therefore, improperly models an enhanced condition that is not required as part of the proposed action. The draft EIS provides no evidence that the action as proposed would provide suitable thermal conditions for *O. mykiss* in the lower Tuolumne River. The final EIS should include a revised license condition that requires the Districts' proposed flows with-infiltration galleries to provide such suitable conditions. Absent such change, the final EIS should provide the output of temperature modeling for the actual proposed license condition.

Response: The Conservation Groups appear to misunderstand which modeling is analyzed in the draft EIS and who conducted this modeling. This information, provided

in table 3.3.2-17, shows the draft EIS includes analysis of both the Districts' proposed interim flows without infiltration galleries operational (DPP-1r-NoIG) and the Districts' proposed flows with infiltration galleries operational (DPP-1r) and that these analyses are based on the Districts' output for these model scenarios provided in their filings made on May 14, 2018 (Districts, 2018a), and July 30, 2018 (Districts, 2018b), respectively. The minimum flow schedule used to model the DPP-1r-NoIG scenario is consistent with the Districts' proposed interim flows without infiltration galleries operational, based on a comparison of values provided on page 4 of Modeling Results for Districts' Preferred Plan Without IG Operation 'DPP-1r-NoIG' (Districts, 2018b, attachment 1) and the far-right column of table 3.3.2-20 in the draft EIS.

The staff's analysis of simulated water temperatures for these and the other model scenarios is discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Water Temperature Monitoring*, of the final EIS. Table 3.3.2-27 provides an evaluation of the extent that thermal conditions would provide protection for *O. mykiss*, steelhead, and fall-run Chinook salmon based on the frequency of satisfying life-stage-specific water temperature targets at eight locations in the lower Tuolumne River.

E. FISHERY RESOURCES

BASE FLOWS

Comment AQ1: FWS comments that the draft EIS does not analyze how staff recommendations have changed the results of the Districts' Chinook and *O. mykiss* in-river production models or provided updated figures. For example, staff does not recommend the Districts' proposals for gravel cleaning and predator control/suppression, yet these proposed measures were incorporated into the models. FWS recommends that staff re-run the full suite of production models with the updated assumptions based on the recommendations in the draft EIS. California DFW also recommends that Commission staff reanalyze the salmonid production models without the measures that Commission staff does not recommend and clearly articulate all modeling assumptions in the final EIS.

Response: After reviewing the comments filed on the draft EIS, we agree that the recommended staff alternative is not modeled in the draft EIS to allow comparison to the other alternatives modeled by the Districts. Therefore, in an AIR dated September 17, 2019, staff requested that the Districts run a suite of models that would allow comparison of the effects of each of the proposed and recommended flow regimes and each of the proposed non-flow measures individually. The Districts filed those modeling results on December 11, 2019, and we incorporated those results into the analysis in the final EIS.

Comment AQ2: The Conservation Groups comment that figures 3.3.2-26, 3.3.2-29, 3.3.2-32, and 3.3.2-35 of the draft EIS compare Chinook smolt productivity under the flow proposals of NMFS, California DFW, the Water Board, and the Conservation Groups, respectively. However, each of these figures depicts the Districts' non-flow proposals but not the non-flow measures of the other entities; therefore, the Commission

presents a biased comparison because the Districts' values include non-flow measures that account for almost all the predicted benefit. The Water Board similarly notes that the aquatic resource benefits shown by the modeling results would not accurately predict what could be expected from implementing only the flow measures and not the non-flow measures proposed by the Districts but excluded from the staff alternative.

Response: The effects of the flow and non-flow measures recommended and proposed instream flows of FWS, California DFW, and the Districts are presented in the draft EIS in figures 3.3.2-38, 3.3.2-39, and 3.3.2-40. However, we also requested additional information on September 17, 2019, asking the Districts to re-run their models to allow comparison of the staff alternative to other alternatives that include flow and non-flow measures. Those modeling results were filed by the Districts on December 11, 2019, and we incorporated them into the analysis in the final EIS. We also revised our analysis to show the effects of proposed and recommended flow regimes without non-flow measures in figures 3.3.2-30, 3.3.2-31, 3.3.2-32, and 3.3.2-33 in the final EIS.

Comment AQ3: The Conservation Groups comment that the Commission must reevaluate the relative benefits to fish from competing flow and non-flow recommendations based on reliable evidence. The Chinook salmon production model shows that the Districts' largest benefits come from the predation control measures and also ascribes improvements over base case to an experimental gravel cleaning measure and to a gravel augmentation measure that would differ little from the scope of gravel augmentations in the last 20 years. The Chinook salmon production model output, therefore, does not provide evidence for the claimed benefits of the Districts' proposed flow and non-flow measures.

Response: See our response to comment AQ1.

Comment AQ4: NMFS states that it is unclear why Commission staff does not recommend the Districts' proposed predator suppression program, based on staff's conclusion that it is not known whether the program would have measurable benefits for Chinook salmon or *O. mykiss* populations, while staff also draws conclusions (page 3-135 and figures 3.3.2-26 through 3.3.2-40 of the draft EIS) from the Districts' Chinook and *O. mykiss* in-river production models that incorporate the effects of the predator suppression program. As far as NMFS understands, these in-river production models do not model effects of the project or agency recommendations downstream of the Tuolumne/San Joaquin River confluence. NMFS comments that it is unclear why Commission staff drew conclusions from models that do not encompass the full geographic scope of the projects' effects as determined in the scoping documents. NMFS comments that the Commission should rely on results from models that accurately represent the full geographic extent of flow and non-flow measures that are included in any new licenses for the projects. Ideally, these models would also be subject to peer review to determine whether they are acceptable to compare population-level effects of alternatives.

Response: Regarding NMFS' desire to include effects downstream of the Tuolumne/San Joaquin River confluence in the Districts' Chinook and *O. mykiss* in-river production models, the Commission addressed this issue in its December 22, 2011 study plan determination. In its comments on the revised study plan, NMFS commented that the Districts' proposed study area for the Chinook salmon model from La Grange dam to the confluence of the San Joaquin River was not adequate, and recommended that a full life-cycle model be used to assess factors outside of the Tuolumne River, including the Delta and ocean, as well as in-river influences. The Commission determined that the Districts' proposed approach of developing information on out-of-basin factors as part of a conceptual model to inform the effects analysis of out-of-basin factors for anadromous fish in the lower Tuolumne River was appropriate, as was the Districts' proposed approach of using a stock-production approach to production modeling to determine in-river factors affecting life-stages of both populations. The Commission concluded that the model objective is not to predict the precise population size of any particular life-stage, as in a life-cycle model, but rather to identify project effects on all in-river life stages affected by the project to support the evaluation of appropriate protection, mitigation and enhancement measures. However, we expanded our discussion of effects downstream of the Tuolumne/San Joaquin River confluence in section 3.3.2.2, *Aquatic Resources, Cumulative Effects, Fisheries Resources, Fish and Aquatic Resources Cumulative Effects Assessment*, of the final EIS.

Regarding predator control, as discussed in more detail in our response to comment AQ18, below, we re-assessed the predator control issue and conclude that while there could be some benefits to a predator control program, predation on salmon is not a project-related effect and any predator control program would be the responsibility of state and federal fishery management agencies.

Comment AQ5: During the public meeting about the draft EIS, Jake Wenger commented that the Water Board's unimpaired flow range of 30 to 50 percent overcompensates flow because the Water Board does not have the authority to mandate non-flow measures. Increasing the flow to the Water Board's 40 percent unimpaired flow would result in eight juvenile salmon per spawning female. However, the Districts' proposed flow and non-flow measures would produce 17 juvenile salmon per spawning female.

Response: The final EIS recommends the flow regime in the draft Voluntary Agreement because this flow regime would better balance the needs of multiple resources, including water supply, aquatic resources, power generation, and recreation. Our analysis relies on the Districts' modelling results that were developed during relicensing and more recently on those that were filed with the Commission on December 11, 2019, in response to our September 17, 2019, AIR.

Comment AQ6: The Central Valley Environmental Research Center and 22 individuals comment that the new flow regulations established by the Water Board for the Tuolumne

River, through the San Francisco Bay Delta Water Quality Control Plan amendment process, are necessary for equitable water use. The Water Board's 2010 report, *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem*, determined that approximately 60 percent of unimpaired flow between February and June would be fully protective of fish and wildlife in the lower San Joaquin River and its three major tributaries, including the Tuolumne. By recommending approximately 20 percent of unimpaired flow, the Commission and the Districts go against this finding and the 2018 Water Board instream flow standards of 30 to 50 percent of unimpaired flow between February and June, starting at 40 percent.

Response: As noted at the beginning of the Water Board's *Development of Flow Criteria for the Sacramento-San Joaquin Delta Ecosystem*:

> This report, required by Water Code section 85086(c) (2009 Delta Reform Act) in 2010, suggests the flows that would be needed in the Delta ecosystem if fishery protection was the sole purpose for which its waters were put to beneficial use. In keeping with the narrow focus of the legislation, this report only presents a technical assessment of flow and operational requirements to provide fishery protection under existing conditions.

The Water Board's report also notes:

> …that there are many other important beneficial uses that these waters support such as municipal and agricultural water supply and recreational uses. The State Water Board is required by law to establish flow and other objectives that ensure the reasonable protection of beneficial uses. In order for any flow objective to be reasonable, the State Water Board must consider and balance all competing uses of water in its decision-making. More broadly, the State Water Board will factor in relevant water quality, water rights and habitat needs as it considers potential changes to its Bay-Delta objectives. Any attempts to portray the recommendations contained in this report as an indicator of future State Water Board decision-making ignores this critical, multi-dimensional balancing requirement and misrepresents current efforts to analyze the water supply, economic, and hydropower effects of a broad range of alternatives. This report represents only one of many factors that will need to be balanced by the State Water Board as it updates the Bay-Delta Water Quality Control Plan.

Commission staff are required to equally consider and find the appropriate balance among all competing uses of water in their decision-making. While returning the flow regime in the lower Tuolumne River to a condition that more closely mimics the magnitude, duration, and timing of the unimpaired hydrograph would likely provide multiple benefits to aquatic resources, the staff-recommended flow regime would also

improve aquatic habitat conditions compared to the base case and would continue to meet existing and projected water demands in the region.

Comment AQ7: The Conservation Groups comment that the staff does not describe the "more normative ecological processes" as stated on page 3-145 of the draft EIS. To provide an analysis of how "more normative ecological processes" would benefit the aquatic environment, the Conservation Groups recommend that the final EIS should start with evidence in the record, such as the 2010 Delta Flow Criteria Report (Water Board, 2010), which describes and analyzes the benefits of a more natural flow regime and analyzes the final Substitute Environmental Document for Phase I of the update of the *Bay-Delta Water Quality Control Plan* (Water Board, 2018c), and the *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (Water Board, 2018a).

Response: Human-induced changes in flow regimes often do not adequately reflect the adaptive history of salmonids nor support the ecosystem attributes that are necessary for the recovery and long-term survival of these species. The more normative ecological processes that were eluded to in the draft EIS are consistent with those described in the Water Board's 2010 Delta Flow Criteria Report, in that we acknowledge that species and biological systems respond to combinations of quantity, timing, duration, and frequency and how these inputs vary spatially.

Comment AQ8: The Tuolumne River Conservancy comments that higher flows than those recommended by Commission staff would be necessary to support *O. mykiss* populations from May through August, as demonstrated in the Tuolumne River Conservancy's attached snorkel counts (the Districts' 2017 Annual Report to the Commission) and historical flows. *O. mykiss* snorkel reports document that fry do well at flows higher than 2,000 cfs. The Conservation Groups point out that *O. mykiss* snorkel surveys from 1995 through 2017 show consistently higher observations of *O. mykiss* in years with prolonged flood flows than in lower water years.

Response: We reviewed the Tuolumne River Conservancy *O. mykiss* snorkel reports and understand that higher flows during the summer may result in increased productivity of *O. mykiss*. The staff-recommended flow regime in the final EIS is expected to improve aquatic habitat conditions (increase weighted usable area and reduce water temperatures compared to existing conditions) for *O. mykiss* downstream of La Grange Diversion Dam. For example, the Districts' recommended base flows would provide from 71 to 95 percent of maximum weighted usable area for *O. mykiss* (depending on life stage and water year type).

Comment AQ9: The Districts comment that the statement on page 3-145 of the draft EIS that it "is evident that mimicking the natural hydrographs would likely create more normative ecological processes that would benefit native resident and anadromous fish populations and their habitat" is neither self-evident nor supported by any substantial evidence in the record. At best, this statement is one of several unproven hypotheses that have been put forward on the lower Tuolumne River over the last 10 years. However, the

draft EIS does an excellent job in pointing out that the lower Tuolumne River does not possess a "natural river" channel or floodplain. The environment and ecology of the lower Tuolumne has been subject to numerous and significant human disturbances for 150 years, not the least of which include in-channel mining and the introduction of non-native predators. Presuming that simply mimicking a "natural flow regime" in this very novel, non-natural environment would automatically "benefit native" fish populations is not only unsupported by any evidence, but it is contrary to basic biological understanding of stream ecology that teaches that local stream conditions must be taken into account when considering the health and flow needs of fisheries. The Districts' modeling demonstrates that mimicking a more natural flow regime would have significantly less likelihood of improving native fish populations in the lower Tuolumne River and at a much higher cost of water than the Districts' proposal. For example, a more natural flow regime may benefit striped bass more than *O. mykiss* or fall-run Chinook. None of the proposals put forward by any of the agencies or NGOs was supported by any analysis at a population level or the available physical habitat simulation (PHABSIM) information. The Districts provide similar comments for similar statements made on draft EIS pages 3-228 and 5-25 to 5-26.

Response: While no direct (site-specific) evidence is available that mimicking the natural hydrograph would benefit aquatic resources in the Tuolumne River, we note that scientists have recently come to recognize the importance of natural flow variability as a driver of ecosystem processes (Naiman et al., 2008) and the inherent interplay among river structure, physical processes, and ecological patterns (Fremier and Strickler, 2010; Wohl, 2012). When these natural dynamic interactions are limited by flow alterations, blocked by channel levees, or perturbed by sediment deficit or surplus, rivers can become homogenous, and biodiversity decreases (Moyle and Mount, 2007; Wohl et al., 2015). Our statement that mimicking the natural hydrographs would likely create more normative ecological processes was made with a basic understanding of these natural dynamic interactions. In their amended final license application for the Don Pedro Project, the Districts also appear to acknowledge the benefits of mimicking a natural hydrograph, as one of their proposed measures is to "make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions."

In the draft EIS, we acknowledge that the Tuolumne River is a highly modified riverscape. We also fully understand that a more natural hydrograph in the absence of other large-scale changes in how the river is managed would not likely yield all desired ecological outcomes (e.g., the restoration of peak flows would not necessarily regenerate habitats if the river were starved of sediment or if the river channel were highly confined [Wohl et al., 2015]). Given that the Tuolumne River has been subject to numerous and significant human disturbances and would continue to be managed in a manner that attempts to balance multiple resource demands, we recommend providing elements of the natural hydrograph (such as pulse flows and spill management) that promote the maintenance or recovery of native fish populations in the Tuolumne River. Based on our analysis, we conclude that the Districts' flow proposal, as modified in the draft Voluntary

Agreement, would enhance aquatic habitat and, at the same time, continue to meet the Districts' irrigation demands and CCSF's water supply needs.

SPILL MANAGEMENT PLAN

Comment AQ10: FWS comments that because the Commission recommends against adopting the TPAC included in FWS's 10(j) recommendation 2, Spill Management Plan, it is unclear how the plan would be implemented without the scientific and technical expertise that an advisory committee would provide. The TPAC would facilitate discussing and sharing scientific, technical, and policy information in an efficient and effective way. It would also provide the opportunity for participants to develop and implement a common vision for restoration and enhancement on the lower Tuolumne River. NMFS also supports creation of the TPAC and comments that agencies may choose to decline to participate in the committee and would subsequently lose decision-making authority in the group. The Districts state that the TPAC does not contemplate or seek to require participation by any third party and is no different than a coordinating committee that the Commission has frequently identified and acknowledged for execution of measures in a new license.

Response: Draft License Article 413, Spill Management Plan, includes a requirement that the Districts consult with all pertinent state and federal agencies in preparing the spill management plan and then annually consult with the same agencies to determine the annual spill schedule. An additional advisory committee for implementing the spill management plan would be duplicative of this consultation requirement.

Comment AQ11: The Districts comment that the purpose of the draft EIS (page 3-148) analysis of "how often a spill flow of at least 1,750 cfs could be maintained for the entire March through April period" is neither clear nor stated. They state that nothing in the record supports a need for maintenance of a floodplain flow for all of April and May to be beneficial for rearing juvenile salmon. Matella and Merenlender (2015) indicate a continuous floodplain inundation of 14 days is sufficient to benefit fish.

Response: The referenced analysis is not recommending that the Districts implement a spill flow of at least 1,750 cfs for all of March and April. It is simply intended to inform the reader that a flow of at least 1,750 cfs could be maintained for the entire March through April period in wet and above normal water year types, and for an average of 13 days in below normal water year types.

Comment AQ12: The Districts comment that as described by FWS and agreed to by the Districts, the year-to-year implementation of the spill management plan must be acknowledged in the final EIS to be at the full discretion of the Districts, subject to compliance with the U.S. Army Corps of Engineers' flood control guidelines, dam and project safety, and the Districts' water supply needs. The final EIS needs to identify the discretionary nature of the spill management plan in any final license article.

Response: We revised the description of the spill management plan in the final EIS to note that releases made under the plan would be subject to the constraints of flood

control, project safety, and water demands. In practice, the Districts would be responsible for evaluating these constraints and determining appropriate spill volumes in accordance with the plan. However, the Commission would retain ultimate oversight authority and determine whether the licensees' operations are in compliance with the plan.

SPRING PULSE FLOWS

Comment AQ13: NMFS comments that despite the conclusion on page 3-307 of the draft EIS that the staff-recommended pulse flows would be designed to encourage fall-run Chinook smolt outmigration and increase survival and also would benefit *O. mykiss*, it believes the staff-alternative spring pulse flows would not increase survival during most of the fall-run Chinook salmon and steelhead outmigration period. The staff-recommended spring outmigration flows would only provide increased flows during approximately 18 days in 2012 (below normal water year) and 6 days in 2007 (critical water year) assuming flows at 2,750 cfs. NMFS notes that fall-run Chinook salmon catch data from the Districts' RST studies in the Tuolumne River and FWS's steelhead data from the Stanislaus River and lower San Joaquin River show that both species migrate downstream over a six-month period from January through June.

Response: In the draft EIS, staff recommends implementing the Districts' proposed spring pulse flows because they would likely facilitate outmigration and increase the survival of juvenile salmon and steelhead, particularly in periods of high turbidity during spill events. Staff also recommends adopting FWS's recommended spill management plan because this excess water could be used to provide additional pulse flows to benefit out-migrating smolts, potentially optimize juvenile floodplain rearing habitat, or aid in temperature management. The spill management plan would allow key water supply entities (the Districts and CCSF) to work collaboratively with the resource agencies in the development of management strategies to make the best use of this excess water during the six-month outmigration period. During the September 19, 2019, 10(j) meeting with the resource agencies and the Districts, staff agreed to incorporate requirements for annual consultation into the draft license articles for the spring pulse flow release plan and spill management plan. Staff also recommends the Districts prepare a summary report in year 10 following license issuance to evaluate effectiveness and determine need for any additional monitoring.

Comment AQ14: The Conservation Groups comment that it is not clear whether the stated volumes for spring pulse flows required in recommended draft License Article 410 for the Don Pedro Project are reduced on a one-to-one basis by any flood flows or whether temporal limits are placed on any flood flows that would allow reducing the volume of required pulse flows. For example, suppose the required spring pulse flow release were 100,000 acre-feet, and a 100,000 acre-feet flood release occurred in February, would the volume of the spring pulse flow release be reduced because of that earlier flood release, and if so, by how much?

Response: The purpose of draft License Article 410 is to encourage fall-run Chinook salmonid smolt outmigration and increase survival, typically occurring in the Tuolumne River from late April through mid- to late-May. Therefore, a 100,000 acre-feet flood release in February would not satisfy a required spring pulse flow release of 100,000 acre-feet. We revised draft License Article 410 to clarify that the fall-run Chinook salmon smolt outmigration period is approximately late April through mid- to late-May.

FALL PULSE FLOWS

Comment AQ15: California DFW questions the statement on pages 3-145 and 3-146 of the draft EIS that it is not apparent how a fall pulse flow would substantially improve migration or spawning conditions for fall-run Chinook salmon. California DFW states that it has observed very poor adult Chinook salmon returns in years without pulse flows in the fall (e.g., 2014 and 2015), especially when comparing results from the Tuolumne River and the Stanislaus River. In 2015, weir counts of adult Chinook salmon were 436 and 12,707 adults in the Tuolumne and Stanislaus Rivers, respectively. California DFW also notes that the study conducted by Peterson et al. (2016) on the Stanislaus River, referenced in the draft EIS, does not include any years without pulse flows. California DFW believes that an adequate analysis for evaluating the hypothesis that managed pulse flows have a limited effect on salmon attraction should have compared fish returns in years with and without pulse flows in each river or, at a minimum, between rivers with the analysis focusing on the differences based on pulse flows or lack thereof. California DFW anticipates consistently poor returns in the Tuolumne River if the Commission does not recommend the allocation of fall attraction flows. NMFS adds that fall pulse flows released the previous three years on the lower Tuolumne River were successful in initiating upstream migration from fall-run Chinook salmon. Wet-season initiation flows, which provide other ecosystem benefits, such as nutrient cycling and sediment mobilization, are a part of the natural hydrograph in which native salmonids have adapted. The staff-recommended alternative does not provide this important aspect of salmonid habitat (draft EIS page 5-27). The Conservation Groups comment that the draft EIS does not explain why Commission staff discounted the evidence presented in their comments and the reports that they cited to support their flow recommendations.

Response: During the September 19, 2019, 10(j) meeting, NMFS presented data from the Tuolumne River showing that in years without fall pulse flows, weir-counts of adult Chinook salmon migrating upstream in the Tuolumne River have been very low. NMFS presented data from 2013, 2016, 2017, and 2018, when weir counts of upstream migrating Chinook salmon in the Tuolumne River show a strong relationship with the timing and magnitude of fall pulse flows. NMFS subsequently filed these data with the Commission. Based on further review of these data, we are now recommending the annual implementation of fall pulse flows that are timed to promote upstream migration. We are also recommending ongoing weir monitoring to determine timing/effectiveness for promoting upstream migration and the preparation of a summary report in 10 years to

evaluate effectiveness of this measure and to determine the need for additional monitoring.

Comment AQ16: California DFW comments that the annual flushing flows of 1,000 cfs on October 5, 6, and 7 would likely have no substantial effect on gravel cleaning, and that by setting this flow for early October, the flows may attract fish into the river before temperatures are suitable for salmonids. NMFS also comments that the timing of the flows would likely not provide adequate biological cues for upstream migrating adult salmonids because the peak upstream immigration of fall-run adults in the lower Tuolumne River is mid- to late October.

Response: As discussed during the September 19, 2019, 10(j) meeting, California DFW and NMFS were concerned that the Districts proposed annual 5,950 acre-foot flushing flows would not adequately clean gravel in preparation for Chinook spawning and could attract fish into the river before temperatures are suitable for salmonids. They also do not agree with the statement made by the Districts that releasing pulse flows slightly later would incur a substantial risk of scouring redds. California DFW also anticipates consistently poor returns of Chinook salmon into in the Tuolumne River if the Commission does not recommend the allocation of fall attraction flows. NMFS noted that fall pulse flows released the previous three years on the lower Tuolumne River were successful in initiating upstream migration of fall-run Chinook salmon. Following this discussion, staff agreed that it would be more beneficial to use these proposed fall flow releases to help promote upstream fish migration. In the final EIS, we recommend that the Districts develop a plan to provide fall pulse flows with timing to be determined each year in consultation with the agencies to promote upstream migration. We also recommend this plan include monitoring passage at the temporary counting weir to determine timing/effectiveness for promoting upstream migration and the filing of a summary report after 10 years to evaluate effectiveness and determine the need for additional monitoring.

RAMPING

Comment AQ17: The Districts comment that the statement in the draft EIS (page lix) that "Possible effects on anadromous fish could include reductions in availability of spawning or rearing habitat or stranding downstream of La Grange when river flows are reduced by project operation or seasonal changes in minimum flow requirements," is not supported by any evidence in the FERC record or in the draft EIS. The Districts comment that it is well-established that stranding of salmon fry and juveniles is highly river-specific depending on local channel and floodplain geometries and structure. Applying downramping rate requirements using generalized prescriptions developed from other states or rivers is only acceptable when site-specific information is unavailable, or an analysis is conducted that demonstrates floodplain/channel similarities. Studies conducted during relicensing demonstrate that under current conditions there is fewer than 2-inches of fluctuation in any 15-minute interval at the La Grange gage over 99 percent of the time. The Districts comment that ramping rates of 2-inches per hour are

not supported and may adversely affect flood control purposes of the Don Pedro Project. They note that flood control operations are likely to require rapid changes in flow to maintain flows at Modesto below 9,000 cfs, although this would occur only during high-flow events in wet or above normal water years.

Response: We augmented our analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Ramping Rates and Fish Stranding*, to include a summary of results from stranding surveys conducted between 1986 and 2002 that were included in the 10-year summary report on monitoring conducted under the 1995 settlement agreement (Districts, 2005). The report documents counts of stranded salmon ranging from 0 to 67 during transect surveys conducted since 1995. The highest counts observed since ramping rates were implemented under the settlement agreement include 54 salmon stranded when flow was reduced from 5,000 to 3,000 cfs on February 22, 1996, 21 salmon stranded when flow was reduced from 3,500 to 500 cfs on May 17, 1999, and 67 salmon stranded when flow was reduced from 7,000 cfs to 4,000 cfs on March 20, 2000. Although the report does not identify the rate of stage change during the flow reductions, some stranding was observed in cases where flow changes were relatively minor, including 12 stranded salmon being documented when flow was reduced from 243 cfs to 193 cfs on May 17, 2002. However, we modified recommended draft License Article 405 for the La Grange Project to allow exceptions to the ramping rate if needed to meet flood control requirements.

PREDATOR CONTROL

Comments AQ18: The Districts comment that Commission staff's conclusion for not recommending the proposed barrier/counting weir or a predator control and suppression plan is evidently based on the results of a study conducted in a very open environment at the Clifton Court Forebay in the Delta, which is very different from the confined channel of the Tuolumne River. They also note that they could find no reference to predator control "success" or "lack of success" in the reference cited. In further literature searches, they report that they did find information on Clifton Court (https://www.usbr.gov/mp/bdo/docs/ba-appendix-g-clifton-court-forebay-predation-studies.pdf). In this documentation, while many predators were removed, there was no evidence of depletion of the predator population in 2017. The researchers hypothesize that this could explain the absence of detectable survival effects and recommended increased removal effort in 2018. They also noted that substantial losses occur near the debris boom and trashrack where predator removals do not occur. In other words, gains in survival across the forebay could have been offset by heavy losses as fish enter the salvage facility. In 2018, California DWR increased removal efforts (i.e., more fish were removed), and depletion was achieved. A report discussing how predator reductions related to Chinook salmon survival has not yet been released.

The Districts identified several large-scale management programs that are currently being implemented in North America to remove or suppress predatory fish to benefit native fish species as well as several studies that examine survival responses of Chinook salmon to

non-native predatory fish removal in California. The Districts attached a summary of these programs and studies to their reply to comments on the draft EIS, filed on August 15, 2019.

The California Farm Water Coalition, Opportunity Stanislaus, and four individuals support the Districts' predation management measures. Gary Darpinian comments that Commission staff should recommend the Districts' proposed predator suppression program in the final EIS because failing to address salmonid predation in the Tuolumne River would hamper efforts to improve the fishery. The Conservation Groups comment that the draft EIS proposes no alternative measures to reduce the effects of a predatory gauntlet on salmonids in the lower Tuolumne River.

Response: We re-assessed the predator control issue for this final EIS. We acknowledge that the predation study that we cited in the draft EIS was conducted in a very different environment (Clifton Court Forebay is a 2-mile-wide regulating reservoir within the tidally influenced region of the Delta) and agree that the prospects for successfully reducing populations of predatory fish are much better in the more confined environment of the Tuolumne River. We appreciate the additional information the Districts provided on California DWR's ongoing predator removal studies and corrected the citation for the 2017 study that we cited in the draft EIS.

The additional studies provided by the Districts indicate that predator control efforts have the potential to reduce predation on fry and juvenile Chinook salmon in riverine environments. Production modeling results filed by the Districts in response to staff's September 17, 2019, AIR indicate that reducing predator populations by 20 percent upstream of the proposed fish counting/barrier weir and by 10 percent downstream of the weir would result in a 65 to 75 percent increase in the relative number of Chinook salmon smolts produced per female spawner. Although we acknowledge that salmon production would likely be improved by a predator control program, there is no evidence that predation on salmonids is directly related to project operations. Other historical activities in and along the Tuolumne River, such as gravel and gold mining, have had a much greater impact on fisheries habitat (via creation of SRPs), along with introduction of predatory species, resulting in establishment of large predatory fish populations. Existing hydropower facilities on the river should not be responsible for mitigating the effects of these other historical activities or for supporting strictly fisheries management actions that should be the responsibility of state and federal fishery agencies. Therefore, we continue to recommend that the predator control program proposed by the Districts not be included as a license condition of any license issued for the projects.

Comment AQ19: Eight individuals who attended the public meeting on the draft EIS questioned the value of eradicating predatory fishes to protect salmonids in a river with low salmonid habitat value and discussed the social value of bass fishing. Katherine Borges commented that a compromise would be to transport bass caught in the weir to the Delta, continue habitat restoration, and create a salmon hatchery. Andy Doudne

requests that the Commission consider relocating, rather than killing, captured predatory fish.

Response: These comments from the public meeting are all related to fishery management which is the responsibility of the state and federal fishery management agencies, and not the Commission.

Comment AQ20: The Districts disagree with the conclusion in the draft EIS (page 3-229) that "The Districts' proposed permanent fish counting/barrier weir and predator control and suppression program is not supported by the resource agencies and it is not known if it would provide a measurable benefit to Chinook salmon or *O. mykiss*." The Districts state that contrary to the statement in the draft EIS, the FWS filing of October 1, 2018, specifically acknowledges "that predation rates on juvenile salmonids likely have a significant impact on their populations and predation management would be beneficial…" and FWS asserts that it will "participate with the License Applicants … as they undertake and refine their predation management strategy over time."

Response: We acknowledge that predation by non-native predatory fish on Chinook salmon smolts in the Tuolumne River has been identified as an important issue in filings by the fisheries agencies and in public testimony from management officials at NMFS and California DFW. However, we still do not recommend the proposed permanent barrier weir and predator control and suppression program, because fisheries management programs are the responsibility of the state and federal fishery management agencies. Please see our responses to AQ18 and AQ19.

Comment AQ21: NMFS comments that the Commission does not analyze the increased flow and lower temperatures associated with a spring pulse that mimic the natural hydrograph, which has been shown to disrupt warm-water species spawning and dramatically decrease predator abundance.

Response: In response to this comment, we added an analysis of the effects of the recommended spring pulse flow on predation in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Minimum Flows and Pulse Flows*, of the final EIS. This analysis finds that pulsed river flows can positively influence juvenile salmon survival during the outmigration period by expediting migration and temporary increases in turbidity and/or reductions in water temperature and may also affect the spawning success of non-native striped and black bass.

Comment AQ22: The Districts comment that it is unlikely that any of the agency-proposed discharge regimes for the lower river would provide "flows above the suitable range for predatory species." Even if temporarily displaced during a high-flow event, the predatory fish species in the lower Tuolumne River would likely fall back to the special-run pools (SRPs) where suitable depths and velocities occur during virtually all flow regimes. Suitability criteria for striped bass show favorable conditions for all life stages as flows increase up to, and likely beyond 5,000 cfs. The Districts request that striped

bass habitat suitability figures be added to show the same information as draft EIS figures 3.3.2-20 through 3.3.2-23.

The Districts also note that while predation risk is likely higher under low flow conditions, juvenile salmon survival is low in all but the highest flow years (e.g., flows exceeding 7,000 cfs for extended time frames). The survival index between the RSTs shows low survival in all years during the 2008–2018 period evaluated except 2011 and in 2017, when high flood control releases occurred.

Response: We agree that predatory fish species in the lower Tuolumne River would likely take refuge in SRPs after being displaced from upstream areas during a high-flow event, that juvenile salmon survival is low in all but the highest flow years, and included the referenced striped bass habitat suitability figure (figure 3.3.2-27) in section 3.3.2.2 of the final EIS. Please also see our responses to AQ18 and AQ19.

Comment AQ23: The Districts comment that the best science available on predators and predation rates on the Tuolumne River are from the site-specific studies conducted on the Tuolumne River. The findings of these studies are part of the input data to the fall-run Chinook in-river production model. Under the Districts' proposed predation control and suppression plan, target reductions in predation rates are set at 20 percent above the proposed fish-counting/barrier weir and only 10 percent below the weir. The Districts computed, based on the current predator population, the numbers of predator fish that would have to be removed to achieve these reductions in predation. They state that the 10 percent level of removal downstream of the weir and 20 percent upstream are realistic and feasible.

Response: We agree that the stated target reductions in predator populations should be achievable and incorporated the results of the Districts' production modeling into our analysis of the proposed predator control measures. While this analysis shows a potential benefit to the salmon population from predator control measures, there is no evidence that predation on salmonids is directly related to project operations. Existing hydropower facilities on the river should not be held responsible for mitigating the effects of other historical activities or for supporting strictly fisheries management actions that should be the responsibility of state and federal fishery agencies.

Comment AQ24: The Districts disagree with statements in the draft EIS that the proposed fish counting/barrier weir could pose an impediment to salmonid migration. Regarding the potential for predation by striped bass congregating near the weir on downstream-migrating smolts, they comment that one of the purposes of the weir is to provide a location where striped bass will congregate, facilitating their capture and removal. Regarding any adverse effects on upstream migration, they note that there are many examples of upstream passage facilities that successfully pass fish over much higher obstacles, and that staff conclude in the draft EIS that the much higher fish ladder proposed by NMFS at the La Grange facility is expected to meet performance criteria.

Response: As stated in our previous responses, we reevaluated the merits of the proposed fish counting/barrier weir and predator control and suppression program and conclude that while there would likely be benefits from these measures, these fishery management actions should be the responsibility of the state and federal fishery management agencies and not the Districts. We maintain that impeding upstream migration could occur if fish are reluctant to enter the ladder, but acknowledge this may be avoided through proper design and addressed through subsequent modifications, if needed. We also believe that predation of salmon smolts in the downstream vicinity of the weir could increase and create predation "hot spots" that may not exist under existing conditions.

LOWER TUOLUMNE RIVER HABITAT IMPROVEMENT PROGRAM[10]

Comment AQ25: In response to Commission staff's recommendation to not adopt FWS's 10(j) condition 3 (the LTRHIP), FWS comments that the model for this measure is the Commission's determination in the Narrows Project (P-1403), which states: "the salmonid resource in the Yuba River has been negatively affected by loss of habitat from dam construction; unfavorable flows and water temperature regimes; and loss of fish at unscreened diversions" and its requirement that the licensee "prepare a plan to enhance fisheries habitat in the Yuba River downstream of the Project." This section 10(a) license requirement for the Narrows Project resulted in the licensee creating and providing funding to the Narrows Enhancement Fund, which has been used to fund restoration planning and implementation projects in the lower Yuba River. FWS sees the license requirement on the Yuba River as precedent and evidence of the potential for success of the LTRHIP and associated funding condition included in its filing. The Districts comment that Commission staff is inconsistent in the application of what constitutes a sufficient level of detail when making a determination about what to include in the new license and compares the specificity of Commission staff's recommended coarse sediment management plan to the Districts' proposed LTRHIP. The Districts recommend that the final EIS authorize the LTRHIP and contain a proposed license article similar to the one provided in its comment letter.

Response: The draft EIS concludes that while the LTRHIP could improve salmonid habitat in the lower Tuolumne River, it would greatly exceed the cost for restoring our overall estimate of 44 acres of floodplain habitat reduced due to reservoir storage (using the FWS average cost of $146,836 per acre for floodplain reconnection/restoration projects). It also was unclear: (1) precisely which habitat restoration projects would be funded, (2) where those projects would be located in the lower river, (3) how the Districts would obtain the rights needed to access a property for restoration and maintenance activities for each proposed improvement site, (4) how compliance with the Endangered

[10] This is now discussed under the subsection entitled *Floodplain Habitat Restoration* in sections 3.3.2.2 and 5.1.2 of the final EIS.

Species Act and National Historic Preservation Act of 1966 would be obtained at each site, and (5) the details on the project design and scope of operation and maintenance activities that would occur at each habitat improvement site to allow the Commission to determine whether the site should be included in the project boundary. Because of these uncertainties and the high cost of the program (levelized annual cost of $2,707,820), we did not recommend the LTRHIP in the draft EIS.

However, since issuance of the draft EIS, additional detailed information on potential projects that could be implemented under the LTRHIP has been filed with the Commission, including four projects that were described in an August 15, 2019, filing by the Districts; additional comments filed by state and federal agencies and other parties supporting the Districts' proposal; and discussions among these same parties at the September 19, 2019, section 10(j) meeting held in Sacramento, California. These filings and discussions provided further clarification of the proposed LTRHIP. In consideration of this additional information, we conclude this program would mitigate project effects in the lower river (the 44 acres of floodplain habitat reduced due to reservoir storage), as well as provide additional floodplain habitat enhancement that would increase fry to smolt survival and go hand in hand with the recommended flow measures for the project. The Districts' August 15, 2019, filing also addressed the five staff uncertainties described above that were used as a basis for not recommending the LTRHIP in the draft EIS.

Further, on December 11, 2019, the Districts filed a response to the Commission's September 17, 2019, AIR, which requested that the Districts complete additional modeling simulations to allow staff to adequately address several alternatives included in the draft EIS, including the effects of implementing the LTRHIP on Chinook salmon smolt productivity, *O. mykiss* young-of-year productivity, and *O. mykiss* adult replacement rate. The Districts' modeling showed that the LTRHIP would increase Chinook salmon smolt relative productivity by 10 to 19 percent and *O. mykiss* young-of-year productivity by 3 to 5 percent over the draft Voluntary Agreement flows alone.[11] This modeling indicates that the LTRHIP would have a beneficial effect on salmon and *O. mykiss* production in the lower Tuolumne River, and staff believes that the relative benefits could be even greater if engineered log jams (ELJs) are incorporated into the LTRHIP projects to further increase habitat diversity, as we discuss in the subsection, *Large Woody Material Augmentation*. Therefore, because of these new modeling results and the additional information provided by the Districts on potential projects that could be implemented under the LTRHIP, staff is now recommending the LTRHIP as a condition of any license issued. While potential habitat restoration under the LTRHIP could exceed our estimated 44 acres of floodplain habitat reduced due to reservoir

[11] Flows would increase below the infiltration galleries in dry and critical water years from 75 to 125 cfs from July 1 to October 15 but would decrease slightly at the La Grange gage from 350 to 300 cfs in wet, above normal, and below normal water years.

storage, the LTRHIP would be a cost-effective way to enhance conditions for anadromous fish, along with the recommended flow regime for the project. The Districts' plan to implement the initial four sites during the first five years of the license, monitor, and then file a plan in year 6 for the next set of three to five projects is reasonable.

Comment AQ26: In response to the statements made on page 3-202 of the draft EIS that few specifics are provided by either FWS or the Districts about how the $38 million of the LTRHIP would be spent and whether this program would mitigate project effects or serve as enhancement, NMFS comments that the Commission should authorize the LTRHIP fund be used exclusively for actions that create new off-channel habitat for juvenile salmonids. This would create floodplain, backwater, and side channel habitat that would expand juvenile salmonid rearing opportunities. These actions would also lower existing terraces so that they are inundated at the "bankfull" channel flow of 1,000 cfs. Any off-channel habitat should either maintain suitable temperatures for *O. mykiss* rearing throughout the summer or be dry at summer base flow levels to minimize warm-water predator habitat.

Response: As discussed in our response to the previous comment, staff is now recommending the LTRHIP as a condition of any license issued. The Districts' August 15, 2019, filing provides details of the four initial projects that the Districts are proposing under the LTRHIP, and all four projects would provide/improve juvenile salmonid habitat both in-river and off channel, which would mitigate the 44 acres of floodplain habitat reduced due to reservoir storage, as well as enhance habitat along with the recommended flow regime for the project. Although the Districts state that discussions with private property owners to obtain easements are underway, they also indicate that additional consultations with state and federal agencies would be required to finalize these project plans. If the LTRHIP is made a condition of any license issued, we recommend that all of the enhancement projects to be implemented under the LTRHIP be developed in consultation with FWS, NMFS and California DFW and then filed for Commission approval.

Comment AQ27: NMFS states that it is unclear how Commission staff evaluate "substantial" rearing habitat, as stated on page 5-58 of the draft EIS, where staff do not recommend the floodplain rearing habitat restoration plan, citing that available information indicates that floodplain rearing habitat is inundated at regular intervals under current operations and that inundation provides substantial rearing habitat for both Chinook and *O. mykiss* fry and juveniles. NMFS states that Chinook salmon and steelhead usually live for three to four years and flows that occur in 45 percent of years would not benefit multiple cohorts of these salmonid populations. NMFS recommends including in the final EIS an analysis of the full temporal extent of juvenile salmonid rearing and outmigration needs in the lower Tuolumne River.

Response: The discussion beginning on page 5-58 of the draft EIS describes Commission staff's basis for not recommending the LTRHIP, which we summarize

above in the response to comment AQ25. We also state in that response that we are now recommending the LTRHIP, which would substantially enhance floodplain rearing habitat, so there would be no need to conduct the analysis suggested by NMFS as part of the final EIS.

Comment AQ28: The Conservation Groups comment that the analysis of Don Pedro Project effects on floodplain inundation improperly excludes the water supply operation of project works from project effects and makes other assumptions that understate cumulative effects. The draft EIS analysis excludes project releases diverted into irrigation canals, and it excludes February, May, and June, important months for fry, parr, and smolt life stages of salmonids and other fish and wildlife species. The analysis also appears to discount the value of floodplain habitat in the Tuolumne River downstream of the spawning reaches.

Response: Our analysis of cumulative effects on aquatic resources in the draft EIS begins on page 3-226 and discusses the effects of water supply operations and other human activities on the Tuolumne River and does not discount the value of floodplain habitat. While our cumulative effects analysis may be limited by the amount of available information, with the adoption of the LTRHIP and the potential substantial habitat benefits that should accrue under that program, we see no need to further expand the cumulative effects analysis in the final EIS.

Comment AQ29 The Tuolumne River Conservancy comments that remnants of construction roads, bridges, and staging areas originally used during the construction of new Don Pedro Dam still exist on the Zanker property and the Buck Flat property. The road remnants are elevated and prevent the river from overflowing onto the floodplain, and the in-stream bridge beams are life-threatening boating hazards (during one incident a beam tore a hole in a California DFW boat) that threaten public safety. The Tuolumne River Conservancy requests that the Commission require the Districts to remove the road fill and all concrete and metal remnants from both properties. It also notes that the Commission is required to look to the baseline conditions when evaluating license requirements and references the American Rivers and Alabama Rivers Alliance v FERC, July 6, 2018, decision that documented: "Indeed, the Commission agreed that the NEPA cumulative-effects analysis had to account for all past impacts of the dam's construction and operation, including the enduring or ongoing effects of past actions."

Response: The Buck Flat property is included in the initial list of four projects to be funded by the LTRHIP, as described in the Districts' August 15, 2019, filing (the Buck Flat Riffle 3A/3B Complex). The Districts propose to remove concrete rubble, bridge sheet-piling abutments, adjacent haul road fill, and other debris associated with the construction of new Don Pedro Dam, and approximately 45 acres of adjacent surfaces between New and Old La Grange Bridges would be lowered to interact with contemporary flows for floodplain connectivity and off-channel habitat enhancement. Thus, it appears that the Tuolumne River Conservancy's recommendations for the Buck Flat property would be addressed by the LTRHIP if it is made a requirement of the

license, as we now recommend. Although the Zanker Reach (RM 45.4 to 46.5) is not included among the initial list of projects, it could be considered in the next group of projects, which would be developed within six years after issuance of any license for the project.

Comment AQ30: FWS comments that Commission staff's recommended coarse sediment management plan would benefit salmonid spawning habitat for only Chinook salmon and *O. mykiss*. FWS recommends Commission staff expand its analysis to include a wider range of impacts from the projects and a plan that provides broader benefits to improve salmonid fry and juvenile rearing habitat, benthic macroinvertebrate habitat, and improved geomorphic processes in the Tuolumne River.

Response: Staff believes that adoption of the LTRHIP, which we now recommend, as well as the larger volume of gravel augmentation that we now recommend, would provide broader benefits to salmonid fry and juvenile rearing habitat and aquatic habitat in general, and there is no need to further expand this analysis in the final EIS.

GRAVEL AUGMENTATION AND CLEANING

Comment AQ31: The Districts comment that the final EIS should adopt the Districts' site-specific set of coarse sediment measures instead of Commission staff's recommended plan to augment gravel annually for the term of any new license. Using estimates of gravel capture by Don Pedro Reservoir as a measure of the downstream needs for spawning gravel, as implied by NMFS and California DFW in their recommendations, is not supported by science, nor is it supported in the record before the Commission in this proceeding. However, the Districts state that their plan to add 75,000 tons over 10 years is equivalent to losses that might occur over a 60-year period based on Commission staff's estimate of 1,250 tons per year (draft EIS, page 3-9). Adding gravel "annually" is neither effective for spawning nor economically cost-effective.

If the final EIS continues to include a license article calling for the development of a coarse sediment management plan (e.g., proposed Don Pedro Article 415, *Coarse Sediment Management Plan*), the Districts' request such an article include reasonable limits of the quantities involved in accordance with the draft EIS findings provided on pages 3-8 and 3-9 of the draft EIS. A generally worded license article would leave the Districts open to requests for vastly greater gravel quantities than justified by project effects. The Districts state that their proposed revisions to Article 415 in attachment A reasonably modify the article to align with the information in the record regarding gravel loss.

Response: We modified our coarse sediment management analysis in the final EIS to include more detail regarding the quantity of gravel to be augmented and the frequency of placement into the Tuolumne River. Our revised analysis in section 3.3.2.2 of the final EIS concludes that the Districts' proposed gravel augmentation, if evenly allocated over a 40-year license term, would approximate the gravel loss rate over eight years in the 6.7-mile-long study reach used by Stillwater Sciences (2013d). Based on the current

amount of spawning gravel in the lower river and the spawning populations it could support, the level of gravel augmentation proposed by the Districts would be sufficient to maintain and enhance spawning gravels in the lower river. However, although we are not recommending the level of gravel augmentation recommended by NMFS and California DFW, we agree that some additional gravel augmentation should occur in portions of the river downstream of RM 39 (our previous downstream limit for gravel augmentation), based on recent findings that an average of about 36 percent of Chinook salmon redds were constructed downstream of RM 39 to as far downstream as RM 24.5. Thus, we now recommend the Districts modify their proposed coarse sediment management program to: (1) expand the reach where potential gravel augmentation sites would occur to extend downstream to RM 24.5; (2) require 75,000 tons of gravel to be placed at sites between RM 52 and RM 39, and 25,000 tons of gravel to be placed at sites between RM 39 and RM 24.5, for a total not to exceed 100,000 tons over the duration of the license; (3) include filing of an implementation plan for the first group of gravel augmentation sites within one year, after review and input from California DFW, NMFS and FWS; (4) require filing of a report with the Commission in year 12 after license issuance presenting monitoring, mapping, and evaluation of projects conducted in the first 10 years, and an evaluation of the need for additional gravel augmentation at the initial sites or new augmentation sites; and (5) include filing of an implementation plan for any new gravel augmentation sites identified in the year 12 report. The basis for our revised analysis in the final EIS is comments received from FWS, NMFS, California DFW and the Districts during and after the section 10(j) meeting on the need to specify a gravel augmentation volume, and from FWS, NMFS, California DFW on the need to extend the enhancement reach farther downstream to better encompass the entire reach where most Chinook salmon spawning occurs, including the approximately one-third of redds that are built downstream of RM 39. Specifying a gravel augmentation volume is important for the Districts and all parties to set the bounds for the gravel augmentation program and to align with the current gravel loss rate in the lower Tuolumne River. We revised Don Pedro Article 415 to reflect our above recommendations. We also recommend that any gravel augmentation program be made part of the LTRHIP, which would allow the Districts and FWS, NMFS, California DFW to consult in the preparation of specific plans for gravel augmentation.

Comment AQ32: FWS states that it is unclear why Commission staff recommends that coarse sediment augmentation only occur between RM 52 and RM 39 in its coarse sediment management plan when spawning surveys have shown that 3 to 20 percent of spawning activity each year occurred downstream of RM 34, and redds are observed between RM 26.4 and RM 21.5. FWS recommends that the Commission provide flexibility for the Districts and agencies to identify locations in the entire gravel-bedded reach for augmentation activities.

Response: As we described in our response above, we revised our analysis of gravel augmentation in the final EIS, and based on information provided by California DFW and FWS at the section 10(j) meeting that about one-third of Chinook salmon redds are

constructed between RM 39 and RM 24.5, we now recommend that gravel augmentation occur as far downstream as RM 24.5 and that another 25,000 tons of gravel be placed at sites between RM 39 and RM 24.5.

Comment AQ33 NMFS states that it is unclear where Commission staff derived 1,000 cubic yards per year of coarse sediment, as cited on page 5-35 of the draft EIS, because no citation is presented to support this statement. NMFS notes that studies conducted on the Tuolumne River determined that the Don Pedro Project captures approximately 18,800 cubic yards of coarse sediment per year (McBain and Trush, 2004, page 23). NMFS recommends its gravel plan (10(j) condition 2) because it would add to the lower Tuolumne River a commensurate amount of coarse bed material that would be lost to storage.

Response: Please see our response to comment AQ31. We also note that NMFS has stated that most of its recommended gravel augmentation would be to refill the SRPs, but we conclude that the SRPs are not project-related effects that the Districts should be responsible for mitigating.

Comment AQ34: FWS notes that Commission staff recommends gravel augmentation of only 1,000 cubic yards per year and bases this volume on the lowest range of estimated amount of coarse bed material lost from storage in the lower Tuolumne River annually rather than the amount of material withheld by the Don Pedro Dam. FWS acknowledges that some "short-term sediment transfusion" has occurred; however, the volume that has been placed falls far short of the 1.3 million cubic yards recommended by McBain and Trush (2004). FWS contends that the staff recommendation does not address the remaining "short-term sediment transfusions" necessary to address how the project dams have trapped, and continue to trap, all coarse sediment originating from unregulated portions of the upper watershed.

Response: Please see our response to comment AQ31.

Comment AQ35: California DFW requests clarification about the statement on pages 3-183 to 3-184 of the draft EIS that reads "It is reasonable to conclude that the Districts' ongoing gravel augmentation program is maintaining an adequate amount of spawning habitat in the lower Tuolumne River…" because California DFW is unaware of any actions over the license term besides the Districts' gravel augmentation proposal. In addition, the Conservation Groups state that, to their knowledge, there has been no such gravel placement since 2013, and that placement was implemented by California DFW and the Tuolumne River Conservancy for the RM 43 Project.

Response: Based on further review of the project record, it is apparent that the Districts developed a coarse gravel augmentation program in 2006, but it was never funded, and all gravel augmentation projects to date have been conducted by California DFW, FWS, and Friends of the Tuolumne (now Tuolumne River Conservancy). As such, we modified the final EIS to correct the record.

Comment AQ36: The Conservation Groups comment that the statement on page 3-183 of the draft EIS that "river channel impacts associated with gold and aggregate mining are not related to the projects and would not be required to fill the bedload traps/SRPs, as these impacts have no direct nexus to project operations," discounts the fact that gravel capture by project reservoirs is an ongoing project effect that requires mitigation. NMFS adds that if the Don Pedro Project were not blocking all coarse gravel transport for over 100 years, the special-run pools would have filled in over time with naturally occurring bedload material. Furthermore, the Don Pedro Project reduces the duration, frequency, and magnitude of peak flows that transport gravel, further preventing natural recovery from anthropogenic effects to the Tuolumne River such as gravel mining.

Response: We agree that Don Pedro Reservoir does capture gravel and recommend a gravel augmentation program for the term of the license. Please see response to comment AQ31. However, past effects from mining in the Tuolumne River are not related to the operation of the projects or caused by the proposed relicensing action.

Comment AQ37: FWS comments that Commission staff does not recommend conducting effectiveness monitoring after gravel augmentation activities and recommends that staff include spawning/redd surveys in the staff-recommended coarse sediment management plan to evaluate the effectiveness of gravel augmentation activities and determine whether gravels are being used, the quality of spawning habitat being created, success in meeting project goals, and where methods of restoration can be improved. The Districts comment that the draft EIS misunderstands the purpose of the Districts proposed "spawning surveys," which would be field-based observations of use of new gravel areas for spawning, perhaps better termed as "redd surveys." These field surveys of salmonids would give an indication of the success of the coarse sediment augmentation and indicate whether new gravels were subject to greater redd superimposition.

Response: Based on comments received on the draft EIS, discussion that occurred at the September 19, 2019, 10(j) meeting, and additional information filed on the record, we modified several of our recommendations and included monitoring elements where they are appropriate to guide project operations or the implementation of environmental measures. We now recommend the Districts' proposal to evaluate the need for additional gravel at the initial sites and for additional augmentation sites as part of the gravel augmentation study to be filed in year 12 of any license issued and filing an implementation plan for any new gravel augmentation sites identified in the year 12 report.

Comment AQ38: The Districts comment that proper planning and best management practices (BMPs) during gravel and large woody material (LWM) placement would make it unlikely that *O. mykiss* would be injured or killed during these projects proposed by the Districts. Moving fish away from the area to be disturbed then isolating the areas would ensure lack of impact. Previous snorkeling during gravel addition projects have

documented active feeding by *O. mykiss* directly downstream of gravel addition, likely on invertebrates displaced during gravel dumping.

Response: We recognize that the Districts would likely implement proper planning and BMPs during gravel and LWM placement to protect *O. mykiss*. We also understand that any biological opinion issued by NMFS for the projects would likely include an incidental take statement and a list of reasonable and prudent measures designed to protect the listed population.

Comment AQ39: The Districts disagree with the conclusion on page 3-229 of the draft EIS "that the Districts' flow proposal will achieve gravel cleaning objectives more effectively and in a less damaging manner than their proposed experimental program." The Districts note that considerable care would be taken to locate cleaning areas to avoid any adverse impacts. Areas that would benefit most from gravel cleaning are unlikely to be used successfully by spawning salmonids because of the fine sediment infilling where gravel cleaning would occur. The draft EIS also fails to consider the benefit to outmigrating fall-run Chinook resulting from the temporary increase in sediment that would reduce sight feeding effectiveness of black bass.

Response: We revised our recommendation in the draft EIS on the proposed experimental gravel cleaning measure and now recommend that it be included in any license issued for the Don Pedro Project. To better understand the expected magnitude of the benefit of non-flow measures, we requested that the Districts' run the Chinook salmon and *O. mykiss* production models to evaluate the relative benefit of each non-flow measure independently, as part of an AIR. The filed results indicate that the experimental gravel cleaning program has the potential to increase the relative number of smolts produced per female Chinook salmon spawner by 22–26 percent and the number of young-of-year per *O. mykiss* spawner by 12–25 percent if the expected magnitude of increased egg survival is achieved. We agree with the Districts that the temporary increase in turbidity that would occur during gravel cleaning could help reduce predation on outmigrating salmon smolts if the gravel cleaning were timed to coincide with juvenile salmon outmigration.

Comment AQ40: The Districts disagree with the statement on page 3-184 of the draft EIS that installation of a temporary barrier weir as part of their proposed spawning superimposition reduction program could result in "take" of *O. mykiss*. They state that because *O. mykiss* spawning is generally from January through April, there is little chance of impact on *O. mykiss* spawning; however, they note that monitoring *O. mykiss* passage at the counting weir would help to inform the presence of adult steelhead in the river. In addition, they note that location of the temporary barrier would be preceded by a snorkeling and redd surveys to inform placement of the temporary barrier.

Response: Although we consider it unlikely, we are not able to rule out the possibility that some adult or juvenile *O. mykiss* encountering the proposed temporary weir in the Tuolumne River could be the offspring of anadromous steelhead, and that individuals in this population could be delayed or injured attempting to pass the weir. Because "take"

under the Endangered Species Act means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct," it is unreasonable to conclude that the weir could not result in "take" of *O. mykiss*.

LARGE WOODY MATERIAL MANAGEMENT

Comment AQ41: The Districts comment that the draft EIS proposes a relatively infeasible option by recommending that appropriate-sized LWM for the lower Tuolumne River should "only be collected from Don Pedro Reservoir when it becomes available." Vehicular access to the upper reaches of Don Pedro Reservoir is unavailable in the area where woody debris is now captured to protect recreation uses, and the very steep and undeveloped terrain prohibits the development of new access roads in this area. FWS also notes that Commission staff indicate that only wood collected from Don Pedro Reservoir should be used when it becomes available. However, LWM input into Don Pedro Reservoir is episodic in nature, averaging once every 10 years. Because a large wood flow event just occurred in 2017, it may be several years before the next event. Therefore, FWS also recommends allowing for additional flexibility for acquiring wood from other sources, if necessary, such as salvaging wood from the neighboring BLM lands and the Stanislaus National Forest.

Response: Based on information received since issuance of the draft EIS, we agree that our recommendation that LWM only be collected from Don Pedro Reservoir would not be feasible because of the steep shoreline terrain and lack of roads along the shoreline. Thus, we now recommend that the Districts obtain LWM for habitat enhancement under the LTRHIP from any available feasible sources, which according to agency comments are readily available in the Tuolumne River Watershed. As we further explain in responses below, we are no longer recommending a stand-alone LWM management plan and instead are recommending that any LWM management be completed as part of the LTRHIP, which we now recommend.

Comment AQ42: The Districts disagree with the staff conclusions in the draft EIS that the staff-recommended LWM management plan to increase the amount of LWM downstream of the La Grange Diversion Dam would mitigate project effects on LWM supply and enhance aquatic habitat in the lower Tuolumne River. They state that their study W&AR-12 found that the vast majority of LWM captured in Don Pedro Reservoir was too small to benefit habitat in the Class 6 lower Tuolumne River, and there are no "project effects on LWM supply" to mitigate. The Districts also note that Commission staff does not adopt the NMFS recommendation for a target average frequency of 100 pieces of LWM per mile derived using densities found in other California streams, with the draft EIS concluding it would be more appropriate to focus the LWM management plan on mitigating only the existing effects of the Districts' projects on wood recruitment. The Districts believe this is a direct reference to the generally small size of wood captured in Don Pedro Reservoir.

Response: As noted below, we no longer recommend a stand-alone LWM management plan and instead recommend that any LWM management be completed as part of the LTRHIP, which we now recommend. The record indicates that Don Pedro Reservoir is intercepting LWM, much of it comprising small size as indicated by the Districts, and we now recommend that any LWM management focus on larger wood pieces and ELJs that would have higher value for habitat enhancement in the lower Tuolumne River and the best potential for remaining in place.

Comment AQ43: The Districts question staff's analysis in the draft EIS regarding the projects' effects on LWM functioning habitat in the lower Tuolumne River and the reliance on the Albertson et al. (2013) reference. The Districts cite the lack of LWM in the lower river and the lack of LWM that could provide habitat benefits using wood captured in Don Pedro Reservoir because of its small size related to the average width (119 feet) and depth of the lower river. Regarding the Albertson et al. (2013) reference, the Districts state that the sampling methodology may not have properly surveyed the study rivers, which were significantly different from the lower Tuolumne River in terms of channel width and streamflow, and they question the size criteria used for defining LWM (diameter greater than 6 centimeters [about 2.4 inches]).

Response: We reviewed Albertson et al. (2013) and Senter and Pasternack (2010), two studies that NMFS relies on to develop its recommendations for LWM placement in the lower Tuolumne River, and we also note the relatively small size criteria used by those studies to define LWM. However, the Albertson et al. (2013) study also provides data on average volume of LWM pieces counted and average LWM loading per mile in 19 rivers that support salmon, and that loading was shown to be substantially lower than the volume that would result from the NMFS recommendation of 100 pieces of wood per mile, which we do not recommend. As we previously responded, however, we continue to recommend LWM enhancement as part of the LTRHIP, focused on larger wood pieces and ELJs, with wood to be supplied from any available feasible sources because of the difficulty in obtaining wood from Don Pedro Reservoir.

Comment AQ44: The Districts further question whether LWM enhancement would provide any habitat benefits in a river the size of the lower Tuolumne River because much of the LWM would likely pass through the lower river during high flows, noting that habitat formation due to LWM usually decreases with increasing channel width. Study W&AR-12 found that LWM provided little habitat value for salmonids in the lower Tuolumne River, and adding more LWM may not significantly improve that habitat. The Districts suggest that boulder placement or ELJs may be a better option for habitat enhancement should the Commission require LWM installation in the lower Tuolumne River. The Districts also indicate that they should be allowed to acquire such LWM from any cost-effective source. The Districts have allocated $4 million for LWM improvements in the lower Tuolumne River as part of the LTRHIP; however, they indicated that any license requirement should include specific and appropriate limitations to the extent of LWM improvements.

Response: We no longer recommend a stand-alone LWM management plan and instead recommend that any LWM management be completed as part of the LTRHIP, with a focus on ELJs and placement of LWM in smaller side channels to the lower Tuolumne River where LWM would have a greater chance of providing habitat benefits. Commission staff completed additional analysis (see section 3.3.2.2) of the volume of LWM that should be used for habitat enhancement focused on the amount of larger LWM intercepted by Don Pedro Reservoir and the use of ELJs. We conclude that 213 cubic feet per mile would be an appropriate target LWM volume for habitat restoration/enhancement. This would translate to a total target of 6,535 cubic feet for the 27.8-mile reach (RM 51.8 to RM 24) of the lower Tuolumne River that has the best potential for salmonid habitat enhancement and should be the focus of any LWM enhancement. Specific plans for LWM management should be developed as part of the interagency consultations under the LTRHIP to target areas that would have the best chance for successful habitat enhancement.

Comment AQ45: NMFS states that it is unclear why the Commission concludes on page 3-191 of the draft EIS that the LWM placement target densities recommended by NMFS are not applicable to the Tuolumne River. NMFS states that it provided the Commission with a detailed plan that cites literature from watersheds directly comparable to the Tuolumne River (e.g., Albertson et al., 2013; Senter and Pasternack, 2010). In the final EIS, the Commission should analyze NMFS's specific plan for LWM (NMFS 10(j) condition 3) along with the scientific rationale that supports it and use this analysis to determine the specifics of a plan (including total volume of wood per year) to be implemented in the license order.

Response: Section 3.3.2.2 of this final EIS further analyzes both the NMFS and California DFW recommendations for LWM placement in the lower Tuolumne River. Our analysis indicates that both the NMFS and California DFW recommendations for LWM loading are substantially higher than those observed in the 19 streams surveyed by Albertson et al. (2013) and by Stillwater Sciences (2017a) in the lower Tuolumne River. Both the NMFS and California DFW recommendations specify a majority of LWM to be used for habitat enhancement meet minimum size criteria, with the objective that this LWM remain stable and not be washed out by high flows, yet the 19 streams surveyed by Albertson et al. (2013) appear to maintain a much lower LWM loading in streams that are known to support salmon in California's Central Valley. Because the NMFS and California DFW recommendations appear to be excessive compared to the LWM volume observed in other streams in the region and to the likely magnitude of project effects, we include alternative LWM loadings for use in habitat enhancement as part of the LTRHIP. As noted above, we now recommend 213 cubic feet per mile as an appropriate target LWM volume for habitat restoration/enhancement and a total target of 6,535 cubic feet for the 27.8-mile reach (RM 51.8 to RM 24) of the lower Tuolumne River.

Comment AQ46: NMFS comments that on page 5-33 of the draft EIS, the Commission recommends that the Districts prepare an LWM management plan in consultation with the resource agencies to develop LWM enhancement metrics. However, without a

framework or guidance from the Commission about the specifics of such a plan, the Commission's proposal creates a de facto license reopener and defers basic licensing decisions until after the license is issued. A reopener proceeding "removes the incentive for a speedy and efficient resolution of fishery issues" that exists during licensing and is likely to result in costly delays implementing protection and enhancement measures.

Response: We do not recommend an LWM management plan as a license reopener and note that beginning on page 5-33 of the draft EIS we provide a framework of five provisions that should be included in any LWM management plan, along with a recommended schedule for placement events for any such plan. However, as we describe in our previous responses, we are no longer recommending a stand-alone LWM management plan and instead are now recommending that any LWM management be completed as part of the LTRHIP, which we now recommend. Any LWM management should be developed among the parties to the LTRHIP, which would include NMFS, and any plans under the LTRHIP would be filed with the Commission for approval.

Comment AQ47: The Conservation Groups comment that draft License Article 415, and draft License Article 414, *Large Woody Material Management Plan*, for the Don Pedro Project do not quantify the amount of coarse sediment or LWM to be used and instead require the amounts and locations to be developed in consultation with the resource agencies. The Conservation Groups add that it is not possible to evaluate what would be achieved without these basic definitions. In violation of NEPA, the draft EIS omits the most basic detail on these plans and is not sufficient to satisfy statutory obligations. The Commission cannot find that the license is in the public interest without such evaluations.

Response: Please see our responses to comments AQ31, AQ44 and AQ45 and our revised analysis of LWM enhancement in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Large Woody Material Augmentation*, of the final EIS.

Comment AQ48: FWS generally supports the broad outline of the staff-recommended LWM management plan but recommends including effectiveness monitoring in the plan. Biological monitoring data, including salmonid use, would be used to identify whether the plan goals are being met and to inform future placement activities.

Response: As we noted in the previous responses, we are no longer recommending a stand-alone LWM management plan and instead are recommending that any LWM management be completed as part of the LTRHIP, which we now recommend. We agree that effectiveness monitoring should be required, and FWS would have the opportunity to recommend the specifics of that monitoring as part of the planning process under the LTRHIP.

SALMONID MONITORING PLAN

Comment AQ49: FWS notes that Commission staff does not recommend FWS's salmonid monitoring plan (10(j) recommendation 5) and suggests that staff does not understand: (1) how the salmonid monitoring data would be used to relate to project

operations because a wide variety of factors outside the project area influence salmonids; (2) how the salmonid monitoring results would be used to inform potential future changes in project operations; and (3) what the agencies would do with the data and how it would be used to better manage the resource. FWS and California DFW provide the following additional comments:

- The paired RST monitoring would produce differential survival estimations between the upstream (RM 24.5) and downstream (RM 5.3) RSTs that would allow managers to differentiate project-level effects from marine conditions effects on salmonid populations.

- The staff-recommended spring pulse flow release plan includes a provision to file with the Commission annual reports that include data derived from RST monitoring. FWS expects that information obtained from RST monitoring would also be used to better manage spill events, such as those mentioned in the staff-recommended spill management plan. California DFW comments that RST and seine data can be used to adequately time outmigration pulse flows. California DFW adds that the data obtained from implementing agency-recommended salmonid monitoring would be specifically responsive to the hydroelectric project operations and could be used to inform management actions that affect the fishery resources of the Tuolumne River.

- The data would be used to identify annual and multi-year temporal distributions of Chinook salmon and steelhead passage upstream of the counting weir and potential associations with corresponding time series of lower Tuolumne River flows and water temperatures. Morphometric and biological data collected from FWS's recommended annual carcass surveys would be used to determine the origin of Chinook salmon, population demographics, and to parse the effects of cross-Delta survival and marine conditions.

Response: Based on discussions that occurred at the 10(j) meeting held in Sacramento on September 19, 2019, and in consideration of subsequent filings, we now agree that many of the monitoring components recommended by FWS would help guide the effective implementation of measures and have incorporated these components into the measures that are included in the staff alternative in the final EIS. These include: (1) adult salmon migration monitoring (at the temporary fish counting weir) to guide fall pulse flow implementation; (2) multiple monitoring elements to guide spring pulse flow implementation (RST monitoring, timing of redd construction, water temperature monitoring and modeling of juvenile development verified via fish seining), (3) monitoring of redd construction at gravel augmentation sites to guide further gravel augmentation efforts; (4) *O. mykiss* spawning and redd surveys in areas planned for gravel cleaning prior to commencing any gravel cleaning; and (5) effectiveness monitoring of projects implemented through the LTRHIP. We do not include the

recommended carcass surveys and collection of associated morphometric and biological data because these data are not necessary to guide license implementation.

Comment AQ50: In response to the statements on page 3-208 of the draft EIS regarding the agency-recommended salmonid monitoring plan, NMFS requests that the Commission require the monitoring actions described in NMFS recommendation 4 because collecting baseline information is critical to implementation and effectiveness monitoring of all new license conditions. NMFS further comments that a robust salmonid monitoring program is needed throughout the course of the next license term because long-term monitoring can parse project effects from non-project effects on salmonid populations. Results from salmonid monitoring would directly influence resource management decisions, including duration and magnitude of flow releases and location and intensity of habitat restoration actions. John Buckley similarly comments that if the Commission does not require monitoring the species that are most at risk, it cannot acquire good information to assess whether project operations and river management are benefiting species at risk.

Response: Please see our response to comment AQ49.

Comment AQ51: In response to the statement that the Districts propose to continue salmonid monitoring measures under any new licenses issued for the projects, the Conservation Groups comment that the Commission can neither rely on a condition in an expired settlement agreement nor on voluntary representation by the Districts that they will conduct certain actions, let alone on actions whose performance is assumed in the draft EIS without an actual performance obligation as the basis for its analysis.

Response: We understand that the 1995 settlement agreement will expire upon the issuance of a new license for the Don Pedro Project, and that the continuation of any voluntary measures would be, by definition, uncertain. Any measures adopted by the Commission and made conditions of any new licenses would be subject to the Commission's compliance monitoring to ensure that license requirements are met.

ANADROMOUS FISH REINTRODUCTION

Comment AQ52: NMFS comments that because Commission staff has not analyzed all information relating to the feasibility of reintroduction (e.g., Anchor, 2017; Pearse and Campbell, 2017; Boughton et al., 2018; Speir et al., 2018) and, instead, relies solely on information presented by the Districts, it is premature for the Commission to determine that establishing viable populations of salmonids in the upper Tuolumne River is not feasible. NMFS adds that the hybrid in-river collection facility outlined in the Anchor (2017) report is feasible under the Districts' three feasibility factors and should be analyzed for constructability in the final EIS because it (1) could be designed for flows up to 4,500 cfs, (2) could incorporate boating traffic, and (3) would be consistent with the Wild and Scenic Rivers Act. Furthermore, NMFS does not understand why fish passage would have to be reasonably certain to occur for the Commission to include it as a condition in new licenses for the projects.

Response: The analysis in the draft EIS does not conclude that a future fish passage/reintroduction program would never be feasible in the upper Tuolumne River, rather it notes that such a program would face substantial obstacles to success and would not be justified at this time. It may be possible to design and construct fish passage facilities to successfully pass fish upstream and downstream of the projects in the future, but the costs would likely be high. Furthermore, the need for these facilities at this time appears questionable when anadromous fish stocks in the lower river are at reduced levels and near historical lows and with existing available habitat not fully used. The analysis finds that including a specific fish passage requirement in any licenses issued is not immediately needed; however, with the NMFS mandatory reservation of authority under section 18 and the standard fish and wildlife reopener article, fish passage could be provided in the future if an appropriate administrative record that supports the need for upstream or downstream anadromous fish passage at the La Grange or Don Pedro Dams is developed and provided to the Commission, after giving the Districts notice and opportunity for hearing. This mandatory reservation of authority and a reopener article will be included in any licenses issued for the projects.

STEELHEAD VS. *O. MYKISS*

Comment AQ53: The Districts comment that footnote 69 on page 3-48 of the draft EIS refers to the report by Zimmerman et al. (2008) wherein California DFW collected 146 wild *O. mykiss* from the Tuolumne River between 2001 and 2007 for otolith microchemistry analysis. Using this method, 11 of the 146 fish sampled were identified as having anadromous maternal origin (steelhead), and 1 of these 11 fish displayed an anadromous migratory history. In 2009, the Commission, based on the information provided in the Zimmermann study, concluded "steelhead are present in the Tuolumne River." This decision in 2009 regarding "steelhead presence" in the lower Tuolumne River was made prior to the onset of the licensing proceedings for the Don Pedro and La Grange Projects. Throughout the amended final license application for the Don Pedro Project (and in other documents), the Districts make the distinction between a steelhead "run" or "population" and the presence in the river of a small number of *O. mykiss* large enough that they might be steelhead. This is an important distinction as a practical matter when considering any efforts to enhance the anadromous form of *O. mykiss*. To judge whether any particular measure might improve conditions for anadromous *O. mykiss*, it is necessary to understand the life history traits of the respective population. Lacking a Tuolumne River population of anadromous *O. mykiss*, any enhancement efforts must be considered purely experimental because the life history traits of the "steelhead population" in the Tuolumne River is unknown and unknowable.

The Districts also note that causes for the expression of anadromous or resident life-histories in *O. mykiss* occupying the lower Tuolumne River are poorly understood, and there is no empirical evidence of a self-sustaining "run" or population of steelhead in the lower river. In its August 18, 2017, comments on the La Grange Hydroelectric Project draft license application, California DFW agreed that there is no empirical evidence of a

steelhead run in the lower Tuolumne River. The results of recent investigations suggest that flow and temperature management of tailwater fisheries downstream of many dams in the Central Valley may be preferentially selecting for resident rainbow trout over anadromous steelhead. In its final recovery plan for the Central Valley Steelhead Distinct Population Segment, NMFS notes that large resident rainbow trout populations have developed in parts of the Central Valley as a result of actions undertaken for the management of coldwater species. The Districts' recent genetic analysis of Tuolumne River *O. mykiss* tissue samples (Cramer Fish Sciences, 2018) showed that the migratory genetic variant (single nucleotide polymorphisms on chromosome Omy5) is present in a significant percentage of *O. mykiss* downstream of the La Grange Diversion Dam, and yet there is no steelhead run in the lower Tuolumne River, indicating that for the Tuolumne River *O. mykiss* populations genetic predisposition is less important than environmental conditions in determining whether fish engage in migratory behavior. However, as discussed by Yoshiyama and Moyle (2012), poor migration survival along the migratory pathway of any juveniles that do smolt would result in a low probability of their returning to spawn, and Narum et al. (2008) and Satterthwaite et al. (2010) suggest that reduced smolt survival through the Delta is the greatest management concern, if the goal is to preserve or enhance expression of anadromy among Central Valley *O. mykiss* populations.

Response: We revised section 3.3.2.1, *Aquatic Resources, Affected Environment, Fisheries Resources*, to reflect that available information indicates that at the present time no self-sustaining run or population of steelhead occur in the Tuolumne River, and have revised the terminology (use of steelhead vs. *O. mykiss*) throughout the EIS accordingly. We also note that only seven *O. mykiss* larger than 16-inches in length have been detected at the temporary weir operated by the Districts at RM 24.5 between 2009 and 2018.

Comment AQ54: The Districts comment that the draft EIS reference to table 3.3.2-15 as presenting "steelhead/rainbow trout population estimates" is incorrect and should be corrected in the final EIS. The table heading correctly refers to *O. mykiss*, rather than steelhead/rainbow trout. However, to then refer to the data in the table as representing steelhead/rainbow trout population estimates is misleading, when in fact the anadromous form of *O. mykiss* is very rare in the lower Tuolumne River, as shown by Zimmerman et al. (2008) and confirmed by California DFW (2017). The draft EIS contains many other references to *steelhead* in the Tuolumne River, and the terminology should be corrected in the final EIS.

Response: The reference to the table noted by the Districts has been corrected. As noted above, we also revised the terminology (use of steelhead vs. *O. mykiss*) throughout the EIS to reflect that currently available information indicates that a self-sustaining run or population of steelhead does not occur in the Tuolumne River.

AQUATIC INVASIVE SPECIES

Comment AQ55: California DFW notes that the staff-recommended aquatic invasive species management plan, presented on page 5-38 of draft EIS, includes a provision to reassess the vulnerability of Don Pedro Reservoir for the introduction of non-native dressenid mussel species if they are identified in the Tuolumne River or if reservoir calcium concentrations of 13 milligrams per liter (mg/L) or higher are documented. California DFW requests that the Commission clarify which entity would be monitoring calcium concentrations.

Response: Calcium concentrations in water are primarily associated with geology/soils and climate; therefore, we expect them to remain relatively stable in Don Pedro Reservoir. The maximum reported calcium concentration for 173 samples from Don Pedro Reservoir, its inflow, and outflow (Districts, 2011a; HDR, 2013a) is 7.4 mg/L, which is well below the 12 to 15 mg/L range used to identify low vulnerability to colonization (Cohen, 2008). Therefore, requiring the Districts to monitor Don Pedro Reservoir calcium concentrations is not warranted. We incorporate the summary of historical calcium concentrations into section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, *Aquatic Invasive Species Management*, of the final EIS. In addition, in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications*, *Aquatic Invasive Species Management Plan*, and in Don Pedro Project draft License Article 417, we clarify that, under our recommendation, the Districts would reassess the vulnerability of Don Pedro Reservoir for the introduction of non-native dressenid mussel species if they become aware of documentation that Don Pedro Reservoir calcium concentration is 12 mg/L or higher, as data become available from other entities.

CUMULATIVE EFFECTS

Comment AQ56: Steven White comments that the draft EIS does not address the potential for salmonids to become increasingly susceptible to viral infections as a result of the cumulative effects of low DO concentrations from warm water releases from Don Pedro Reservoir and high flow releases that are silt-enriched and likely contaminated with heavy metals.

Response: The draft EIS includes a summary of existing water quality under current project operations (see *Site-specific Water Quality Data*, beginning on page 3-27), and that summary shows that Don Pedro Reservoir does not release warm water into the Tuolumne River. In fact, the opposite is true. Because of the stratification of Don Pedro Reservoir and the release of cool water from the hypolimnion, Don Pedro Project outflows are relatively cool and stable at about 10 to 12°C throughout the year. Without the Don Pedro Project, water temperatures during the summer months would be much higher than existing conditions. Existing water temperature data show that as water flows downstream into the lower Tuolumne River, away from the influence of the Don Pedro releases, natural warming occurs and monitoring stations well downstream of the Don Pedro Project have substantially higher water temperatures than the river immediately

below the project. Similarly, DO levels in Don Pedro Project releases consistently meet the Basin Plan objectives of equal to or greater than 7.0 or 8.0 mg/L, depending on the season. Regarding the potential for "silt-enriched high flows" to be released from the project, the sediment load passed by the project is not a project effect but instead a reflection of watershed conditions upstream of the project (such as effects associated with runoff from burned areas). Operation of the Don Pedro Project has minimal effect on this sediment load, although the reservoir may provide some beneficial effects by causing deposition in the reservoir. We see no basis in the record for stating that the project results in releases of higher water temperatures, lower DO levels caused by warmer temperatures, or increased sediment loads.

F. TERRESTRIAL RESOURCES

Comment T1: BLM recommends that Commission staff revise the TRMP, which is a part of the staff alternative, to include pre-construction surveys for special-status or threatened and endangered plant and animal species prior to *any* (emphasis added) project-related ground disturbance, whether from hand digging with shovels or heavy machinery, because ground disturbance of any type can affect these species. BLM is especially concerned about the sensitive, unique serpentine soils of the Red Hills Area of Critical Environmental Concern (ACEC). California DFW makes the same comment about *any project-related ground disturbance* and recommends having a qualified botanist conduct the surveys following the *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (California DFW, 2018e).

Response: The Districts' proposed Don Pedro Project TRMP includes a provision to conduct site-specific surveys for special-status plants prior to new ground-disturbing activities affecting more than 0.5 acre. The Districts would develop specific-use plans for areas surrounding known occurrences of special-status plants that would be potentially affected by proposed project activities. In the draft EIS, in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects, Our Analysis*, *Special-status Plants*, we found surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery, rather than the proposed 0.5-acre minimum threshold, would ensure that adverse effects on special-status plant species are minimized during project activities. However, as discussed in the final EIS, in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, *Our Analysis*, *Special-status Plants,* we agree that ground disturbance has potential to affect sensitive species regardless of what method is used, if the disturbance occurs in the immediate vicinity of occupied habitat. Therefore, we revised our recommendation to include pre-construction surveys for special-status or threatened and endangered species prior to any project-related ground disturbance in areas with suitable habitat for such species.

We agree that future surveys for special-status plants should follow protocols approved by California DFW, which the Districts followed during previous surveys at the Don Pedro Project. We revised the final EIS to specify that future surveys for special-status

plants, at both Don Pedro and La Grange Projects, should follow California DFW's *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Sensitive Natural Communities* (California DFW, 2018e). As specified by these protocols, a qualified botanist would conduct the surveys.

Comment T2: BLM comments that Commission staff do not provide a rationale in the draft EIS for not recommending its revised 4(e) condition 32 for the Don Pedro Project to implement pesticide use restrictions on BLM land.

Response: We discuss the Districts' use of pesticides on page 3-265, in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Noxious Weeds*, of the draft EIS. However, we neglect to mention that the Districts' Don Pedro TRMP specifies that they would use pesticides on BLM land in compliance with BLM standards and approved for use on BLM land. These conditions would satisfy revised 4(e) condition 32. BLM policy requires that prior to pesticide application on BLM lands, the Districts must prepare and submit to BLM a Pesticide Use Permit for analysis and review. However, requiring prior written approval by BLM prior to the application of pesticides and annual consultation regarding pesticide use for the upcoming year are administrative measures, not specific environmental measures. The Districts would be required to complete a pesticide application report within 24 hours and submit it to BLM according to the *Vegetation Treatments Using Herbicides on BLM Lands in 17 Western States Final Programmatic Environmental Impact Statement* (BLM, 2007).

Comment T3: The Bay Institute comments that the characterization of its recommended riparian recession flows as *too aggressive to allow for successful riparian recruitment* is inaccurate. The Bay Institute focused its drawdown rates on flows lower than the over-1,000 cfs flows analyzed in table 3.3.3-5. The Bay Institute's recommended short-duration, high drawdown rates in the high flow range analyzed in the draft EIS are intended to take advantage of temporarily high survival rates in the survival curves in Stillwater (2006) and would greatly reduce the water requirements of the riparian recession. This approach mimics natural recession rates that extend longer into the summer months in wetter years, benefitting plants, fish, and benthic macroinvertebrates. The Bay Institute has concerns about those initial steep rates, and its proposal specifies that any time the recession rate exceed 2.5 centimeters per day, those rates should be subject to an adaptive management program.

Response: We analyze the effects of flow recession rates on riparian vegetation in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Wetlands and Riparian Areas*. Table 3.3.3-5 provides the percentage of days with potentially suitable recession rates under flow proposals by the Districts and other stakeholders, quantified as the percentage of days where simulated average stage heights at the La Grange gage decrease between 1.5 and 3.5 centimeters on days following simulated flows of at least 1,100 cfs below the La Grange Diversion Dam from April 1 to July 15. The intent of this analysis is to compare the effects of different proposals on flow recession rates on the floodplain, where cottonwood and willow seedlings are most likely to establish and survive

subsequent floods. FWS (2008) determined that in the Tuolumne River between La Grange Dam and RM 22, flows range between 1,100 cfs and 3,100 cfs. Therefore, we limit the analysis of modeled recession rates to flows of 1,100 cfs or greater. We added text in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Wetlands and Riparian Areas*, to further explain the analysis and to specifically address The Bay Institute's recommendation of short-duration, high drawdown rates. We conclude little evidence exists to suggest that short-duration, high drawdown rates followed by lower drawdown rates would increase seedling survivorship. We also revised section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications, Lower Tuolumne River Habitat Improvement* Program, to recommend implementation of the LTRHIP, which would include 76.8 acres of riparian tree plantings as part of the Bobcat Flat Phase III Project.

Comment T4: California DFW comments that the final EIS should include and expand the discussion of its recommendation for June recession flows (draft EIS page 3-263) and identify a specific recession rate that the Districts would be required to meet for different water year types (draft EIS p. 3-262). The Conservation Groups comment that spring recession flows in the lower Tuolumne River should have a defined rate and volume in defined water year types as an enforceable license condition rather than a vague commitment by the Districts.

The Districts comment that modeling the effectiveness of downramping rates on riparian recruitment is not feasible, nor would it be useful because modeling requires calibration and validation, and no data exist on the Tuolumne River to calibrate downramping and the recruitment of woody riparian vegetation. The Districts argue that such modeling would rely on a large number of assumptions that would make it of little reliability. They also argue that because the Tuolumne River floodplain is variable, specific downramping rates would be able to achieve the target riparian recession rates across the entire floodplain.

Response: We analyze the effects of flow recession rates on riparian vegetation in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Wetlands and Riparian Areas*. Our analysis is limited to the results of the Districts' operations modeling, which uses the simulated stage height of the Tuolumne River at the La Grange gage. We acknowledge that underlying assumptions and variation of floodplain topography limit the application of our analysis. Nevertheless, it is reasonable to assume that simulated stage heights below La Grange Diversion Dam would generally approximate the daily change in river levels at locations during spring recession flows. Although an ideal recession rate for seedling germination would be 2.5 cm per day drop in stage, we assume there to be some error inherent to analyzing stage height at one location, which is partly why we evaluated the number of days during April 1 to July 15 when the daily change in simulated stage height fell by a range of values (1.5 to 3.5 cm per day). Our analysis indicates that the Districts' proposed flows would generally provide fewer days suitable for cottonwood recruitment than the agency-recommended flow scenarios. However, none of the recommended flow proposals would provide more than 10 percent of days

from April 1 to July 15 with recession rates suitable for riparian seedling establishment (see table 3.3.3-5). The Districts' proposal to make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic the natural hydrograph of the Tuolumne River, when possible, is a reasonable balance among the needs of fish, consumptive water uses, recreation, and power generation and would provide a substantial improvement over existing conditions. However, the Districts provide little detail about the efforts they consider reasonable or how they would quantify the extent to which project operations mimic the natural hydrograph. Therefore, as discussed in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modification, Spill Management Plan*, we added text to recommend the Districts, in consultation with FWS, NMFS, California DFW, and CCSF, include measures in the proposed spill management plan to provide specific criteria for evaluating whether project operations during the descending limb of the spring snowmelt runoff period reasonably mimic the natural hydrograph. We also recommend the plan include annual consultation with FWS, NMFS, California DFW, and CCSF to determine the best use of excess water during this period. As discussed in section 3.3.3.2, in the *Wetlands and Riparian Areas* subsection, we suggest such criteria could include specific water volumes in different water year types, target flow reduction rates based on previous daily flows, or a protocol for consultation with resource agencies to identify anticipated water availability based on reported snow pack and a plan to allocate spills that mimic natural conditions.

We acknowledge that the Tuolumne River floodplain is non-uniform, in particular because of topographic changes from mining and levee construction that limit the lateral extent of potential river influence on floodplain vegetation. We added this information to the final EIS, suggesting that specific downramping rates measured as a daily change in gage height would produce variable changes across the length of the entire floodplain. We revised the final EIS to require that the Districts make reasonable efforts to shape the descending limb of the snowmelt runoff hydrograph to mimic natural conditions in spill years, subject to other requirements and constraints including flood control, water supplies, spill management, project safety, and rapidly changing weather patterns. We also added a recommendation that the Districts modify the proposed spill management plan by incorporating specific criteria about how these efforts would be quantified and evaluated to provide stakeholders the ability to review the efficacy of this measure and ensure the measure is enforceable. The final EIS has also been revised to provide for annual consultation with the resource agencies regarding both spring and fall pulse flows, which would allow them an opportunity to provide input about the Districts' planned riparian recession rates each spring.

As we noted in the draft EIS, the extent of native vegetation along the lower Tuolumne River increased by approximately 420 acres between 1996 and 2012 from the active restoration of floodplain topography and vegetation. The draft EIS concludes that cottonwood recruitment and recolonization could be successfully achieved by adopting the LTRHIP, as proposed by the Districts and recommended by the resource agencies, but does not adopt the program because of its high costs and uncertainties about how,

when, and where the funds would be spent. However, the Districts have clarified those concerns and in the final EIS we recommend adopting implementation of the four restoration projects that the Districts identify in their comments on the draft EIS.

Comment T5: The Districts comment that there is little justification, if any, for requiring surveys of special-status plants every 10 years covering the entire project boundary, which they estimate would cost on the order of $500,000. However, the Districts acknowledge that it may be justifiable to require a survey for special-status plants at specific project facilities within the ACEC where there is a project-related ongoing human disturbance.

Response: We discuss the Districts' proposed management of special-status plants in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Special-status Plants,* of the draft EIS (pages 3-268 to 3-273) and find that that the Districts' proposed monitoring of only known occurrences would not sufficiently identify additional undocumented populations or new populations that could become established over the duration of a license. We highlight many locations identified by the resource agencies where project effects could exist as a result of project operation and maintenance; recreation; and related access roads, trails, employee housing, and project facilities. It is especially important to monitor special-status plants within the Red Hills ACEC. Future surveys, as we recommended in the draft EIS, would ensure that the Districts document new occurrences of special-status plants, some of which have dynamic population cycles and long-distance dispersal mechanisms.

Don Pedro draft License Article 419 in the draft EIS does not require surveys of special-status plants every 10 years covering the entire project boundary, as suggested by the Districts. However, the locations for future special-status plant surveys is not clearly defined in the draft EIS. We assume that future surveys would include an effort similar to that performed previously by the Districts in 2013 (see TR-01 *Special-status Plants Study Report*). For clarity, we revised the staff measure in the final EIS to limit future surveys for special-status plants to areas within the project boundary at project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and where project-related disturbance is reasonably expected to occur.

We acknowledge that the estimated costs provided for special-status plant surveys in the draft EIS are too low (see table 4.3-1, page 4-20, and table 4.3-2, page 4-45). We revised the final EIS to present an estimated annual cost of $25,000 every 5 years for special-status plant surveys in the Red Hills ACEC and an additional $200,000 every 10 years for surveys in other areas where project-related disturbance is expected to occur within the project boundary, as described above.

Comment T6: California DFW comments that the draft EIS contains insufficient information to adequately analyze the effects of the La Grange Project on bat species. Specifically, the draft EIS does not specify the survey methodology used to support the conclusion that the project is not likely to adversely affect bats and lacks detail about the use of bat exclusion methods.

Response: Pages 3-277 to 3-280 of the draft EIS present the analysis of potential effects of the La Grange Project on bats. We did not determine that the project "is not likely to adversely affect bats," as suggested by California DFW, and acknowledge that the Districts do not discuss any environmental measures to protect bats in their La Grange final license application. Therefore, as discussed in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications, Terrestrial Resources Management Plan*, our staff measure includes a comprehensive bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) to determine where bats are present and/or roosting in the project; resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting. This measure would be adequate to identify La Grange Project areas with the potential to affect bats, and the surveys would indicate whether bat exclusion measures are needed at La Grange Project facilities.

Comment T7: FWS notes that Commission staff recommend including draft License Article 419 in any license issued for the projects to require the Districts to file a revised TRMP. FWS further requests requiring many of the recommendations for federally listed species be applied to special-status and state-listed species. For example, FWS recommends that surveys for special-status and state-listed species be conducted prior to any project-related ground disturbance, not just those involving heavy machinery, and prior to implementing vegetation management activities.

Response: Special-status species are those that are not federally listed but given other protections as described in section 3.3.3.1, *Terrestrial Resources, Affected Environment*, in the *Special-status Plants* and *Special-status Wildlife* subsections. We analyze the effects on special-status species in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, in the *Special-status Plants*, *Special-status Bats*, *Bald Eagles*, *Burrowing Owls*, and *Other Special-status Birds* subsections. We did not intend to exclude pre-construction surveys for special-status species prior to project-related ground disturbance; therefore, we revised the final EIS accordingly to include special-status species. We address concerns about only conducting pre-construction surveys prior to ground-disturbances involving heavy machinery in our response to comment T1.

Comment T8: California DFW comments that the Districts have not performed bald eagle surveys in the Don Pedro and La Grange Reservoirs and that there is insufficient information to perform an adequate analysis to determine effects on eagle populations and nesting pairs within either of the project boundaries. California DFW recommends a 0.5-mile buffer around active nests as a take avoidance measure and concurs with annual eagle surveys, perhaps less frequent if eagles are not observed in the area during several years.

Response: On pages 3-248 to 3-249 of the draft EIS, we describe that the Districts did perform surveys for nesting bald eagles in 2012 and 2013, encompassing a 1,000-foot buffer around Don Pedro Reservoir and project facilities. We acknowledge that surveys were not performed at the La Grange Project. We also state that bald eagle winter surveys have not been performed by the Districts at either project and note that incidental sightings of wintering bald eagles have been recorded on Don Pedro Reservoir. Therefore, as discussed in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications, Bald Eagle and Special-status Bird Management Plan*, we recommend the development of bald eagle and special-status bird management plans that include: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) a 0.25-mile protective buffer around nests and communal night roosts, unless consultation with BLM, FWS, and California DFW allows for a reduced protective buffer if nesting eagles demonstrate a greater tolerance; (3) coordination with BLM, FWS, and California DFW to establish a protective buffer around any new bald eagle nest or communal night roost; (4) installation of signs to inform recreationists of the temporary closure(s) during the breeding season to prevent disturbance to nesting bald eagles; (5) collection of incidental observations of all raptor species to determine if protective buffers are needed, and (6) consultation with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds. It should be noted that our recommendation for a 0.25-mile protective buffer around bald eagle nests exceeds the recommendations of the FWS (2007a) National Bald Eagle Management Guidelines because we agree with the resource agencies that, given the relatively high level of motorized recreation on Don Pedro Reservoir, human disturbance at Don Pedro Reservoir could cause bald eagle nest failure. However, we found no evidence to suggest California DFW's recommended 0.5 mile buffer was necessary to protect bald eagles from project effects. If it has been established that a bald eagle pair is successful with a 0.125-mile-radius buffer, then the Districts could get agreement from FWS, and BLM on BLM- administered land, to establish a site-specific buffer reduction.

Comment T9: California DFW comments that the Districts have not performed sufficient surveys to determine the presence or absence of the foothill yellow-legged frog, a candidate for state listing, at both Don Pedro and La Grange Projects. It recommends habitat surveys to determine suitable habitat locations and protocol surveys to determine presence in those areas.

Response: We discuss the historical occurrence and currently known potential occurrence of foothill yellow legged frog in section 3.3.3.1, *Terrestrial Resources, Affected Environment*, of the draft EIS, pages 3-250 to 3-251. We revised the text to clarify that the nearest extant populations occur in Moccasin Creek, a tributary to Don Pedro Reservoir, located upstream approximately 4 miles near the confluence with Big Jackass Creek. This reach of Moccasin Creek is fragmented by Moccasin Reservoir 1 mile upstream of Don Pedro Reservoir, created by Moccasin Dam. The Districts' Special-status Amphibians and Reptiles Study Report (TR-06), describes a desktop

evaluation of foothill yellow-legged frog habitat at 20 locations along perennial streams within 0.5 mile of the Don Pedro Reservoir, including the Tuolumne River up to RM 79, and tributaries up to 1 mile upstream of the reservoir. Based on potential habitat identified during a desktop evaluation, the Districts assessed 17 locations in the field for evidence of foothill yellow-legged frog habitat suitability. The Districts did not conduct protocol level surveys to confirm presence or absence; however, we do not agree that such surveys are necessary to evaluate potential for project-related effects because (1) foothill yellow-legged frog are not present in Don Pedro Reservoir; (2) habitat suitability is poor within the major tributaries; and (3) the reservoir supports abundant introduced predatory fish and American bullfrog populations and project operation maintenance is unlikely to affect the species. We added text to the final EIS in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Special-status Amphibians and Reptiles*, to clarify our rationale for concluding that operation and maintenance of the projects are unlikely to affect the species.

Comment T10: California DFW requests that the Districts be required to conduct protocol surveys to determine possible impacts of the La Grange Project on the western pond turtle population.

Response: We discuss the Districts' surveys for western pond turtles in section 3.3.3.1, *Terrestrial Resources, Affected Environment.* We clarified the text to reflect that based on the Districts' observation of western pond turtles below the Don Pedro spillway, we assume that the species occupies the La Grange Reservoir. We reviewed information about water levels in La Grange Reservoir and find that the minor fluctuations in La Grange Reservoir elevation would not likely affect western pond turtles. We added text to the final EIS in section 3.3.3.2, in the subsection on *Special-status Amphibians and Reptiles* to discuss potential effects of changes in water temperature in La Grange Reservoir on western pond turtle. We conclude that while the project may result in minor changes compared to the existing condition, temperatures would remain well within the range of suitable temperature for this species. Our recommended measure would include recording incidental observations of western pond turtles, an evaluation of habitat suitability for the species within the La Grange Project boundary, and consultation with FWS and California DFW to develop protective measures for the species. We do not agree that protocol level surveys are needed to analyze potential changes in habitat characteristics or evaluate potential effects on this species.

Comment T11: The Districts comment that no studies or data in the record connect Don Pedro Reservoir water level fluctuations to water temperature. The average increase in water surface elevation from May 1 through July 31 during the period of record is 16.9 feet, which suggests that there is potential for rising water levels to inundate nests constructed below the normal maximum water surface elevation during low reservoir level periods. However, because western pond turtle typically select sites with at least some vegetation (low grasses and forbs), frequent inundation is not likely to affect these sites. While individual nests in the fluctuation zone could be affected, a population effect from those impacts (i.e., population decline) is unlikely.

Response: On page 3-294 of the draft EIS, we acknowledge that western pond turtles select nest sites with some vegetation and would likely avoid areas subject to the most frequent inundation. However, habitat utilization varies through the range of the species, and nest sites are generally characterized by full sun exposure, well-drained soils, and open habitats. In fact, other references suggest that nesting habitat includes areas of bare ground with low-growing, sparse vegetation and little or no overhead tree canopy that receive full solar exposure (Oregon DFW, 2015) or soils with little or no vegetative covering (Washington State DNR, 2013). We revised text in section 3.3.3.2, in the subsection on *Special-status Amphibians and Reptiles* and conclude reservoir water level fluctuations during the fall and winter could only affect small numbers of hatchlings that remain in their nests for approximately one year prior to emergence. Because of a lack of data, we cannot discount that fluctuating water levels in Don Pedro Reservoir would have some effect on western pond turtle populations, and therefore make no conclusions about populations level effects. Recording incidental observations of western pond turtles during other biological surveys, as proposed in the Districts' TRMP, would indicate if project effects on western pond turtles are a concern. As proposed, the Districts' Don Pedro TRMP would provide for an annual consultation memo submitted to the BLM and California DFW, allowing input about any future protective measures for western pond turtle, if necessary.

Comment T12: The Districts comment that the finding in the draft EIS of a potential effect on western pond turtle from water level fluctuations in the La Grange pool is not supported by any evidence in the record or the draft EIS. The La Grange Project operates in a run-of-river mode with very little water level fluctuation, and the small headpond is dominated by steep rocky shores with little vegetation.

Response: We reviewed information about water levels in La Grange Reservoir and find that the minor fluctuation of the La Grange Reservoir elevation would not likely affect western pond turtles. We revised such references in the final EIS to only state that water fluctuations in Don Pedro Reservoir could affect water temperatures in La Grange Reservoir.

Comment T13: California DFW notes that no ecological reasons preclude golden eagles from colonizing and nesting in the project boundary and thus supports the inclusion of golden eagles in the bald eagle and special-status bird management plan.

Response: In section 3.3.3.2 of the draft EIS, in the subsection on *Bald Eagles,* we state that golden eagles may infrequently occur at the Don Pedro Project and likely use lands within the project boundaries. We also discuss our staff recommendation for the inclusion of golden eagles and other special-status raptors in the Districts' development of bald eagle and special-status bird management plans for both projects in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Other Special-status Birds,* and recommend that measures to manage all birds be included in the bald eagle and special-status bird management plans for both projects. These plans would include: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where

limited operating periods are needed; (2) collection of incidental observations of all raptor species to determine if protective buffers are needed, and (3) consultation with FWS and California DFW to identify suitable protective buffer distances around any active nests of other special-status birds. Because this measure would provide nest protections should any golden eagle nest(s) be detected within the project boundaries, we deleted the sentence referenced by California DFW on page 3-283 and a similar sentence on page 5-39 of the draft EIS that read, "we do not see any benefit to the species by including additional protective measures for golden eagle in the revised bald eagle management plan." We concur with California DFW that over the term of the license, there is potential for golden eagle to occur in the project area. We believe that there would be ample opportunity for the Districts, contracted biologists, and other interested stakeholders to report incidental sightings of golden eagles at the projects, especially if a pair of golden eagles were to nest in the project vicinity. So, while we do not believe that it would be prudent to allocate limited resources to survey the entire project area for golden eagles, we find that the existing staff measure would be adequate for detecting the potential presence of nesting golden eagles at the projects, including during annual surveys for bald eagles and/or other special-status plants and animals, as well as during BLM and Central Sierra Audubon Society mid-winter eagle surveys on Don Pedro Reservoir.

Comment T14: California DFW notes that the Districts have not conducted protocol surveys for the Swainson's hawk, which is state-listed as threatened, and recommend implementation a 0.5-mile buffer around any active Swainson's hawk nest. California DFW further encourages consultation with the resource agencies to develop enforceable avoidance, minimization, and mitigation measures (i.e., protective buffers) before the conclusion of this environmental review and the issuance of any new licenses for the projects.

Response: On page 3-286 of the draft EIS, we state that the Swainson's hawk has been documented within 4 miles of the Don Pedro Project boundary and would likely use lands within both project boundaries. We discuss our staff recommendation for the inclusion of Swainson's hawk in the Districts' development of bald eagle and special-status bird management plans for both projects in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, *Other Special-status Birds*, and recommend that protective measures be included in the bald eagle and special-status bird management plans for both projects. These plans would include: (1) annual bald eagle nesting, wintering, and night roost surveys to identify areas where limited operating periods are needed; (2) collection of incidental observations of all raptor species occurring within the project to determine if protective buffers are needed, and (3) consultation with FWS and California DFW to identify protective buffers around any active nests of other special-status birds with potential to be affected by project-related activities. This would provide for nest protections should any Swainson's hawk nests be detected within the project boundaries by the Districts, their contracted biologists, or other interested stakeholders who report incidental sightings of Swainson's hawks at the projects.

The deadline for development of the bald eagle and special-status bird management plan would be stated in the license and is generally within one year of license issuance. During plan development, the Districts would be required to consult with resource agencies, and the Commission would need to approve the plan prior to implementation.

Comment T15: California DFW requests that the Districts provide a rationale for the lack of protocol surveys for western burrowing owls and recommends that the Commission require protocol surveys that follow the California Burrowing Owl Consortium guidelines (The California Burrowing Owl Consortium, 1993). California DFW concurs with the staff recommendation to include BMPs in the Don Pedro TRMP but recommends that avoidance measures be detailed prior to finalizing this NEPA document.

Response: We analyze potential project effects on burrowing owls in section 3.3.3.2, *Terrestrial Resources, Environmental Effects,* on pages 3-285 to 3-286 of the draft EIS. During scoping for the EIS, no stakeholder requested an analysis of project effects on burrowing owl. In the draft EIS, we recommended that the Districts describe specific locations where ground squirrel activity is problematic and where they propose to use rodent control, which would include protections for burrowing owls by surveying for occupancy of ground squirrel burrows following California DFW and/or FWS protocols prior to any rodent control activities. The Districts would implement avoidance measures for any occupied or potentially occupied burrows. We also revised our staff measure in the final EIS to include the recording and reporting of incidental observations of any special-status or threatened and endangered species. Lastly, we revised the staff recommendation to include pre-construction surveys for special-status species following FWS and/or California DFW protocols, which would include burrowing owls and California Burrowing Owl Consortium guidelines. There are no known occurrences of burrowing owls at the projects, but these additional measures to be included in the TRMP for each of the projects would provide for protections if any burrowing owls were documented.

G. THREATENED AND ENDANGERED SPECIES

Comment TE1: The Tuolumne River Conservancy recommends including a formal reopener in any licenses issued for the projects to review the flows and health of the *O. mykiss* fishery in 15 years because of the hypothetical and experimental nature of the proposed action and the current impaired status of the *O. mykiss* population.

Response: The Commission typically includes in its licenses a standard license article that contains a fish and wildlife reopener provision that could be used to require changes to project facilities or maintenance plans upon Commission motion, or as recommended by the appropriate state and federal fish and wildlife agencies, after notice and opportunity for hearing. This standard reopener retains authority for the Commission to implement any measures that may be needed to protect threatened or endangered fish and wildlife species or other fish and wildlife resources over the term of the license issued for

the project. This general reopener article would allow these agencies, after collecting data on the *O. mykiss* population for the first 15 years of the license (or after any other time interval), to petition the Commission and recommend additional measures, if needed.

Comment TE2: NMFS comments it cannot initiate formal consultation under the Endangered Species Act or on essential fish habitat under the Magnuson-Stevens Fishery Conservation and Management Act because the proposed action and its effects are not adequately described in the draft EIS.

Response: A detailed description of the proposed action (i.e., issuing a new license for the project under the staff alternative) is provided in section 2.3, and the staff alternative with mandatory conditions is provided in section 2.4 of the final EIS. In addition, we modified our recommended measures to provide more specificity (e.g., volumes of gravel and LWM to be used in habitat improvement measures) so that their effects can be evaluated to support formal consultation.

Comment TE3: California DFW comments that while Commission staff refer to Central Valley spring-run Chinook salmon from the San Joaquin River as a non-essential experimental population (draft EIS, page 3-309), this designation only applies to spring-run Chinook salmon from the San Joaquin River Restoration Area. California DFW adds that downstream of the confluence of the San Joaquin and Merced Rivers, these fish have been designated as threatened and require acquisition of take authorization through NMFS.

Response: Thank you for the clarification. We revised the final EIS to state that this non-essential experimental population designation only applies to spring-run Chinook salmon from the San Joaquin River Restoration Area.

Comment TE4: For both the Don Pedro and La Grange Projects, FWS recommends that the staff measure for "pre-construction surveys for special-status plants prior to any project-related ground disturbance involving heavy machinery…" be revised for federally listed plant species because avoidance measures for listed plants are different than those for listed animals. FWS comments that surveys for special-status or threatened and endangered plants should be conducted prior to any project-related ground disturbance, whether it is from hand digging with shovels, mowing, or heavy machinery because ground disturbance of any type, including some types of mowers, can kill or harm plants. They also recommend that the measure be revised to read:

> Prior to implementing ground disturbing activities or implementing vegetation management activities, Districts shall conduct surveys for any federally threatened or endangered plants where suitable habitat exists. Surveys shall be an appropriate distance around the disturbance zone, not just the construction footprint. If federally listed plants are found prior to implementing activities, a 50-foot buffer shall be implemented around the plant, marked with flagging or fencing. When hand-pulling weeds, no

buffer around federally listed plant species is necessary. The flagging or fencing will be removed once the work is complete.

Response: We discuss effects on special-status plants in section 3.3.3.2, *Terrestrial Resources, Environmental Effects, Special-Status Plants*. As discussed above under comment T1, the draft EIS included pre-construction surveys when heavy machinery is involved to prevent requiring the Districts from conducting surveys for routine activities that involve hand tools. However, we acknowledge that effects on special-status plants could occur when heavy machinery is not involved, so we revised the measure in final EIS to require "pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat; and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to the implementation of any vegetation management or ground-disturbing activities."

Comment TE5: FWS does not concur with the Commission's proposed conservation measures for the valley elderberry longhorn beetle and suggests a more detailed measure that would allow FWS to concur with the Commission's "may affect, but is not likely to adversely affect" determination, which includes following the avoidance and minimization measures described in section 5.1 of the FWS (2017a) *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle*.

Response: We revised the EIS as suggested to specify that if elderberry plants are found within 165 feet of ground-disturbing activities or vegetation management activities, the Districts would follow the avoidance and minimization measures specified under section 5.1 of the FWS (2017a) *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle*.

Comment TE6: FWS notes that Commission staff recommend the Districts revise their proposed Woody Debris Management Plan to include designated disposal site maps and descriptions of treatments and coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir near Ward's Ferry Bridge. FWS comments that throughout the relicensing process, it has repeatedly expressed concern regarding the lack of surveys for the California red-legged frog and that stockpiling LWM allows bullfrogs, an introduced predator to the California red-legged frog, to increase in numbers and disperse into California red-legged frog habitat. Moving woodpiles and burning wood could kill California red-legged frogs.

Response: We acknowledge in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects, California Red-legged Frog*, of the draft EIS, that LWM in Don Pedro Reservoir provides artificial habitat for American bullfrogs, which are the primary suspected cause of the decline and likely absence of red-legged frogs from the project vicinity. We also acknowledge that LWM could provide artificial habitat for any California red-legged frogs that disperse from historically occupied habitat in the Piney Creek Core Area and that these frogs could be injured during subsequent burning or

removal of this debris. However, it appears likely that California red-legged frogs have been extirpated from the Piney Creek Core Area, which encompasses a watershed approximately 0.75 mile or more outside the project boundary; Piney Creek is a tributary to Lake McClure, which is also inhabited by predatory, invasive American bullfrogs. Although FWS (2002a) describes the Piney Creek Core Area as having the potential for reestablishment or augmentation and requiring bullfrog control, there is no such effort being performed by FWS or other entities. Furthermore, we are unaware of any effective American bullfrog suppression strategies for large, open aquatic systems. Successful bullfrog eradication is usually labor-intensive, very costly, and many previous efforts have failed (Adams and Pearl, 2007; Kraus, 2009; Snow and Witmer, 2010) and require sustained funding commitments to prevent bullfrog recovery (Simberloff, 2005; Hull and Rushton, 2012). Because the likelihood for California red-legged frog recovery within the Piney Creek Core Area is not anticipated in the foreseeable future because of the pervasiveness of bullfrogs, we conclude additional protective measures for the species are unwarranted.

Comment TE7: The Districts comment that they could find no reference in "section 5.1.3" to explain what is meant by the indication in the 10(j) table on draft EIS page 5-75 that the staff alternative adopted FWS Don Pedro 10(j) recommendation 9 "in part." This needs to be made clear in the final EIS. Additionally, the draft EIS acknowledges that the Districts' control of woody material in Don Pedro Reservoir has been effective in limiting interference with boating take-out at Wards Ferry Bridge.

Response: We mistakenly referenced section 5.1.3, *Other Measures Not Recommended by Staff*, and should have referenced section 5.1.2, *Additional Measures Recommended by Staff*. The text describing Commission staff's partial support of FWS recommendation 9, Revise the Woody Debris Management Plan, is found in the subsection *Woody Debris Management Plan* of the draft EIS. This is also the case for several other 10(j) recommendations adopted in part in tables 5.3.1-1 and 5.3.1-2, where the associated discussion of the recommendation is found in section 5.1.2, rather than 5.1.3. We revised the final EIS to provide the correct section numbers in table 5.3.1-1.

Comment TE8: For the Don Pedro and La Grange Projects, FWS does not concur with the Commission's proposed conservation measures for the California tiger salamander and suggests that, prior to conducting rodent control or ground-disturbing activities, surveys be performed following the methods described in its 2003 *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or Negative Finding of the California Tiger Salamander*.

FWS notes that the Commission does not include conservation and avoidance measures to protect the salamander from rodent control at the La Grange Project but also acknowledges that the Districts do not mention rodent control activities in the La Grange final license application. FWS comments that it would require formal consultation prior to the Commission authorizing rodent control or ground-disturbing activities within 300 feet of known salamander locations.

In addition, for the Don Pedro and La Grange Projects, FWS recommends implementing additional avoidance and minimization measures for project-related, ground-disturbing activities within 300 feet of suitable aquatic and upland California tiger salamander habitat, as opposed to "within 300 feet of wetlands and riparian areas" as proposed.

Lastly, FWS concurs with the Commission's conservation measure for the Don Pedro and La Grange Projects to minimize the spread of chytrid fungus via decontamination of equipment and provided recommended decontamination protocol from appendix B of FWS (2005) *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog*.

Response: We analyze potential project effects on California tiger salamanders in section 3.3.4.2, *Threatened and Endangered Species*, *Environmental Effects,* on pages 3-322 to 3-325 of the draft EIS. As described therein, the potential effects on the species include ground squirrel control and the use of herbicides for vegetation management.

It should be noted that the Districts do not perform rodent control activities at the La Grange Project, which is closer to known occupied California tiger salamander habitat than the Don Pedro Project. There are little to no other potential project effects on the species at the La Grange Project. Regardless, we revised the final EIS to include further protection measures in both TRMPs requiring pre-construction surveys for California tiger salamander following FWS and/or California DFW protocols (i.e., FWS, 2003) prior to any project-related ground disturbance in areas with suitable habitat, rather than when heavy machinery is involved. It is likely true that drought conditions experienced during the Districts' survey would have reduced the potential for the species to be detected. Therefore, the inclusion of protocol-level surveys prior to ground-disturbing activities in areas with suitable habitat is warranted.

The staff-recommended measures for protocol-level surveys in accordance with FWS (2003), and instituting avoidance measures for any occupied or potentially occupied burrow prior to implementing any rodent control measures at the Don Pedro project would ensure the protection of California tiger salamanders. Also, the staff recommendation would reduce potential effects on California tiger salamander through the Districts' modification of the Don Pedro and development of a La Grange TRMP that include BMPs to prevent effects of pesticides on non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas. We modified text in section 5.1.2.3, *Rationale for Additional Staff-recommended Measures and Modifications, Terrestrial Resources Management Plan* to recommend that the TRMP for the La Grange Project include FWS-recommended measures to protect California tiger salamander during project-related construction activities within suitable habitat. However, because no construction activities are proposed for the Don Pedro Project within potential habitat for this species, we do not include FWS's recommended measures related to construction in the Don Pedro TRMP. Because of the low likelihood

of occurrence in the project area, we are confident that these measures would protect California tiger salamanders should the species occur at the projects.

Comment TE9: FWS notes that the Commission does not analyze the potential impacts of the La Grange Project on California tiger salamander critical habitat Unit 8 (La Grange Ridge Unit), which at 0.5 mile from the project boundary is within the 1.3-mile-radius California tiger salamander dispersal distance. FWS recommends that the Commission conduct an analysis to make a determination regarding this critical habitat.

Response: We state in section 3.3.4.1, *Threatened and Endangered Species, Affected Environment*, on page 3-302 of the draft EIS, that the La Grange Ridge Unit of designated critical habitat for California tiger salamander is beyond the average dispersal distance of the salamander (1,844 feet, 0.35 mile) but is within the maximum known dispersal distance (1.3 miles) for the species. We do not specifically analyze potential project effects on this critical habitat because its defined area does not intersect with the La Grange Project, so there would be no direct effects; no indirect effect would occur because the Districts do not perform rodent control at the La Grange Project. The other potential indirect project effect, pesticide use, would be avoided or minimized by our staff-recommended measure to include BMPs in the TRMPs that would minimize potential for pesticides affecting non-target species. We revised the final EIS to indicate there is no critical habitat for California tiger salamander within the La Grange Project boundary and based on our analysis, we conclude that the indirect effects of the La Grange Project are not likely to jeopardize the continued existence of California tiger salamander or result in the destruction or adverse modification of designated critical habitat in the nearby La Grange Ridge Unit.

Comment TE10: FWS comments that it disagrees with the "no-effect" determination for California red-legged frogs at the Don Pedro Project. FWS recommends that pre-construction or pre-activity surveys (following its 2005 *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* [FWS, 2005]) of suitable habitat should be conducted prior to a wider variety of operations and maintenance activities in addition to ground-disturbing activities involving heavy machinery. It also suggests "avoidance and mitigation measures be developed for a wider variety of activities…because the frog uses aquatic habitat for breeding and non-breeding purposes and utilizes upland areas adjacent to or surrounding breeding and nonbreeding aquatic and riparian habitat up to a distance of 1 mile in most cases." FWS notes that if California red-legged frogs are found during pre-construction/pre-activity surveys, the Districts should postpone and/or halt activities immediately until consultation with FWS is completed to develop appropriate and specific protection measures.

Also, rather than requiring "BMPs consistent with California pesticide regulations," FWS recommends that pesticide use should be avoided within 500 feet of suitable aquatic and upland habitat for California red-legged frog and notes that if pesticide use within suitable habitat is planned, formal consultation with FWS is required.

Furthermore, FWS comments that the Commission does not include any avoidance or minimization measures associated with the potential effects on the California red-legged frog from hazard tree removal or fuels reduction debris and recommends any cut hazard trees or fuels reduction debris be removed within 24 hours or be left in place in perpetuity and not be stored within 1,000 feet of a wetland or riparian area or core areas for federally listed species recovery.

Likewise, FWS comments that the Commission does not evaluate the potential adverse effects on the California red-legged frog during woody material management activities at Don Pedro Reservoir, such as crushing, burning, or predation by bullfrogs. FWS suggests that avoidance or minimization measures may be necessary but does not specify the inclusion of an additional conservation measure to reduce the potential impact.

Response: We analyze potential project effects on California red-legged frog, including the Districts' Woody Debris Management Plan, in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects, California Red-legged Frog*, in the draft EIS. The Districts' study of California red-legged frog found that Don Pedro Reservoir does not possess the essential components of red-legged frog breeding habitat because of the absence of suitable vegetation. The reservoir is also stocked with a variety of introduced predatory fish, which combined with predatory invasive American bullfrogs, greatly diminish suitability for California red-legged frog. As a result, we support the Districts' opinion that the collection and disposal of LWM, an activity that is crucial to maintaining boater safety and recreational uses, is unlikely to adversely affect California red-legged frog.

It should be noted that, as described on page 3-301 of the draft EIS, the projects do not contain designated critical habitat for California red-legged frog. Also, contrary to the statement of FWS in its March 19, 2019, non-concurrence letter, the Don Pedro Project is not within a core area as defined in the California red-legged frog recovery plan (FWS, 2002a). The nearest core area, the Piney Creek Core Area, encompasses an adjacent watershed; Piney Creek is a tributary to Lake McClure. California red-legged frogs are thought to be extirpated from this drainage, largely because of the presence of American bullfrogs. Until effective methods to control American bullfrogs and reestablish red-legged frog populations within this core area are developed and implemented, the collection and disposal of LWM in Don Pedro Reservoir would have no effect on the conservation of California red-legged frogs. Likewise, because of the absence of the species, it is not necessary to include any avoidance or minimization measures associated with hazard tree removal or fuels management activities.

Despite the presumed extirpation of California red-legged frogs from within the project boundaries, we revised our recommendation in the final EIS to provide for pre-construction surveys for threatened and endangered species following FWS protocols (e.g., FWS, 2005) prior to any project-related ground disturbance in areas with suitable habitat, rather than just ground-disturbing activities involving heavy machinery. Such additional surveys would continue to provide information about the potential occurrence

of California red-legged frog and predatory species that limit its distribution at both projects.

However, we note that while we do not recommend adopting protection measures for California red-legged frog, BLM 4(e) condition 7 would require the TRMP for the Don Pedro Project to include measures to protect this species from project-related activities. This condition would be included as a mandatory condition in any license(s) issued for the projects.

Comment TE11: For the Don Pedro and La Grange Project TRMPs, FWS suggests three additional conservation measures that would apply to all federally listed terrestrial species, which, if adopted in the staff alternative in combination with other recommended species-specific conservation measures, FWS would concur with the Commission's effects determinations, including:

- Conducting surveys for federally listed threatened and endangered species by an FWS-approved biologist.
- Documenting incidental observations and survey results of federally listed plant and animal species during any project-related biological surveys conducted, including anecdotal evidence of San Joaquin kit fox, California tiger salamander, and California red-legged frog. Biological surveys would include those conducted as part of project-related implementation and effectiveness monitoring on the lower Tuolumne River. Observations should be reported to FWS and the California Natural Diversity Database.
- Ensuring coordination and consistency with other management plans (e.g., erosion and sediment control and woody material management) when developing and implementing the TRMP.

Response: We agree that qualified wildlife biologists with appropriate levels of education, training, and expertise would be best for completing surveys for federally threatened and endangered species, especially surveys that could potentially "take" federally listed species and thus require FWS authorization via a section 10(a)(1)(A) permit. For example, in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, of the draft EIS, in the *Our Analysis* of *New Project Construction* subsection, we state: "Conducting pre-construction surveys by a qualified biologist for special-status or threatened and endangered species prior to any ground disturbance involving heavy machinery, where suitable habitat exists, would provide further assurances that project effects would be minimized." We revised the final EIS to specify that surveys for federally listed species would follow species-specific survey protocols by FWS, including (1) 2003 *Interim Guidance on Site Assessment and Field Surveys for Determining Presence or Negative Finding of the California Tiger Salamander* (FWS, 2003); (2) 2005 *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* (FWS, 2005); (3) 2011 *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground*

Disturbance (FWS, 2011)*;* and (4) 2017 *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a). These guidelines require that surveys be conducted by qualified biologists. Requiring FWS-approved biologists would be duplicative of existing measures that require adherence to FWS survey protocols.

We agree that documenting incidental sightings or anecdotal evidence of threatened and endangered species would help to document the use of the projects by San Joaquin kit fox, California red-legged frog, and California tiger salamander, and state this in the *San Joaquin Kit Fox* and *California Tiger Salamander* subsections in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*. We revised the final EIS to recommend recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS, California DFW, BLM, and the Commission. However, recording incidental observations of terrestrial threatened and endangered species during monitoring outside the projects on the lower Tuolumne River would not be necessary or beneficial to project operations or management. Such data collection would be performed by wetland ecologists, fisheries biologists, or other ecologists who are not necessarily familiar with identifying these species.

We also reviewed the other project management plans for consistency with the TRMP, and no inconsistencies were revealed.

Comment TE12: FWS does not concur with the Commission's proposed conservation measures for the San Joaquin kit fox at the projects and suggests a more detailed measure that specifies when and where the surveys should occur, which would allow FWS to concur with the Commission's "may affect, but is not likely to adversely affect" determination. FWS recommends that the measures read:

> An FWS-approved biologist will survey the proposed project boundary and a 200-foot area outside of the project footprint to identify habitat features for the fox and utilize this information as guidance to situate the project to minimize or avoid impacts. Pre-construction/pre-activity surveys shall be conducted no less than 14 days and no more than 30 days prior to the beginning of ground disturbance and/or construction activities or any project activity likely to impact the fox. The status of all fox dens should be determined and mapped.

Also, for the Don Pedro and La Grange Projects, FWS recommends that when project-related ground disturbance is planned where unoccupied suitable kit fox habitat exists, including dispersal habitat, the Commission should include measures consistent with its 2011 *Standardized Recommendations for Protection of the Endangered San Joaquin Kit Fox Prior to or During Ground Disturbance* (FWS, 2011).

Lastly, for the Don Pedro and La Grange Projects, FWS requests that the Commission identify avoidance measures that should be taken if San Joaquin kit fox are present in areas where rodent control is proposed. To prevent the fox from being harmed, injured,

or killed, potential dens should be monitored as if they were known dens in accordance with the previously referenced 2011 guidance.

Response: We analyze potential project effects on San Joaquin kit fox in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects,* on pages 3-313 to 3-316 of the draft EIS, and note that there is no definitive evidence of the species absence from the projects. However, potential project effects on the species are related to ground squirrel control, and we include protective measures to avoid effects from this activity. It should be noted that the Districts do not perform rodent control activity at the La Grange Project. The staff-recommended measures for protocol-level surveys in accordance with FWS (2011) and avoidance measures for any occupied or potentially occupied burrow prior to any rodent control would ensure the protection of San Joaquin kit fox. Additionally, we revised the final EIS to include a measure in both TRMPs that would require pre-construction surveys for special-status or threatened and endangered species following FWS and/or California DFW protocols prior to any project-related ground disturbance in areas with suitable habitat, rather than only when heavy machinery is involved, as recommended in the draft EIS. Because of the low likelihood for San Joaquin kit fox to occur within the project area, we are confident that these measures would adequately protect the species should they occur at the projects.

H. RECREATION RESOURCES

Comment RR1: FWS and California DFW note that Commission staff do not recommend including the Districts' infiltration galleries as project facilities in any licenses issued for the projects, nor do they recommend a streamflow gage near the galleries because it would not monitor compliance with potential license requirements or have a project nexus. However, because additional flows associated with the infiltration galleries would provide recreational boating benefits upstream and downstream of the galleries, a project nexus and need to monitor compliance do exist. FWS and California DFW request Commission staff clarify how recreational boating flow measures would be implemented, compliance monitored, and how flow information would be communicated to recreational boaters and anglers. Charles Pike comments that the schedules of recreational boating flows and minimum flows for aquatic resources should be made available to the public in advance of their actual occurrence.

Response: We modified the staff alternative in the final EIS to include the Districts' proposed interim and with-infiltration galleries' minimum flows, as modified in the draft Voluntary Agreement, with appropriate compliance points. If the infiltration galleries are included as licensed facilities, we recommend that flow compliance be monitored as proposed by the Districts, with compliance measured by subtracting flow diverted into the galleries from the flow measured at the La Grange gage. If the Commission does not include the infiltration galleries as part of the license, we recommend requiring that the Districts install an instream flow gage downstream of the infiltration galleries. We also recommend that the Districts consult with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day)

and making information on the planned boating releases and minimum flow schedule available to the public.

Comment RR2: The Tuolumne River Conservancy comments that stream fishing is a recreational issue that the Commission should analyze against irrigation and municipal needs. Only a river can provide a natural experience with stream trout and salmon. The Districts can and should enable the natural restoration of stream fishing by providing adequate flows for all life stages at a balance equal to irrigation and municipal needs.

Response: Determining the appropriate balance among the many resource values associated with a given flow regime often involves a complex series of considerations that affect conditions for different fish species and life stages, consumptive water uses, recreation, and power generation. Staff believes that the flow regime that we recommend represents an appropriate balance among these resource values and provides a substantial improvement over existing conditions for stream fishing.

Comment RR3: The Districts comment that the statement on page 3-444 of the draft EIS that the Recreation Resource Management Plan (RRMP) "does not provide a schedule or indicate an intention to reconstruct [recreation] facilities during the license term" is incorrect. The Districts' proposed RRMP includes provisions "to address new recreation needs within the Project Boundary as they evolve throughout the term of the license" (section 3.2 of RRMP). The RRMP may be revised over the term of the new license to direct facility reconstruction and new construction as needed.

Response: We acknowledge that section 3.2 of the RRMP states that the Recreation Facility Development Program will be periodically reviewed and revised to evolve throughout the term of the license. We incorporated this information in section 3.3.5.2, *Recreation, Environmental Effects, Recreation Resource Management*, of the final EIS.

Comment RR4: Regarding Commission staff's statement on page 3-349 of the draft EIS that "BLM's preliminary condition specifies that Districts obtain a burn plan, but it is not clear what entity would develop the plan," BLM states that it prepares burn plans with information provided by the requesting party. BLM developed the Don Pedro Reservoir Woody Debris Burn Plan (CA-180-18-04) in coordination with the Districts on December 17, 2017. The burn plan contains designated disposal site maps and treatment descriptions and lays out coordination with BLM, the Districts, and the County of Tuolumne Air Pollution Control District. The burn plan is good for 10 years, and the licensees must maintain and comply with this burn plan.

Response: Thank you for the clarification. We integrated this information in the final EIS.

Comment RR5: BLM notes that the staff alternative does not include several BLM mandatory conditions, including 4(e) condition 13, which requires developing a Ward's Ferry day-use facility engineered plan. Since the inundation of the original take-out site by the reservoir, the Wards Ferry take-out point has become the best, and essentially only take-out point when boating the Lumsden to Wards Ferry segment of the Tuolumne Wild

and Scenic River, although the site has hazardous access conditions as acknowledged in the draft EIS. The Commission previously recognized the effect of the project on the Ward's Ferry site, when in 1987 it amended the current license, requiring in Article 53 that the Districts provide a restroom, and in Article 52 that the Districts remove the LWM jam that would otherwise form in the upper arm of the reservoir and block whitewater boaters from reaching the take-outs. BLM notes that Ward's Ferry is within the project boundary and meets the Commission's guidance on what constitutes nexus, citing two other projects where the Commission required mitigation for loss of an access point and important whitewater run. BLM also states that 4(e) condition 13 is consistent with the settlement agreement between BLM and the Districts, and BLM expects that this mandatory condition will be included in the license. U.S. Department of Agriculture, Forest Service (Forest Service) comments that it supports BLM 4(e) condition 13 and the design parameters described.

Response: After consideration of comments on the draft EIS, we now agree that Don Pedro Reservoir fluctuations adversely affect access at Wards Ferry and the recreation/access trails, which establishes a nexus between project operations and access improvements at this location. However, we are concerned that the lifting platform specified by BLM would not substantially reduce safety risks to recreationists associated with using hoists to lift rafts in a confined and crowded canyon environment and have expanded our analysis in section 3.3.5.2, *Recreation, Environmental Effects, Recreation Management at Ward's Ferry Bridge,* of the final EIS detailing these concerns. We continue to recommend that the Districts improve or construct new trails at Ward's Ferry to allow boaters to safely egress the reservoir, consistent with past Commission actions to require a restroom and remove LWM to allow recreationists to safely use the site.

We do, however, acknowledge that this is a mandatory BLM 4(e) condition, so it will become part of any license issued.

Comment RR6: Sierra Mac River Trips, Inc. and American River Touring Association, Inc., comment that the statement on page 2-23 of the draft EIS that "We do not recommend the installation of a whitewater boat take-out facility upstream of Ward's Ferry as a license requirement because the measure has no nexus to the continued operation of the project" is false. Both entities point out that they pay an annual fee to the Districts for permits that allow them to egress the reservoir at Ward's Ferry, and that fluctuating reservoir levels have caused damage to the Ward's Ferry area. In addition, comments from 42 individuals state that Don Pedro Reservoir level fluctuations cause erosion in the Ward's Ferry area.

Response: See our response to comment RR5.

Comment RR7: The Forest Service comments that the no-nexus statement on page 2-23 is questionable because of the Commission statement on page 24, section 2.3 of the July 29, 2011, scoping document states that the Don Pedro Project does affect whitewater boating facilities at Ward's Ferry Bridge. The Forest Service, ECHO: The Wilderness Company, and Sierra Mac River Trips, Inc. state that the Districts have not provided

non-motorized users an exit trail or road at the upper reach of the Don Pedro Reservoir and have not mitigated the loss of an outstanding whitewater boating take-out at Jacksonville that was flooded by the Don Pedro Project in 1972.

Response: See our response to comment RR5.

Comment RR8: The Conservation Groups comment that Commission staff incorrectly separates cumulative effects from project effects on whitewater boating at Ward's Ferry Bridge. The fact that effects on whitewater boaters are cumulative does not relieve the Districts of their responsibility for mitigating what they do control at the site. For the past 50 years, fluctuating water levels in Don Pedro Reservoir have scoured the trails and local shoreline. The filling of the reservoir has created conditions where shoreline access is steep and uneven. In its current condition, the take-out at this irreplaceable location is unsafe for the uses it supports.

Response: See our response to comment RR5.

Comment RR9: The Conservation Groups comment that the draft EIS provides no information or analysis about recreational opportunities and visual quality in the urban corridor from RM 25.5 to RM 11, the reach of the lower Tuolumne River that passes through greater Modesto. Under both the Districts' proposed flows downstream of operating infiltration galleries at RM 25.5, and the Districts' proposed interim flows that staff recommends as the permanent license condition, flows from June 1 through October 15 downstream of RM 25.5 would range from 75 to 150 cfs varying by month and water year type. The only apparent issue that the draft EIS considers in relation to these July through October 15 flows is water supply. The draft EIS does not explain why limiting boating in the lower Tuolumne River to short periods in summer would meet demand or provide a reasonable level of opportunity. The draft EIS also does not explain how staff evaluated water quality for contact recreation in greater Modesto.

Response: The draft EIS provides information on recreational opportunities along the lower Tuolumne River in section 3.3.5 and notes that this stretch of river includes boating opportunities in urban settings. Additionally, land use and aesthetics along the project area are discussed in the draft EIS in section 3.3.6, which also addresses the urban corridor. As noted previously, balancing the many resource values associated with a given flow regime often involves a complex series of tradeoffs that affect conditions for different fish species and life stages, consumptive water uses, recreation, and power generation. We believe that the flow regime that we recommend in the final EIS represents an appropriate balance among these resource values and provides a substantial improvement over existing conditions for boating.

In the draft EIS, our evaluation of water quality in the lower Tuolumne River, including for contact recreation, is based primarily on the Water Board's most recent evaluation for the integrated 303(d) list and 305(b) report, which includes analysis of 101 *E. coli* samples collected from six locations (Mancini Park, Legion Park, Ninth Street, Seventh Street, Audie Peeples Fishing Access, and Shiloh). We revised section 3.3.2.1, *Aquatic*

Resources, Affected Environment, Water Quality, by adding a discussion of the Water Board's evaluation of these *E. coli* data and its conclusions (Water Board, 2017b). We also added a discussion of the *SWAMP Safe to Swim Study May 2012—September 2013* (Li and Atwill, 2014) results for the Tuolumne River at Fox Grove. Both fecal coliforms and *E. coli* are bacteria that inhabit the intestinal tract of warm-blooded animals; therefore, project operations would have no direct effect on their concentration in the lower Tuolumne River.

Comment RR10: BAWSCA and CCSF comment that the draft EIS specifies higher boatable flow rates in Don Pedro Project draft License Article 419 than are included in the staff alternative. BAWSCA further comments that inclusion of these higher summer boatable flows would increase water shortages compared to the Districts' preferred plan. Commission staff should analyze the effects of the water shortage frequency and magnitude on the RWS.

Response: We modified our recommendation to include the Districts' interim and with-infiltration galleries' flows as modified in the draft Voluntary Agreement, including appropriate compliance points. The Districts' proposed boating flows have been incorporated into license Don Pedro draft License Article 409; therefore, a separate license article specifying boating flows is no longer needed and is not included in the final EIS.

Comment RR11: Charles Pike comments that the boating flows proposed by the Districts and recommended by Commission staff in the draft EIS are inadequate. Based on Mr. Pike's participation in boating study events in the Tuolumne River in 2013 and 2018, the summer and autumn flow downstream of La Grange Dam should be at least 400 cfs, as measured at Modesto or downstream of the proposed infiltration galleries near RM 29. Mark Gonzalves also participated in a boating study on the Tuolumne River and comments that flow rates of 150 cfs were too little and he needed to drag his boat across rocks at least five times.

Response: We modified our recommendation to include the Districts' proposed interim and with-infiltration galleries' flows as modified in the draft Voluntary Agreement, including appropriate compliance points. According to the Lower Tuolumne River Lowest Boatable Flow Study Report, boaters in hardshell kayaks, inflatable kayaks, and canoes were able to float the river from Basso Bridge (RM 47.5) to Turlock State Recreation Area when flows were as low as 101 cfs to 109 cfs. Although higher flows (150 cfs to 200 cfs) may improve the boating experience by reducing the amount of times boats scrape bottom, the proposed flows represent a reasonable balance among resource values including but not limited to boating, aquatic resources, and consumptive uses. Although boaters were mixed in their assessments of boatability and enjoyment below 150 cfs, boaters reported fun and exciting chutes at all flow levels. Therefore, we conclude that the flows proposed by the Districts would be adequate for boating and an improvement over existing conditions.

Comment RR12: Elias Ruiz commented during the public meeting on the draft EIS that under existing project operations, recreating on the Tuolumne River is very difficult because of the abundance of water hyacinth that completely blanket the river and make it un-navigable.

Response: We revised section 3.3.5.1 *Recreation*, *Affected Environment*, of the final EIS to note that water hyacinth mats completely spanning the river have occurred as far upstream as RM 37, and they likely contribute to low boatability scores at flows of 175 cfs. We also added text regarding water hyacinth control in section 3.3.2, *Aquatic Resources, Environmental Effects, Aquatic Invasive Species Management Plan* regarding water hyacinth removal. While this invasive plant species can adversely affect navigability of the river, it has proven difficult to control and its occurrence and abundance is not attributable to the operation of the hydroelectric projects. Although the Districts proposed in their amended final license application to provide funding to California DFW to support water hyacinth removal, this measure was withdrawn when the Districts agreed to fund the LTRHIP, and no other parties have recommended that water hyacinth removal be required as a license condition.

I. CULTURAL RESOURCES

Comment CR1: EPA recommends the final EIS include an updated status of consultation with tribes affected by the projects and the impacts and mitigation measures identified through that consultation. EPA requests that the Commission include the tribes in the distribution list of the final EIS and Record of Decision.

Response: We updated the final EIS to address cultural resources information contained in the Districts' revised final Historic Properties Management Plan (HPMP) filed on February 14, 2019, and the California State Historic Preservation Officer's letter dated January 31, 2019, contained in attachment B of the HPMP; the Districts' comments on the draft EIS; and the Commission's September 31, 2019, draft Programmatic Agreements for both projects. The HPMPs filed on February 14, 2019, for the Don Pedro Project and on July 10, 2019, contain documentation of all section 106 consultation undertaken for the projects, including copies of all correspondence with the California State Historic Preservation Officer, BLM, and participating Indian tribes.

All participating tribes are included on the Commission's mailing list for the project.

Comment CR2: The Districts comment that they will revise the Don Pedro HPMP to clarify that all parties involved in any dispute on cultural resources management related to the project or the HPMP will follow the process provided in the dispute resolution stipulation to be included in the Programmatic Agreement to be executed for the project.

Response: We revised the final EIS to acknowledge this comment from the Districts. Because the Districts have addressed all other comments on both the Don Pedro and La Grange project HPMPs, and the Commission's draft Programmatic Agreements issued on September 31, 2019 provide the dispute resolution process to which the signatories must abide, no further revisions to the HPMPs are needed.

J. SOCIOECONOMIC RESOURCES

Comment SR1: CCSF comments that the use of 220 mgd throughout the draft EIS as an estimate of San Francisco's base-year demand is inaccurate, and its use fails to incorporate SFPUC's 8.5-year "design drought." The draft EIS rationale for using 220 mgd for the NEPA base case in the water supply analysis is not supported by evidence in the record. CCSF additionally comments that the methodology used for evaluating SFPUC water supply performance at a demand of 220 mgd is not explained in the draft EIS and leaves the reader to speculate about how the values in table 3.3.8-10 were developed. In the final EIS, Commission staff should use the shortage estimates provided by San Francisco and the Districts at the 238 and 265 mgd levels of SFPUC water demand, respectively, using the San Joaquin Pipeline diversion rates included in the Don Pedro operations model (W&AR-02) in lieu of independently attempting to analyze water supply effects at the 220 mgd demand level.

Response: A base-year demand of 220 mgd was chosen as the estimate of San Francisco's water usage in the draft EIS based on the Sunding (2018) report that indicates that a 220 mgd demand level was considered the base-year water demand for July 2010 to July 2011, a period following several dry water years in California. After considering CCSF's comments related to water use rebound following a drought period and adjustment for local weather, population, and employment patterns, we modified the socioeconomic resources section in the final EIS to use the 238 and 265 mgd water demand levels used in the SFPUC modeling reports. Using these water demands and the results of SFPUC's water simulation model filed in December 2019, we modified tables 3.3.8-10 and 3.3.8-11 in the final EIS to show the maximum water supply deficit SFPUC could face under each minimum instream flow proposal for each water year type. We also added text clarifying how these estimates were developed.

Comment SR2: The Conservation Groups comment that the draft EIS relies heavily on information provided by SFPUC's hired economist, Dr. David Sunding, and on water supply model output reported by BAWSCA. However, real-world experience has proven Dr. Sunding's predictions of the economic impacts of reduced water use in the SFPUC and BAWSCA service areas to be greatly overstated. BAWSCA's modeling, for its part, uses demand figures far greater than those recently experienced in the SFPUC and BAWSCA service areas, relies on a model that is not publicly available and whose modeling assumptions are not transparent, and assumes replacement of water less than stated demand even though the deficiency during the recent drought was offset by conservation. The draft EIS does not question the assumption that the City of San Francisco would be required to make up for any flow increases required in the new project license, consistent with the Fourth Agreement between the Districts and the City. For these reasons, the draft EIS significantly inflates the projected socioeconomic effects of increasing flows in the lower Tuolumne River, and the Conservation Groups recommend that the final EIS reevaluate the socioeconomic effects of water made unavailable to SFPUC and BAWSCA under different flow recommendations. Restore Hetch Hetchy similarly requests that the Commission require SFPUC to resubmit

socioeconomic analysis with a more reasonable set of underlying assumptions, including a reasonable projection of the improvements it would pursue and how much they would cost.

Response: In the draft EIS, we indicate that the Sunding (2018) report does not attempt to predict any actions SFPUC might take to acquire new sources of water and does not analyze any of the alternative instream flow recommendations. In addition, we note that the report overstates socioeconomic effects by presenting a "worst case" scenario where any increase in minimum flow requirements would require SFPUC to contribute 51.7 percent of the increase in required flow, as stated in the Fourth Agreement. Therefore, we expanded our discussion of water use trends in the CCSF region in the final EIS to include empirical data on actual water user behavior in the SFPUC RWS region. However, as discussed in the comment response to CCSF above, we revised the socioeconomics section in the final EIS to use the baseline demand of 238 mgd, which is presented in the Sunding (2018) report, to be consistent with the Districts' Don Pedro operations model. Additional socioeconomic analysis presented in the final EIS (i.e., table 3.3.8-10) considers differences among the various water agencies served by the RWS and then aggregates the agency-specific results to derive total RWS impacts.

Comment SR3: CCSF comments that the statement on page 3-411 of the draft EIS that the Sunding (2018) report estimates economic impacts assuming that shortages last no longer than one year is not correct. CCSF states that while Dr. Sunding's analysis presents information based on a single dry year, he escalates economic losses from year to year, consistent with the historical hydrology.

Response: We corrected this statement in the final EIS to note that Dr. Sunding's report presents information based on a single dry year and escalates economic losses from year to year consistent with the historical hydrology of the Tuolumne River.

Comment SR4: The Sierra Club California, Dave Warner, and William Martin note that tables 3.3.8-5, 3.3.8-6, and 3.3.8-7 in the draft EIS show "welfare losses, business losses and job losses" under various levels of water rationing in the SFPUC service area as reported by Sunding (2018) and the SFPUC letter. They request that the Commission delete these analyses and that SFPUC resubmit an updated analysis because:

- No real-world evidence exists to support SFPUC claims that economic activity in the RWS area would be severely affected under any water rationing.
- The concept of "welfare losses" does not apply because there is no price that Bay Area water consumers can pay to get more water during a serious drought.
- Future water use in the RWS is highly uncertain.
- SFPUC fails to use probability analysis in its economic analysis. Inclusion of probability analysis would greatly reduce the potential impacts of SFPUC's erroneous projections.

- New technologies and practices are becoming available every year that could make water use more efficient and bring new water supplies on line.

Response: The tables referenced above are based on standard methods of economic analysis, rules for allocating scarce water supplies within the SFPUC RWS region, and demand relationships for San Francisco's retail customers and each wholesale agency customer.

Comment SR5: California DFW comments that while Commission staff estimate the economic losses to the City of Modesto due to municipal and industrial water supply shortages (draft EIS, page 3-413 and table 3.3.8-9), it would like clarification about estimated reductions in Modesto Irrigation District water supplies in years with a water supply that is 100 percent of full supply.

Response: After review of the source data used to develop table 3.3.8-9 in the draft EIS, we discovered a data entry error. We agree with California DFW's comment that there would be no expected economic loss in years of 100 percent water supply and corrected table 3.3.8-9 in the final EIS to show estimated economic losses ranging from 90 percent of full supply to 50 percent of full supply.

Comment SR6: Dave Warner comments that tables 3.3.8-10 and 3.3.8-11 in the draft EIS do not reflect the rationing that SFPUC builds into its drought planning model. SFPUC's drought planning model is designed to provide adequate supply through its "design drought" scenario, which combines the 1987–1993 drought back-to-back with the 1976–1977 drought for 8.5 years. The model has 10 percent water rationing built in, starting in year 3 and 20 percent rationing starting in year 5. If SFPUC's planned rationing had been incorporated into the data shown in table 3.3.8-10, SFPUC would not have a supply deficit under the Water Board's recommended flows under either the 220 mgd or 265 mgd columns during either the 1987–1993 or 2013–2017 periods. Accordingly, for table 3.3.8-11, the cost to replace the flows under the Water Board plan would be zero. These tables should be corrected to reflect the rationing built into SFPUC's drought planning model.

Response: On December 11, 2019, the Districts' submitted updated modeling results, and a follow-up filing on January 10, 2020, of the model output data that includes SFPUC water delivery amounts under each instream flow alternative. Table 3.3.8-10 in the in the final EIS is based on these modeling results. In addition, table 3.3.8-10 reflects SFPUC's recommended water demand of 238 mgd. This value includes the 8.5-year design drought built into SFPUC's drought planning model. Table 3.3.8-10 also includes all critically dry water years in the modeling record, not just the 1987–1993 and 2013–2017 periods and provides the maximum deficit for each instream flow alternative. Critically dry years are summarized between the 1971–2012 modeling period, and include 1976–1977, 1987–1992, 1994, and 2007–2008. Table 3.3.8-11 reflects the cost to replace sample water deficits in critically dry water years. This value is based on the maximum alternative cost associated with water supply replacement.

Comment SR7: BAWSCA comments that the assumption on page 3-419 of the draft EIS that SFPUC can find alternative supplies for the RWS at a cost of $3,000 per acre-foot to make up for Tuolumne River supplies lost to increased instream flows is not only unsupported by the record, but because the Commission assumes that additional water supply is available, it fails to analyze the documented steps that BAWSCA member agencies would pursue during water shortages: (1) at least nine BAWSCA member agencies would increase reliance on local groundwater, increasing the probability for groundwater basin overdraft, saltwater intrusion, and land subsidence; (2) two BAWSCA member agencies would rely on more local surface water supplies, which could be greatly depleted or completely unavailable during times of drought; (3) two BAWSCA member agencies would seek to acquire new water supplies; and (4) many BAWSCA member agencies would implement a development moratorium (e.g., no new hook ups) that would have economic impacts and impacts from displaced growth and urban sprawl subsidence.

CCSF similarly comments that the analysis of the socioeconomic impacts of water supply reductions should be conducted at the city or water district level as opposed to the regional level and the $3,000 per acre-foot estimate replacement cost lacks evidentiary support. In addition, CCSF similarly comments that the draft EIS does not consider the cost associated with the Carlsbad desalination plant, which is roughly the size assumed in the draft EIS and provides a more realistic basis for estimating replacement water costs involving desalination than the Utah example.

Response: We modified the effects analysis in the final EIS to clarify the actions water users in the SFPUC RWS region could take to develop alternative water supplies in response to a reduction of water supply. This analysis also applies to BAWSCA member agencies and other water users. For clarity, we do not include analyses for individual water users. We understand that some of the actions taken by BAWSCA member agencies in response to a reduction in water supply could differ.

In the final EIS, we revised the alternative supplies for the SFPUC RWS service area to a per acre-foot estimate consistent with the Carlsbad Desalination Plant estimates. The value presented in the final EIS, $2,500 per acre-foot, includes costs for debt service, equity returns, capital expenses incurred to upgrade existing facilities to use the water, new capital costs, and operating costs. In addition, this value includes the assumption that CCSF would be required to incorporate water from a potential desalination plant in more than just dry or critical water years. We agree with CCSF and BAWSCA that costs would be higher than the $2,500 per acre-foot estimate in a case where the desalination plant is only used intermittently.

Comment SR8: CCSF comments that the Carlsbad desalination plant opened after 12 years of planning and more than 6 years of permitting negotiations. Even if San Francisco decided to augment its water supplies with a comparable desalination plant in response to the alternative instream flow proposals, water rationing would be the only immediately available option for at least a decade based on the Carlsbad experience. The

Commission's analysis cannot assume that a large desalination plant would actually be permitted and built in the Bay Area.

Response: In the draft EIS, desalination is not considered the sole option for water replacement in the CCSF RWS service area. In addition to desalination, we list other potential new sources of replacement water that could supplement CCSF RWS service area water needs during extended drought periods. While we understand that the dollar value of the alternative cost to replace water storage in the draft EIS is based on other desalination projects, this value is presented to show a maximum socioeconomic effect on the CCSF RWS service area since desalination would most likely be the costliest option for water replacement.

Comment SR9: BAWSCA comments that Commission staff's statement that "by incurring the cost to replace the reduced water supplies from increased flows, SFPUC could avoid potential job and business losses from having to ration water supplies" is incorrect for the following reasons: (1) there are no data in the record on the Utah Reverse Osmosis Project; (2) the costs of replacing lost water would exceed $3,000 per acre-foot; (3) the quantity of water needed to replace lost water supply can be neither created nor attained from alternative sources; (4) new water supplies can take decades to develop, and there are many technical and institutional hurdles to their development; and (5) based on BAWSCA's experience, the transfer of imported water into the Bay Area is not available, especially when needed during a drought.

Response: As noted previously, we revised the final EIS to use a per-acre foot estimate consistent with the Carlsbad desalination plant, which we agree is the best available estimate of the cost of replacement water for this region. We do not have information supporting a higher cost of water. We agree that the costs associated with desalination may be difficult to predict and have qualitatively addressed some of those factors in the final EIS.

Comment SR10: BAWSCA comments that it can be reasonably assumed that some of the BAWSCA member agencies would increase levels of rationing and may ultimately need to impose moratoria on new development because of reduced Tuolumne River flows to the RWS, which reduces normal and drought year supply available to agencies beyond their ability to manage or mitigate impacts. Commission staff should consider BAWSCA member agencies' required water rationing in response to reduced Tuolumne River flows. In addition, BAWSCA comments that Commission staff should consider BAWSCA member agencies' existing water conservation programs and the effect of demand hardening in the final EIS.

Response: We agree that some of the BAWSCA member agencies would potentially increase levels of rationing in dry water years and may ultimately need to impose moratoria on new development because of reduced water availability during extended drought periods. While the effects analysis presented in the draft EIS and the final EIS does not outline the water supply effects on individual BAWSCA member agencies, it does define the effects of drought on the SFPUC RWS service area, which includes

BAWSCA member agencies and CCSF retail customers. In addition, the effects analysis presented in the draft EIS and the final EIS incorporates aspects of water conservation and demand hardening from the collection of water users in the SFPUC RWS service area.

Comment SR11: The Districts take exception to the statement on page 3-426 of the draft EIS that reliable surface water supplies are "likely" to have a positive influence on land values, and reference a comparison of the value of agricultural land in the Districts' service area to other areas, both irrigated and non-irrigated, throughout the region that is provided on pages 5-27 through 5-30 of the Socioeconomics Updated Study Report, W&AR-15.

Response: The statement in the draft EIS agrees with the Districts' statement that the availability and reliability of affordable water and electricity from the Don Pedro Project affects land values, particularly agricultural land values. Particularly, we note in the final EIS that flow regimes that cause large reductions in water supply are likely to have a substantial adverse effect on land values. However, we do not analyze other factors not attributable to water supply that drive land values (i.e., the factors relative to supply and demand as outlined in the Socioeconomics Updated Study Report, W&AR-15).

Comment SR12: The Districts comment that the suggestion that "farmers may choose to switch to less water intensive crops" is erroneous. The Districts state that less than 10 percent of total irrigated acres are planted in annual crops, and the remaining 90 percent of land is either planted in perennials (trees and vines) or planted in animal feed crops. The costs and impacts of such major transformations in a service area dominated by tree crops is not estimated. This statement should be qualified or eliminated.

Response: In the final EIS, we have modified our discussion to acknowledge that crop-shifting is not easily accomplished in areas that are dominated by tree and vine crops.

Comment SR13: The Districts comment that the almond growers in the region have invested heavily in efficient irrigation delivery systems, primarily drip irrigation, and request a source for the assertion that further improvements in irrigation technology could be made.

Response: We understand that irrigators have made substantial investments in efficient systems. However, a desktop review (i.e., Google Earth) of the area reveals the presence of many gravity irrigated operations. In addition, the ongoing popularity of grant programs (California Department of Food and Agriculture, 2018) that improve irrigation in the Merced region suggests investment in efficient systems is not yet widespread. Local planning documents (including the *Modesto Irrigation District Agricultural Water Management Plan* and the *Merced Integrated Regional Water Management Plan*) indicate that while efforts are currently underway to improve the efficiency of irrigation technology, many farms continue to use methods (i.e., gravity) that have been found to be less efficient than other systems (Merced Irrigation District, 2016).

Comment SR14: The Conservation Groups comment that the draft EIS fails to analyze potential measures to offset water shortages through water use efficiency and alternative supplies. The draft EIS assumes that any water no longer available to the Districts would translate into lost revenue, but this analysis is one-sided. The draft EIS accepts the premise that water left in the river mean revenue lost to the agricultural economy. In the final EIS, Commission staff should consider and analyze feasible alternatives to achieve existing levels of agricultural production with less water. Similarly, John Buckley commented during the public meeting on the draft EIS that the draft EIS does not adequately address the ability for water users to use new technologies and new practices. He states that it seems that the Commission staff are assuming that these economic factors are going to be irreconcilable and irreversible, despite the fact that people can adapt and reduce water use in many ways by using available technologies.

Response: Analysis presented in the final EIS shows that all the proposed and recommended flow regimes reduce the amount of water available for irrigation, ranging from 8 percent to more than 30 percent for certain water years. We note in the final EIS that individual farmers may adapt over time to water shortages in a number of ways that may temper some of the socioeconomic impacts of the proposed and recommended flow regimes. This includes switching to less water intensive crops or installing more efficient irrigation systems. However, shifting to less water-intensive crops could still reduce economic output, since some of the highest-value crops (such as almonds) are also water-intensive.

Comment SR15: CCSF comments that the draft EIS does not indicate which entity or entities are expected to experience reduced adverse socioeconomic impacts from the Commission staff-recommended drought management plan.

Response: We revised the text in the final EIS to indicate that the staff-recommended drought management plan is designed to reduce adverse effects on water users in the SFPUC RWS service area when extreme drought conditions occur.

Comment SR16: CCSF comments that SFPUC's water supply modeling that Commission staff used in its analysis on pages 3-417 through 3-418 (draft EIS section 3.3.8.2, *Socioeconomics, Environmental Effects, CCSF Study*) is not an accurate analysis for the Commission staff alternative because the SFPUC modeling is based on the Districts' flow schedule proposed in its amended final license application for the Don Pedro Project.

Response: We have modified the staff alternative in the final EIS to include the change in flow regime that would occur after the infiltration galleries are operational under the draft Voluntary Agreement. However, the socioeconomic effects analysis in both the draft EIS and final EIS is not based on a specific flow alternative, nor does it specify a recommended flow regime. Instead, in the draft EIS, we present a comparison (tables 3.3.8-10 and 3.3.8-11) of RWS water supply impacts under each proposed instream alternative at a base-year water demand of 220 mgd and 265 mgd. This analysis is provided in response to SFPUC's water supply modeling not including the likely amount

and cost of water supply that SFPUC would need to replace. As discussed previously, we modified the base-year water demand value of 220 mgd to 238 mgd in the final EIS, the revised analysis is presented in table 3.3.8-10 of the final EIS. As such, the use of SFPUC's analysis is appropriate in the final EIS because the staff analysis now reflects the base-year water demand values used by both the SFPUC and Districts' water supply models.

Comment SR17: The Districts comment that the source of the data for table 3.3.8-13 (appendix K of the amended final license application for the Don Pedro Project) reports the data in 2012 dollars, and the economic loss reported in the draft EIS are consistently 6.8% higher than those reported in appendix K. The Districts request that the final EIS state the index that was used to convert the estimated costs for 2012 to 2017.

Response: We revised the final EIS to note we use the Consumer Price Index to adjust the values in this table from 2012 dollars to 2018 dollars.

Comment SR18: The Districts comment that the draft EIS is silent on the frequency with which the various water year types occur and states that appendix K of their amended final license application for the Don Pedro Project reports that critical water year types occur in 25 percent of the modeled years. The frequency of these losses is a vital component in understanding the total effect of the various flow regimes on the regional economy.

Response: We revised table 3.3.2-20 in section 3.3.2.2, *Aquatic Resources, Environmental Effects, Streamflows and Reservoir Levels*, to include the frequency with which the various water year types occur. While the socioeconomic water supply effects analysis presented in the draft EIS describes the general effect each flow regime would have on the regional economy in the SFPUC RWS service area, we added additional discussion about the importance of water year type frequency on the local agricultural economy.

Comment SR19: The Districts comment that the statement on page 5-26 of the draft EIS that "Our analysis of the Districts' modeling results…indicates that under the base case (existing conditions), full irrigation demand would be met under all water year types, except in critical years, when only 92 percent of irrigation demands would be met." should be amended. The draft EIS notes in several sections that the purpose of the Don Pedro Reservoir is to provide reliable water availability during extended droughts, especially sequences of dry and critical water years. The analysis of effects of alternative flow regimes should avoid using averages in assessing and reporting water supply impacts. Averaging the water supplies provided by the project to the Districts' customers in critical water years over the 1971–2012 period is not meaningful from a reliability perspective. The occurrence of a single critical water year following a wet or even above normal water year is likely to have a full, or close to full, water supply (e.g., 1976 and 1987). The crucial role of the Don Pedro Reservoir is maintaining sufficient storage in sequences of dry and critical water years. It is sequences like 1987–1992 and 2012–2015 that should be evaluated for water supply impacts. This is especially true for the

Districts' service area where the primary agricultural crop are nut trees and orchards. Under the Districts' flow proposal, during the 1987–1992 hydrology, the Districts' water shortages range from 13 percent to 27 percent and CCSF's Bay Area shortages are consistently 15 percent to 20 percent. Under the Water Board's flow proposal, the Districts' water shortages are more than 50 percent, and the Bay Area water shortages exceed 60 percent during the 1987–1992 drought. The final EIS should report potential water supply impacts using critical drought sequences to describe the impacts of the various flow proposals submitted to the Commission.

Response: We modified table 3.3.8-12 to include a note stating that Don Pedro Reservoir maintains sufficient storage to meet 100 percent of demand or close to full demand in single critical water year types following a wet or above normal water year. We also highlight that the values are based on average percentage of demand met over a period of years, and that it takes some time for reservoir levels to be affected during periods of reduced water availability.

Comment SR20: BAWSCA comments that the draft EIS incorrectly states that "BAWSCA is a special district that represents the interests of the CCSF." Rather, BAWSCA is a special district that represents the interests of 24 cities and water districts and 2 private utilities that receive two-thirds of San Francisco's RWS supplies.

Response: Thank you for the correction. We removed this statement from the final EIS.

Comment SR21: BAWSCA notes that the draft EIS states that 13 of the BAWSCA "wholesale customers rely on SFPUC for 95 percent or more of their total water supply, and 8 wholesale customers rely on SFPUC for 100 percent of their total water supply." Based on a recent annual survey, this information has changed. Now, 16 of BAWSCA's member agencies rely solely on the RWS to address all their potable water supply needs. Of the remaining 10 BAWSCA member agencies, 8 rely on the RWS to meet 50 percent or more of their potable water supply needs.

Response: We revised section 3.3.8.1, *Socioeconomics*, *Affected Environment*, *Municipal and Industrial Use*, in the final EIS to indicate that 16 of BAWSCA's member agencies solely rely on the RWS to address all their potable water supply needs, and 8 rely on the RWS to meet 50 percent or more of their potable water supply needs.

Comment SR22: The California Sportfishing Protection Alliance, Tuolumne River Trust and Golden West Women Flyfishers, (collectively CSPA et al.) submitted comments in response to modeling results filed by the Districts on January 24, 2020. In their comments CSPA indicates the "Demand Summary" spreadsheet filed by the Districts, which presents the effects on water supply for the Districts and for the San Francisco Public Utilities Commission (SFPUC), reports data for water deliveries to San Francisco and percent of demand met over disparate times of year. CSPA notes that in the demand summary table presented by the Districts, "Percent of Total Demand" is summarized by demand year (July 1 through June 30), and the "San Joaquin Pipeline Deliveries to Bay Area" is summarized by water year (October 1 through September 30).

CSPA notes that this side-by-side comparison is confusing and misleading because each row on each tables that presents output for San Joaquin Pipeline deliveries shows data in different columns for two different time periods and thus there is a nine-month time lag between the data reported for the amount of water delivered (in acre-feet) in a given year and the percent of demand delivered in any given year. In other words, the reported amount of water delivered in acre-feet does not represent the stated percent of demand delivered in the same 365-day period of time.

Response: During the relicensing period, City and County of San Francisco (CCSF) prepared numerous water supply analyses simulating the water supply rationing that would occur over multiple water years under the proposed streamflow requirements. These simulations were performed at the two levels of SFPUC systemwide demand, 238 million gallons per day (mgd) and 265 mgd, which are the same levels of demand presented throughout the socioeconomic analysis presented in the final EIS. CCSF notes that in their analysis the San Joaquin Index (SJI) water year types are shown lagged in time so that they are paired with the SFPUC operational year that is most influenced by the hydrology indicated by the year type. As such, we compared the Districts' and CCSF's datasets for the number of years requiring rationing. For the majority of the flow proposals (i.e., base case, DPP-1r, draft Voluntary Agreement with infiltration galleries, NMFS REA, FWS REA, DFW REA, and SWB REA) there was a difference of 2 years or less in the total amount of years requiring rationing. The ECHO REA and TBI REA flow proposals did have larger differences between the number of years requiring rationing. However, the Districts provided updated modeling data for these proposals while CCSF has not, so a correlation between the two cannot be established without additional modeling. Overall, we determined that while minor differences do exist, they are not significant enough to require additional modeling from the Districts.

K. DEVELOPMENTAL RESOURCES

Comment DR1: The Conservation Groups comment that the developmental analysis in the draft EIS states an average annual cost of alternative power of $74.85 per megawatt-hour (MWh). Additionally, Commission staff defines its basis for valuing power as follows: "The Districts provided an on-peak energy rate of $67/MWh (60 percent of annual generation) and an off-peak energy rate of $55/MWh (40 percent), which results in a composite energy rate of $62.20/MWh." Throughout the draft EIS, Commission staff uses the composite value of $62.20/MWh to determine the cost of measures that would affect generation; however, both the on-peak and off-peak values from the Districts, on which Commission staff base its composite value, are substantially above current average wholesale market rates for power. The Conservation Groups' analysis of historical day-ahead locational marginal price data (shown in table 1 of their comment letter) for every hour of 2018 from the California Independent System Operator shows a market value for energy of $36.48/MWh. The Conservation Groups recommend that in the final EIS, Commission staff should: (1) recalculate power values throughout the "Comparison of Alternatives" in the developmental analysis using a more accurate value

of power based on real market conditions; (2) consider current market conditions and clarify the relative frequency of project on-peak and off-peak generation (including the Districts' ability to move project generation within any given day consistent with their water supply operations); (3) consider the movement of generation from month to month for various flow alternatives and calculate the cost differentials for these alternatives; (4) evaluate the Districts' economic vulnerability (if any) to surplus power on the grid, considering the Districts' ability to bypass powerhouses during conditions when excess power is available to the Districts; and (5) evaluate how alternatives would or would not change the capacity of the project.

Response: This comment cites some incorrect information. The $74.85 per MWh value cited for the La Grange Project from the draft EIS is a composite power value that includes energy value in $/MWh and a capacity value based on dependable capacity times $/kW-year converted to $/MWh. In this response, we refer only to energy rate/value in $/MWh to provide the basis for a more accurate comparison.

We acknowledge that we simplified the composite energy rate for the La Grange Project by using the composite energy rate for the Don Pedro Project, a value that was based on a ratio of 60 percent on-peak to 40 percent off-peak. The Conservation Groups are correct that the licensee estimated that for the La Grange Project, 48 percent is an on-peak rate and 52 percent is an off-peak rate. The resulting composite energy rate for the La Grange Project is $60.76/MWh, compared to the Don Pedro Project value of $62.20/MWh, only a 2.3 percent difference in rates. Because the difference is minor and for the sake of simplicity, we applied the Don Pedro value of $62.20/MWh to both projects.

The Conservation Groups cite locational marginal price data from the CAISO node closest the Don Pedro Project, which is the mathematical mean for all hours and does not differentiate between on-peak and off-peak mean values. Consequently, the $36.48/MWh cannot be compared directly and cannot be substituted for the values we used in our analysis. Although the computed mean composite energy rate for 2018 (based on on-peak and off-peak hourly rates) is likely lower than the $62.20/MWh rate that we used, that value is based on only one year (2018) of data. The value of $62.20/MWh that we used is based on multiple years of data, and therefore, provides a more accurate estimate of the actual power value for the project. For these reasons, we make no changes to our estimated power value of $62.20/MWh for both projects.

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APPENDIX B

License Conditions Recommended by Staff for the Don Pedro Project

I. MANDATORY CONDITIONS

On January 29, 2018, the California State Water Resources Control Board filed 11 preliminary conditions under section 401 of the Clean Water Act (appendix E). These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the environmental impact statement (EIS). We consider preliminary condition 11 to be administrative. We anticipate that all valid section 401 conditions would be included in any new license issued for the project.

On August 23, 2018, the U.S. Department of Interior, Bureau of Land Management (BLM) filed 44 revised 4(e) conditions (appendix C). These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the EIS. We consider revised conditions 1, 5, 10, 19 through 31, 33, 34, 36 through 42, and 44 to be administrative or legal in nature and not specific environmental measures. Of the 17 conditions we consider to be environmental measures applicable to the Don Pedro Project, we include in the staff alternative 9 conditions as specified by the agency, modify 3 conditions to adjust the scope of the measure, and do not recommend 5 conditions. We recognize, however, that the Commission is required to include valid 4(e) conditions in any license issued for the project. As such, the BLM conditions that we do not recommend or that we recommend modifying in the manner noted above, would be included in a new license as specified by the agency and to the extent allowed by applicable law.

II. ADDITIONAL LICENSE ARTICLES RECOMMENDED BY COMMISSION STAFF

We recommend including the following license articles in any license issued for the project in addition to the preliminary mandatory conditions.

Article 401. *Commission Approval, Reporting, and Filing of Amendments.*

(a) Requirement to File Plans for Commission Approval

Various conditions found in the California State Water Resources Control Board (Water Board's) preliminary section 401 water quality certification (certification) require the licensees to prepare plans in consultation with other entities for approval by the Water Board for submittal to the Commission and to implement specific measures without prior Commission approval. Each such plan must also be submitted to the Commission for approval. These plans are listed below.

Certification Condition No.	Plan Name	Due Date
4	Large Woody Material Management Plan	Within one year of license issuance
5	Sediment Management Plan	Within one year of license issuance
6	Water Quality Monitoring Plan	Within one year of license issuance
7	Water Temperature Monitoring Plan	Within one year of license issuance
8	Aquatic Invasive Species Management Plan	Within one year of license issuance
9	Erosion and Sediment Control Plan	Within one year of license issuance
10	Hazardous Material Plan	Within one year of license issuance

The licensees must include with each plan filed with the Commission documentation that the licensees developed the plan in consultation with, and received approval from, the Water Board. The Commission reserves the right to make changes to any plan filed. Upon Commission approval, the plan becomes a requirement of the license, and the licensees must implement the plan or changes in project operations or facilities, including any changes required by the Commission. Any further changes in the Commission-approved schedules or plans require approval by the Commission before implementing the proposed change.

(b) Requirement to File Reports

Certain conditions of the Water Board's 401 certification require the licensees to file reports with other entities. Because these reports relate to compliance with the requirements of this license, each such report must also be submitted to the Commission. These reports are listed in the following table:

Certification Condition No.	Description	Due Date
4	Reports that document the implementation and effectiveness of large woody material management in the Tuolumne River downstream of La Grange Diversion Dam.	One year after completion of each large woody material monitoring period.
5	Reports that document the implementation and effectiveness of the coarse and fine sediment transport past La Grange Dam in the Tuolumne River.	One year after completion of each sediment monitoring period.

The licensees must submit to the Commission documentation of any consultation, and copies of any comments and recommendations made by any consulted entity in connection with each report. The Commission reserves the right to require changes to project operations or facilities based on the information contained in the report and any other available information.

Article 402. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensees to construct and maintain, or to provide for the construction, operation, and maintenance of, such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, pursuant to section 18 of the Federal Power Act.

Article 403. *Minimum Pool at Don Pedro Reservoir*. The licensees must maintain a minimum pool elevation in Don Pedro Reservoir of not less than 550 feet National Geodetic Vertical Datum of 1929, except for drawdowns necessary to maintain minimum streamflows specified in article 409. The licensees must notify the Commission, the U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife when the pool elevation in Don Pedro Reservoir is expected to drop below 600 feet National Geodetic Vertical Datum of 1929.

Article 404. *Erosion and Sediment Control Plan.* Before the commencement of any ground-disturbing activity within the project boundary, the licensees must file, for Commission approval, a soil erosion and sediment control plan. The plan must include, at a minimum, the following:

(1) a description of the best management practices for erosion control that will be applied in specific circumstances;

(2) provisions for inspecting erosion control measures while they are in place;

(3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event);

(4) techniques that will be used to stabilize sites once construction is completed; and

(5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

The soil erosion and sediment control plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife, and be filed with the Commission for approval at least 90 days in advance of initiating construction of recreation or other project facilities that require ground-disturbing activities. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Ground-disturbing activities must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 405. *Spill Prevention Control and Countermeasure Management Plan.* Within six months of license issuance, the licensees must file, for Commission approval, a revised Spill Prevention Control and Countermeasure Management Plan.

The licensees must revise the Spill Prevention Control and Countermeasure Management Plan, filed October 11, 2017 as appendix E3 of the amended final license application, to include the following additional measures:

(1) a description of how hazardous substances would be transported, stored, handled, and disposed;

(2) a description of equipment and procedures to be used to address hazardous substance spills;

(3) a provision to notify the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), California State Water Resources Control Board (Water Board), and California Department of Fish and Wildlife (California DFW) within 24 hours of discovering a hazardous substances spill; and

(4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean

up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.

The revised Spill Prevention Control and Countermeasure Management Plan must be developed after consultation with BLM, FWS, NMFS, the Water Board, and California DFW. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 406. *Drought Management Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a drought management plan. The plan must include, at a minimum, the following:

(1) a definition of drought conditions that would trigger implementation of the plan, and such conditions must be based on available data specific to the project (e.g., current and projected storage in Don Pedro Reservoir, watershed snowpack and precipitation conditions, current and projected operating requirements for instream flows and water supply deliveries, weather forecasts, and other project operation limitations);

(2) which license requirements would be temporarily modified during drought conditions;

(3) how available cool-water storage and instream temperatures would be incorporated into selecting preferred operations; and

(4) how the project would be operated when drought conditions occur (e.g., reduction in minimum flows).

The licensees must develop the drought management plan after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, California Department of Fish and Wildlife, and the City and County of San Francisco. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before

filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 407. *Water Temperature Monitoring Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a water temperature monitoring plan. The plan must include, at a minimum, the following:

(1) a provision to for real-time monitoring at the U.S. Department of the Interior, Geological Survey, gage No. 11289650 below La Grange and at the temporary fish counting weir at river mile 24.5;

(2) a provision for periodic monitoring in Don Pedro Reservoir near the dam whenever the reservoir elevation is lower than 700 feet National Geodetic Vertical Datum of 1929;

(3) a provision to make water temperature data from below the La Grange gage and temporary fish counting weir available in real time and Don Pedro Reservoir temperature available within three days of downloading according to the schedule defined in the plan;

(4) a provision to file annual summary reports for all temperature monitoring conducted in each year; and

(5) a provision to file a summary report after five years that includes any recommendations for adjusting future monitoring and any measures recommended to enhance water temperature conditions to benefit Chinook salmon and *O. mykiss* in the lower Tuolumne River.

The licensees must develop the water temperature monitoring plan after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan

is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 408. *Operation Compliance Monitoring Plan*. Within six months of license issuance, the licensees must file, for Commission approval, an operation compliance monitoring plan to document compliance with the streamflow and reservoir level requirements specified in articles 403, 409, 410, 411, and 413.

The plan must describe, at a minimum, the following:

(1) identification of the existing U.S. Department of the Interior, Geological Survey (USGS), gage located on the Tuolumne River downstream of La Grange (gage no. 11289650) as the primary flow compliance point at RM 51.7,[12] and identification of the existing gage in Don Pedro Reservoir to monitor compliance with reservoir level requirements;

(2) equipment that would be used by the licensees to monitor streamflow and reservoir levels;

(3) how the equipment would be deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained;

(4) how data would be retrieved from the equipment, including frequency of data downloads, quality assurance/quality control procedures, and data storage;

(5) how the licensees would make streamflow and reservoir level data available to the Commission, U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and California Department of Fish and Wildlife (California DFW), upon request for the data; and

(6) how the licensees would update the proposed plan as needed in the future, including compliance monitoring and procedures for monitoring downstream of the infiltration galleries once they are operational.

The licensees must develop the operation compliance monitoring plan after consultation with the Bureau of Land Management, FWS, NMFS, California State Water Resources Control Board, California DFW, and USGS. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to

[12] If the Commission determines that the infiltration galleries are project facilities and after they become operational, flow compliance at RM 25.5 will be measured as proposed by the Districts, with flows calculated by subtracting flow diverted via the infiltration galleries from the flow measured at the La Grange Gage. If the Commission determines that the infiltration galleries are not project facilities, flow compliance will be determined via an instream gage to be constructed at RM 25.5 by the Districts as a condition of the Don Pedro license.

the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 409. *Minimum Flows below La Grange Diversion Dam.* To support aquatic resources and water-based recreation opportunities, the licensees must maintain the minimum flows shown in table 1, below, according to the most recent preliminary/final water year classification as determined by the California Department of Water Resources using the 60-20-20 San Joaquin River Index.[13] Preliminary water year determinations must be made by the Districts on February 1, March 1, and April 1 of each year using a 90 percent probability of exceedance of the 60-20-20 San Joaquin River Index, to govern project operations from February 1 through May 15. The Districts must make a final water year determination by May 7, based on the 60-20-20 San Joaquin River Index determined by California Department of Water Resources on or about May 1 of each year using a 75 percent probability of exceedance, to govern project operations from May 16 through the remainder of the year.

[13] This index uses the San Joaquin River unimpaired runoff, which is the sum of Stanislaus River inflow to New Melones Lake, Tuolumne River inflow to New Don Pedro Reservoir, Merced River inflow to Lake McClure, and San Joaquin River inflow to Millerton Lake. Specifically, the 60-20-20 Index consists of the addition of 60 percent of the April through July forecasted unimpaired runoff, 20 percent of the October through March forecasted unimpaired runoff, and 20 percent of the previous year's index with a cap to account for required flood control releases in wet years.

Table 1. Required minimum flows in cubic feet per second by water year type, as determined in accordance with the 60-20-20 San Joaquin River Index.

	Minimum Flows with Infiltration Galleries (cfs)		Interim Minimum Flows [to be provided until both infiltration galleries are operational] (cfs)
Water Year/Period	**RM 51.7 (La Grange Gage)[a]**	**RM 25.5[b]**	**RM 51.7 (La Grange Gage)[a]**
Wet, Above Normal, Below Normal Water Years			
June 1 through June 30	200	100[c]	150
July 1 through October 15	300	150[d]	225
October 16 through December 31	275	275	275
January 1 through February 28/29	225	225	225
March 1 through April 15	250	250	250
April 16 through May 15	275	275	275
May 16 through May 31	300	300	300
Dry Water Year			
June 1 through June 30	200	125	125
July 1 through October 15	300	125[d]	175
October 16 through December 31	225	225	225
January 1 through February 28/29	200	200	200
March 1 through April 15	225	225	225
April 16 through May 15	250	250	250
May 16 through May 31	275	275	275
Critical Water Years			
June 1 through June 30	200	125	125
July 1 through October 15	300	125	150
October 16 through December 31	200	200	200
January 1 through February 28/29	175	175	175
March 1 through April 15	200	200	200
April 16 through May 15	200	200	200
May 16 through May 31	225	225	225

[a] U.S. Department of the Interior, Geological Survey, gage no. 11289650, Tuolumne River below La Grange Diversion Dam near La Grange, California.

[b] See footnote to article 408 for how compliance will be monitored at RM 25.5.

[c] Cease irrigation gallery withdrawals for one pre-scheduled weekend to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries.

[d] Release 200 cfs for three-day July 4 holiday, for three-day Labor Day holiday, and for two pre-scheduled additional weekends in either June, July or August to provide boating opportunities in the Tuolumne River downstream of the irrigation galleries. If July 4 falls on a Wednesday, the Districts will provide this 3-day boating flow either the weekend before or the weekend after the holiday.

The interim flows specified in the fourth column of table 1 will be required until the proposed infiltration galleries are operational. After the infiltration galleries are operational, the flows specified in the second column (river mile [RM] 51.7) and third column (RM 25.5) of table 1 will be required.

Minimum flows must be maintained to meet the following requirements: (1) instantaneous flows must be no more than 10 percent below the specified minimum flow for more than 60 minutes; (2) flows must be no more than 20 percent below the specified minimum flows for any duration; and (3) average monthly flows must equal or exceed the specified minimum flow. If there are any deviations with the operational requirements of the license, the licensee must notify the Commission as soon as possible, but no later than 10 days, after each such incident.

The flow release requirement may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensees, California Department of Fish and Wildlife, U.S. Fish and Wildlife Service, and National Marine Fisheries Service. If the flow is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 410. *Spring Pulse Flow Release Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a spring pulse flow release plan designed to increase floodplain rearing habitat and increase the survival of salmonid smolts during outmigration. The plan must include, but not necessarily be limited to, the following:

(1) a provision to provide an outmigration pulse flow release during the juvenile fall Chinook salmon outmigration season (approximately late April through mid- to late May), with a total volume of 150,000 acre-feet in wet and above normal water years; 100,000 acre-feet in below normal water years; 75,000 acre-feet in dry water years; 45,000 acre-feet in dry water years immediately following a dry or critical water year; 35,000 acre-feet in the first critical water year; and 11,000 acre-feet in critical water years immediately following a dry or critical water year, as determined in accordance with the 60-20-20 San Joaquin River Index (with the total volume of the pulse release that passes the compliance points specified in article 409 being in addition to the minimum flows required by article 409); and

(2) a provision to implement the floodplain pulse flows as described in the March 1, 2019, draft Voluntary Agreement. These floodplain pulse flow releases

vary by water year as determined in accordance with the 60-20-20 San Joaquin River Index, include a dry-year relief for successive occurrences of below normal, dry and critical water years, and include a 300-cfs/hour up-ramping rate and a 200-cfs/hour down-ramping rate that is included in the pulse flow requirements. Except in successive below normal, dry and critical water years, these pulses increase the minimum flows from those specified in article 409 to:

(a) 2,750 cfs for 20 days in wet and above normal water years,

(b) 2,750 cfs for 18 days in below normal water years,

(c) 2,750 cfs for 14 days in dry water years, and

(d) 2,750 cfs for 9 days in critical water years.

In the first successive below normal water year that immediately follows a dry or critical water year, the floodplain pulse flow must be 2,750 cfs for 14 days. In a third successive below normal water year, the Districts must meet with CCSF and California DFW to determine if water is available for a floodplain pulse.

In any dry or critical water year immediately following a below normal, dry, or critical water year, the floodplain pulse flow is zero, and continues at zero in any following, successive dry or critical water years.

(3) The timing of spring pulse flows and floodplain pulse flows must be adaptively managed following the methods provided in appendix E-1, attachment F, of the licensee's amended final license application for the Don Pedro Project, filed on October 11, 2017.

The licensees must develop the spring pulse flow release plan after consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission. No changes to pulse flow volumes contained in this article shall occur without approval by the Commission.

Article 411. *Fall Pulse Flow Release Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a fall pulse flow release plan to promote the upstream migration of Chinook salmon.

The plan must include, but not necessarily be limited to, the following:

(1) a provision for the annual release of 5,950 acre-feet of water downstream of La Grange Diversion Dam to promote the upstream migration of Chinook salmon during favorable instream thermal conditions, with the total volume of the pulse release that passes the compliance points specified in article 409 being in addition to the minimum flows required by article 409;

(2) a provision for annual consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Wildlife, and California State Water Resources Control Board to determine the timing and magnitude of flow releases;

(3) a provision for annual weir monitoring to determine timing/effectiveness for promoting upstream migration;

(4) a provision for annual reporting of water temperatures and river flows at the La Grange Gage, and downstream of the irrigation galleries after they are operational, and weir counts of adult fall Chinook salmon during the upstream migration season; and

(5) a provision to file a report with the Commission that assesses the results of the pulse flow implementation and monitoring after a period of 10 years, including any recommended changes to the fall pulse flow release plan, to determine if any adjustments in pulse flow triggers and duration are needed, as well as whether other pulse flow management options should be considered or additional monitoring conducted.

The licensees must develop the fall pulse flow release plan after consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission. No changes to pulse flow volumes contained in this article shall occur without approval by the Commission.

Article 412. *Gravel Mobilization Flows.* In years when the March through June spill is projected to exceed 100,000 acre-feet at the U.S. Department of the Interior, Geological Survey, gage no. 11289650 below La Grange Diversion Dam (La Grange gage), the licensees must provide a flow of 6,500 cubic feet per second (cfs), as measured at the La Grange gage, for at least two days within the March through June spill period, with downramping not to exceed 400 cfs/hour until a flow of 3,000 cfs is reached, and then 300 cfs/hour at flows less than 3,000 cfs.

To evaluate whether corresponding changes occur in channel morphology or improvements to the quality of spawning gravel via a reduction in interstitial fines, the licensees shall conduct substrate surveys at designated sites located upstream of river mile 43 prior to, and following, each gravel mobilization flow provided under this article for the first 10 years of the new license, and file an annual report summarizing the results of the surveys by August 31 of each year in which the flow was provided. The licensees must also file a summary report with the Commission that assesses the results of the gravel mobilization flow implementation and monitoring after a period of 10 years, including any recommended changes to the gravel mobilization flows or additional monitoring that is needed.

The licensees must provide a draft of the summary report to U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Wildlife, and allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the report with the Commission. The final summary report must include documentation of consultation, copies of comments and recommendations on the draft report, and specific descriptions of how the agencies' comments are accommodated in the report. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

Article 413. *Spill Management Plan.* Within one year of license issuance, the licensees must file, for Commission approval, a spill management plan. The plan must provide guidance to the licensees on how to use water that is in excess of the amount needed to meet flows required by other articles in this license and to provide for consumptive use. The plan must describe criteria for determining the preferred magnitude, duration, and timing of releases to make the best use of excess water to enhance fall-run Chinook salmon floodplain rearing, juvenile outmigration or adult upstream migration, in-channel rearing, riparian recruitment and/or temperature management; subject to the constraints of flood control, project safety, and water supply demands.

The plan must include a provision for annual consultation with the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), California State Water Resources Control Board (Water Board), California Department of Fish and Wildlife (California DFW), and the City and County of San Francisco (CCSF) to determine the preferred timing of releases, minimum duration, preferred flow rates, and

specific criteria for evaluating whether project operations during the descending limb of the spring snowmelt runoff period reasonably mimic the natural hydrograph. Following such consultation, the annual plan for spill releases must be filed with the Commission for approval.

The spill management plan must be developed after consultation with FWS, NMFS, the Water Board, California DFW, and CCSF. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 414. *Lower Tuolumne River Habitat Improvement Program.* Within one year of license issuance, the licensees must file, for Commission approval, a revised Lower Tuolumne River Habitat Improvement Program (LTRHIP) to guide the implementation of habitat and floodplain restoration projects. The revised LTRHIP must include, but not necessarily be limited to, the following:

(1) an implementation plan for the initial group of four habitat enhancement projects to be conducted during the first 5 years of the license, as described in the licensees' August 15, 2019, filing, to include a cost estimate and implementation schedule;

(2) a provision to incorporate a minimum of 6,535 cubic feet of large woody material into the design of the first group of habitat enhancement projects, anchored in a manner designed to provide the maximum sustained habitat benefit, potentially using engineered log jams or similar approaches;

(3) a provision for monitoring each enhancement site to determine if the project was satisfactorily implemented as designed, which project goals were met, and how project features persist and function through time and over a variety of flow conditions; and

(4) a provision to file, for Commission approval, an implementation plan in year 6 that describes the next set of three to five enhancement projects to be implemented under the LTRHIP.

The revised LTRHIP must be developed after consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, California State Water Resources Control Board, California Department of Fish and Wildlife, and the City and

County of San Francisco. The licensees must include with the revised LTRHIP documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 415. *Coarse Sediment Management Plan.* Within one year of license issuance, the licensees must file, for Commission approval, a coarse sediment management plan to enhance spawning habitat for Chinook salmon and *O. mykiss* by placing 75,000 tons of gravel at sites between RM 52 and RM 39 and 25,000 tons of gravel at sites between RM 39 and RM 24.5, for a total not to exceed 100,000 tons for the duration of the license. The plan must include, but not necessarily be limited to, the following provisions:

(1) filing of an implementation plan to place at least 75,000 tons of gravel at the first group of gravel augmentation sites within one year, after review and input from the California Department of Fish and Wildlife (California DFW), National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (FWS);

(2) annual surveys of fall-run Chinook and *O. mykiss* spawning use of new gravel patches for five years following completion of gravel augmentation;

(3) filing of a summary report with the Commission in year 12 after license issuance presenting monitoring, mapping, and evaluation of projects conducted in the first 10 years, and an evaluation of the need for additional gravel augmentation at the initial sites or new augmentation sites; and

(4) filing of a second implementation plan for any new gravel augmentation sites identified in the 12-year report.

The licensees must prepare the plan and the 12-year summary report after consultation with NMFS, FWS, California State Water Resources Control Board, and California DFW. The licensees must include with the plan and the report documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan and report. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan or report with the Commission. If the

licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 416. *Gravel Cleaning Plan.* Within one year of license issuance, the licensees must file, for Commission approval, a gravel cleaning plan. The gravel cleaning plan must include, but not necessarily be limited to, the following provisions:

(1) annual cleaning of selected gravel patches for the first five years after plan approval, in the lower Tuolumne River at or below the confluence of intermittent streams downstream from La Grange Diversion Dam, including Gasburg Creek (river mile [RM] 50.3) and Peaslee Creek (RM 45.5), for two to three weeks each year using a gravel ripper and pressure washer operated from a backhoe, or equivalent methodology;

(2) conducting *O. mykiss* spawning and redd surveys in areas planned for gravel cleaning, prior to commencing any gravel cleaning, to help avoid conducting gravel cleaning where and when it would disturb spawning fish or eggs incubating in the gravel;

(3) consulting with the California Department of Fish and Wildlife (California DFW), National Marine Fisheries Service (NMFS), and U.S. Fish and Wildlife Service (FWS), to determine the timing for conducting gravel cleaning each year, to include avoidance of areas where redds were found during redd surveys, and consideration of timing gravel cleaning to coincide with spring pulse flows to benefit Chinook smolt outmigration by providing increased turbidity to reduce predator sight feeding effectiveness;

(4) performing substrate monitoring of interstitial fines at designated sites before and after cleaning events; and

(5) filing a summary report with the Commission following the fifth year of gravel cleaning that documents the results of the program and recommendations on whether to continue or modify the program.

The licensees must prepare the plan and the summary report after consultation with NMFS, FWS, the California State Water Resources Control Board, and California DFW. The licensees must include with the plan and report documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the consulted parties, and specific descriptions of how stakeholders and agencies' comments are accommodated by the plan or report. The licensees must allow a minimum of 30 days for the consulted parties to comment and to make recommendations before filing the plan or report with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 417. *Aquatic Invasive Species Management Plan*. Within one year of license issuance, file a revised Aquatic Invasive Species Management Plan to control the spread of aquatic invasive species in the project area. The licensees must revise the Aquatic Invasive Species Management Plan, filed October 11, 2017, as appendix E4 of the amended final license application, to include the following:

(1) recording and communicating incidental observations of aquatic invasive species to the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), the California State Water Resources Control Board (Water Board), and California Department of Fish and Wildlife (California DFW) within 24 hours, and to the Commission within 10 days after observation; and

(2) reassessing the vulnerability of Don Pedro Reservoir for the introduction of non-native dressenid mussel species if dressenid mussel species are identified in the Tuolumne River or if the Districts become aware that calcium concentrations of 12 milligrams per liter or higher are documented in Don Pedro Reservoir.

The revised Aquatic Invasive Species Management Plan must be developed after consultation with BLM, FWS, NMFS, the Water Board, and California DFW. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 418. *Terrestrial Resources Management Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a revised Terrestrial Resources Management Plan. The licensees must revise the Terrestrial Resources Management Plan, filed October 11, 2017, as appendix E6 of the amended final license application, to include the following additional provisions:

(1) Conducting noxious weed surveys on project lands in areas that support occurrences of special-status or threatened and endangered plants and using manual control of noxious weeds, where feasible (instead of pesticides), in areas with sensitive resources.

(2) Implementing control measures for the giant reed population documented along the Don Pedro Powerhouse access road.

(3) Implementing best management practices (BMPs) to minimize potential for pesticides[14] affecting non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

(4) Recording incidental observations of any special-status or threatened and endangered species and reporting them to the U.S. Fish and Wildlife Service (FWS), California Department of Fish and Wildlife (California DFW), Bureau of Land Management (BLM).

(5) Conducting surveys for special-status plants on project lands following California DFW protocols (California DFW 2018e) within the Red Hills Area of Critical Environmental Concern (ACEC) every 5 years and every 10 years elsewhere within the project boundary at project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and where project-related disturbance is reasonably expected to occur.

(6) Installing interpretive signs about the unique plant communities on project lands within the Red Hills ACEC requesting that recreationists stay on trails.

(7) Conducting pre-construction surveys for special-status or threatened and endangered plant species following FWS and/or California DFW protocols (FWS 2017a, b, and c, and California DFW 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.

(8) Conducting a bat survey of project facilities focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity

[14] The use of the term “pesticide” in this license includes both herbicides and/or rodenticides.

season (July 1 through August 31), within 2 years after license issuance; and resurveying project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installing and annually inspecting bat exclusion devices at project facilities with evidence of bat roosting.

(9) Reporting any sick or dead bats found at the Don Pedro Project to California DFW and FWS as soon as possible and following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).

(10) Recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle. If elderberry plants are identified, following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a).

(11) Describing specific locations on project lands where the Districts' proposed rodent control activities could occur.

(12) Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, California tiger salamanders, and burrowing owls in accordance with California DFW and FWS protocols (FWS 2011, FWS 2003, and California DFW 2008) prior to any rodent control or ground disturbing activities that could destroy potential burrows; implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox, burrowing owl, and California tiger salamander during other biological surveys.

(13) Implementing BMPs to protect California tiger salamander from project related activities, including (1) only conducting project-related ground disturbance or vegetation management within 300 feet of suitable California tiger salamander breeding habitat during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions); (2) only conducting project-related ground disturbance in suitable upland habitat between July 1 and October 15; and (3) avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander.

(14) Decontaminating equipment in accordance with appendix B of FWS (2005)[15] during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.

The licensees must revise the plan after consultation with BLM, FWS, and California DFW. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 419. *Bald Eagle and Special-status Bird Management Plan*. Within one year of license issuance, the licensees must file, for Commission approval, a bald eagle and special-status bird management plan to mitigate for potential disturbances to bald eagle and special-status bird foraging and nesting resulting from project operation and maintenance and project recreational use.

The plan must include, but not necessarily be limited to, the following:

(1) annual bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 0.25 mile of the shorelines of Don Pedro Reservoir to identify areas where limited operating periods[16] are needed, and in accordance with the California Department Fish and Wildlife's (California DFW's) *Bald Eagle Breeding Survey Instructions* and the U.S. Fish and Wildlife Service's (FWS's) 2004 *Protocol for Evaluating Bald Eagle Habitat and Populations in California*;

[15] FWS. 2005. Revised guidance on site assessments and field surveys for the California red-legged frog. Available at: https://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/crf_survey_guidance_aug2005.pdf. Accessed October 5, 2019.

[16] Limited operating periods include seasonal restrictions on vegetation maintenance or other activities that result in loud noises that would have potential to disturb nesting or winter roosting bald eagles, as described in the National bald eagle management guidelines (FWS, 2007)

(2) if any new nests or communal night roosts are located, coordinate with BLM, FWS, and California DFW to establish a protective buffer around each nest;

(3) establish a 0.25-mile protective buffer on project lands around active bald eagle nests and communal roosting sites, unless consultation with the resource agencies allows for a reduced protective buffer if eagles nesting in the area demonstrate a greater tolerance;

(4) install signs on project lands to inform recreationist of any temporary closure(s) around active bald eagle nests to prevent disturbance to nesting birds;

(5) collect incidental observations of all raptor species at the project, while performing other activities in the Don Pedro Project boundary to determine if protective buffers on project lands are needed; and

(6) consult with FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

The plan must be developed after consultation with BLM, FWS, and California DFW. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 420. *Recreation Resource Management Plan*. Within six months of license issuance, or at least 90 days prior to the start of any ground-disturbing activity, whichever comes first, the licensees must file, for Commission approval, a revised Recreation Resource Management Plan.

The licensees must revise the Recreation Resources Management Plan, filed October 11, 2017, as appendix E7 of the amended final license application, to include the following provisions:

(1) install signs, fences, and gates, where appropriate, along the existing Don Pedro shoreline access trail to discourage trespassing on private land adjacent to the trail;

(2) describe the operation and maintenance of the Don Pedro shoreline access trail to ensure the trail is maintained through the license term;

(3) describe the thresholds or conditions in recreational use data that would warrant the need for additional facilities, based on the results of the visitor use reports that would be filed every 12 years;

(4) invite the Bureau of Land Management (BLM) and other interested parties to an annual coordination meeting to discuss the management, public safety, protection, and use of project recreation facilities and resources;

(5) conceptual drawings and descriptions of project recreation facilities, that are consistent with the outcome of design review by BLM, that would be constructed, reconstructed, or rehabilitated on BLM-administered land;

(6) consult with BLM to design visitor use surveys to ensure data are collected about topics relevant to project visitor use of project facilities located on BLM-administered lands;

(7) designate the Fleming Meadows Visitor Center as a project recreational facility and describe protocols for its operation and maintenance;

(8) identify the access designation (i.e., public versus private non-public) of adjacent non-project lands on recreational facility maps to reduce the potential for project visitors to inadvertently trespass on adjacent private land;

(9) identify specific measures to address adverse recreation-related resource effects on project lands that receive recurrent recreational use classified as “high impact sites”;

(10) construct and maintain shoreline access trails on each side of Ward’s Ferry Bridge to provide suitable, safe shoreline access for visitors and reduce adverse effects of erosion and vegetation removal caused by user created trails;

(11) construct a non-motorized project trail including signs, fences, and gates, where appropriate, between the former Don Pedro Visitor Center parking lot and the La Grange Reservoir, to provide visitor access to La Grange Reservoir;

(12) consult with boating interests to determine the timing of weekend boating releases (dates of releases and start/end times of releases on each day) and making information on the planned boating releases and the minimum flow schedule available to the public; and

(13) develop a schedule for construction of the Don Pedro shoreline access trail, the proposed visitor center, the Ward’s Ferry shoreline access trails, and reconstruction of facilities, including restrooms, that are currently in poor condition or do not meet accessibility guidelines, which includes proposed accessibility upgrades and allows adequate time for design, permitting, agency approvals, and construction as well as consideration of facility condition, capacity, and location when determining reconstruction priorities.

The revised Recreation Resources Management Plan must be developed after consultation with BLM, the National Park Service, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how agency comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Land-disturbing activities must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 421. *Woody Debris Management Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a revised Woody Debris Management Plan. The Woody Debris Management Plan, filed as appendix E5 to the amended final license application, must be revised to include, but not necessarily be limited to, the following:

(1) A provision to maintain a valid Bureau of Land Management (BLM)-approved burn plan for any large woody debris stored and burned on BLM-administered lands; and

(2) A description of the coordination between the Districts and BLM to manage wood on the surface of Don Pedro Reservoir to maintain boating access and navigability of the reservoir near Ward's Ferry Bridge, in consultation with BLM, U.S. Fish and Wildlife Service, National Marine Fisheries Service, the California State Water Resources Control Board, and California Department of Fish and Wildlife.

The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 422. *Transportation System Management Plan*. Within one year of license issuance, the licensees must file, for Commission approval, a transportation system management plan for all project lands.

The plan must include, but not necessarily be limited to, the following:

(1) identify all roads and trails that are predominately used for project-related purposes;

(2) demonstrate that each identified road is predominately used for project-related purposes, and a description of all non-project-related uses on each identified road;

(3) develop condition assessments for each identified project road and trail; and

(4) specify maintenance standards.

The transportation system management plan must be developed after consultation with the Bureau of Land Management (BLM). The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the BLM, and specific descriptions of how BLM's comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the BLM to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 423. *Visual Resources Management Plan*. Within one year of license issuance, the licensees must file, for Commission approval, a visual resources management plan for the Don Pedro Project that incorporates the requirements specified in the Bureau of Land Management's (BLM) 4(e) condition 18 in Appendix C, and addresses the new facilities to be located on non-BLM land specified in the *Wards Ferry/Tuolumne River Take-Out Management Plan* required by BLM's 4(e) condition 13, to mitigate project effects on aesthetic resources. The plan should include, at a minimum:

(1) a description of the materials and color of materials to be used in construction of the new facilities to ensure that the new facilities blend with the existing environment and minimize any effects on visual resources; and

(2) a provision to monitor visual resources over the term of the new license to determine whether additional treatments would be necessary to retain the existing characteristics of the landscape.

The visual resources management plan must be developed after consultation with BLM. The licensees must include with the plan an implementation schedule,

documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the BLM, and specific descriptions of how their comments are accommodated by the plan. The licensees must allow a minimum of 30 days for BLM to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 424. *Fire Prevention and Response Management Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a revised Fire Prevention and Response Management Plan. The Fire Prevention and Response Management Plan, filed as Appendix E-2 to the amended final license application, must be revised to include, but not necessarily be limited to: information on fire history, references, results of fire occurrence analysis, permits, and use and storing of explosives.

The Fire Prevention and Response Management Plan must be revised after consultation with the Bureau of Land Management (BLM). The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to BLM, and specific descriptions of how BLM's comments are accommodated by the plan. The licensees must allow a minimum of 30 days for BLM to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 425. *Programmatic Agreement and Historic Properties Management Plan*. The licensees must implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuance of a License to the Turlock Irrigation District and Modesto Irrigation District for the Continued Operation of the Don Pedro Hydroelectric Project in Tuolumne County, California (FERC No. 2299-082)," executed on XXX, 2019, and including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

Article 426. *Land Use and Occupancy*. (a) In accordance with the provisions of this article, the licensees must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensees may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensees must also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensees for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensees must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensees may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensees must require multiple use and occupancy of facilities for access to project lands or waters. The licensees must also ensure, to the satisfaction of the Commission's authorized representative that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensees must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensees may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensees' costs of administering the permit program. The Commission reserves the right to require the licensees to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensees may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69 kilovolt or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensees must file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensees may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is 5 acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensees must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date, requires the licensees to file an application for prior approval, the licensees may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensees must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensees must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensees to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensees under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.

APPENDIX C

License Conditions Recommended by Staff for the La Grange Project

III. MANDATORY CONDITIONS

On January 29, 2018, the California State Water Resources Control Board filed 11 preliminary conditions under section 401 of the Clean Water Act (appendix E). These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the environmental impact statement (EIS). We consider preliminary condition 11 to be administrative. We anticipate that all valid section 401 conditions will be included in any new license issued for the project.

On January 29, 2018, the U.S. Department of Interior, Bureau of Land Management (BLM) filed 35 preliminary 4(e) conditions (appendix D). These conditions are described in section 2.2.5, *Modifications to Applicant's Proposal—Mandatory Conditions*, of the EIS. We consider preliminary conditions 1, 4, 10 through 22, 24, 25, 27 through 33, and 35 to be administrative or legal in nature and not specific environmental measures. Of the 10 conditions we consider to be environmental measures applicable to the La Grange Project, we include in the staff alternative 5 conditions as specified by the agency, modify 1 condition to adjust the scope of the measure, and do not recommend 4 conditions. We recognize, however, that the Commission is required to include valid 4(e) conditions in any license issued for the project. As such, the BLM conditions that we do not recommend or that we recommend modifying in the manner noted above, would be included in a new license as specified by the agency and to the extent allowed by applicable law.

IV. ADDITIONAL LICENSE ARTICLES RECOMMENDED BY COMMISSION STAFF

We recommend including the following license articles in any license issued for the project in addition to the preliminary mandatory conditions.

Article 401. *Commission Approval, Reporting, and Filing of Amendments*.

(a) Requirement to File Plans for Commission Approval

Various conditions found in the California State Water Resources Control Board (Water Board's) preliminary section 401 water quality certification (certification) require the licensees to prepare plans in consultation with other entities for approval by the Water Board for submittal to the Commission and to implement specific measures without prior Commission approval. Each such plan must also be submitted to the Commission for approval. These plans are listed below.

Certification Condition No.	Plan Name	Due Date
4	Large Woody Material Management Plan	Within one year of license issuance
5	Sediment Management Plan	Within one year of license issuance
6	Water Quality Monitoring Plan	Within one year of license issuance
7	Water Temperature Monitoring Plan	Within one year of license issuance
8	Aquatic Invasive Species Management Plan	Within one year of license issuance
9	Erosion and Sediment Control Plan	Within one year of license issuance
10	Hazardous Material Plan	Within one year of license issuance

The licensees must include with each plan filed with the Commission documentation that the licensees developed the plan in consultation with, and received approval from, the Water Board. The Commission reserves the right to make changes to any plan filed. Upon Commission approval, the plan becomes a requirement of the license, and the licensees must implement the plan or changes in project operations or facilities, including any changes required by the Commission. Any further changes in the Commission-approved schedules or plans require approval by the Commission before implementing the proposed change.

(b) Requirement to File Reports

Certain conditions of the Water Board's 401 certification require the licensees to file reports with other entities. Because these reports relate to compliance with the requirements of this license, each such report must also be submitted to the Commission. These reports are listed in the following table:

Certification Condition No.	Description	Due Date
4	Reports that document the implementation and effectiveness of the large woody material management in the Tuolumne River downstream of La Grange Diversion Dam.	One year after completion of each large woody material monitoring period.
5	Reports that document the implementation and effectiveness of the coarse and fine sediment transport past La Grange Dam in the Tuolumne River.	One year after completion of each sediment monitoring period.

The licensees must submit to the Commission documentation of any consultation, and copies of any comments and recommendations made by any consulted entity in connection with each report. The Commission reserves the right to require changes to project operations or facilities based on the information contained in the report and any other available information.

Article 402. *Reservation of Authority to Prescribe Fishways.* Authority is reserved to the Commission to require the licensees to construct and maintain, or to provide for the construction, operation, and maintenance of, such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, pursuant to section 18 of the Federal Power Act.

Article 403. *Erosion and Sediment Control Plan.* Before the commencement of any ground-disturbing activity within the project boundary, the licensees must file, for Commission approval, a soil erosion and sediment control plan. The plan must include, at a minimum, the following:

(1) a description of the best management practices for erosion control that will be applied in specific circumstances;

(2) provisions for inspecting erosion control measures while they are in place;

(3) emergency protocols for erosion and sedimentation control (e.g., steps that would be taken if control measures fail during a storm event);

(4) techniques that will be used to stabilize sites once construction is completed; and

(5) a description of when and what type of water quality monitoring of surface waters would occur during and after ground-disturbing activities.

The soil erosion and sediment control plan must be developed after consultation with the Bureau of Land Management, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife, and be filed with the Commission for approval at least 90 days in advance of initiating construction of recreation or other project facilities that require ground-disturbing activities. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on site-specific information.

The Commission reserves the right to require changes to the plan. Ground-disturbing activities must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 404. *Spill Prevention Control and Countermeasure Management Plan.* Within six months of license issuance, the licensees must file, for Commission approval, a spill prevention control and countermeasure management plan.

The plan must include, at a minimum, the following:

(1) a description of how hazardous substances would be transported, stored, handled, and disposed;

(2) a description of equipment and procedures to be used to address hazardous substance spills;

(3) a provision to notify the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), California State Water Resources Control Board (Water Board), and California Department of Fish and Wildlife (California DFW) within 24 hours of discovering a hazardous substances spill; and

(4) a provision to file a report with the Commission within 10 days of a hazardous substance spill that identifies: (a) the location of the spill; (b) the type and quantity of hazardous material spilled; (c) any corrective actions that have been undertaken to clean up the spill; and (d) any measures taken to ensure that similar spills do not occur in the future.

The spill prevention control and countermeasure management plan must be developed after consultation with BLM, FWS, NMFS, the Water Board, and California DFW. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific

descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 405. *Minimum Flows below La Grange Diversion Dam.* The licensees must release a continuous minimum flow of at least 5 cubic feet per second from gates on the Modesto Irrigation District side of the Tuolumne River to the plunge pool downstream of La Grange Diversion Dam to ensure consistent and adequate flow to support aquatic resources. The flow release requirement may be temporarily modified if required by operating emergencies beyond the control of the licensee, and for short periods upon mutual agreement among the licensees, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Wildlife. If the flow is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident. If there are any deviations with the operational requirements of the license, the licensee must notify the Commission as soon as possible, but no later than 10 days, after each such incident.

Article 406. *Ramping Rates.* The licensees must operate the project to restrict down-ramping rates to a maximum of 2 inches per hour, as measured at the U.S. Department of the Interior, Geological Survey, gage no. 11289650 downstream of La Grange Dam. Exceptions to compliance with this requirement are permissible if needed to meet flood control requirements, to address operating emergencies beyond the control of the licensees, and for short periods upon mutual agreement among the licensees, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and California Department of Fish and Wildlife. If the ramping rate is so modified, the licensees shall notify the Commission as soon as possible, but no later than 10 days after each such incident.

Article 407. *Operation Compliance Monitoring Plan*. Within six months of license issuance, the licensees must file, for Commission approval, an operation compliance monitoring plan to document compliance with the streamflow requirements specified in articles 404 and 405, in coordination with the streamflow monitoring requirements for the Don Pedro Project No. 2299 that will also be measured at up to two sites downstream of the La Grange Project. The plan must describe, at a minimum, the following:

(1) locations where the licensees would monitor streamflow requirements;

(2) equipment that would be used by the licensees to monitor streamflow;

(3) how the equipment would be deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained;

(4) how data would be retrieved from the equipment, including frequency of data downloads, quality assurance/quality control procedures, and data storage;

(5) how the licensees would make streamflow data available to the Commission, the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and California Department of Fish and Wildlife (California DFW), upon request for the data; and

(6) how the licensees would update the proposed plan as needed in the future.

The licensees must develop the operation compliance monitoring plan after consultation with the Bureau of Land Management, FWS, NMFS, California State Water Resources Control Board, and California DFW. The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 408. *Water Quality Monitoring Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a water quality monitoring plan to manage dissolved oxygen (DO) concentrations in the La Grange Powerhouse tailrace. The plan must include, at a minimum, the following:

(1) monitoring of DO and water temperature at 15-minute intervals in the upper end of the La Grange Reservoir, La Grange forebay, immediately downstream of the La Grange Powerhouse, and at the downstream end of the powerhouse tailrace channel for three years, beginning in year 1 of license issuance;

(2) supplementing these data with weekly observations of aquatic vegetation and algae in the La Grange Powerhouse forebay and near the penstock intake;

(3) identifying the proposed monitoring season based on the timing of recently observed DO concentrations less than the water quality objective;

(4) annual reporting on the monitoring program for distribution to the consulted agencies and the Commission; and

(5) submitting, for Commission approval, a summary report after three years of monitoring that identifies the cause(s) for any DO concentrations that do not meet the Basin Plan objective, proposed mitigation to address low DO concentrations, and plans for effectiveness monitoring for any measure(s) to be implemented to address low DO concentrations.

The water quality monitoring plan and the summary report must be developed after consultation with the U.S. Fish and Wildlife Service, National Marine Fisheries Service, California State Water Resources Control Board, and California Department of Fish and Wildlife. The licensees must include with the plan and the summary report documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan or report. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan or report with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 409. *Fish Exclusion Design Plan.* Within one year of license issuance, the licensees must file, for Commission approval, a fish exclusion design plan detailing the design of the fish exclusion barrier such that:

(1) the fish exclusion barrier is installed at the Turlock Irrigation Districts sluice gate channel entrance and able to pass flows up to 7,000 cubic feet per second; and

(2) fish are excluded from entering into the sluice gate channel during powerhouse outages.

The plan must also include testing, operation, and maintenance procedures and an implementation schedule.

The plan must be developed after consultation with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and California Department of Fish and Wildlife. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan

is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Article 410. *Aquatic Invasive Species Management Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a plan to manage aquatic invasive species to minimize the potential introduction and spread of aquatic invasive species in the La Grange Project boundary.

The plan must include, but not necessarily be limited to, the following:

(1) a provision to provide information (i.e., signage and information pamphlets at designated public boat access sites and on public websites) to educate recreational users on ways to reduce the spread of invasive species;

(2) a provision to include the following best management practices for minimizing the spread of invasive species during project operation and maintenance: (a) identifying invasive species that may be introduced by a given activity, (b) implementing preventive measures, (c) identifying critical control points (locations and times) for preventing the spread of aquatic invasive species, and (d) identifying actions to be taken if an aquatic invasive species introduction occurs;

(3) a provision to consult with the Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), the California State Water Resources Control Board (Water Board), and California Department of Fish and Wildlife (California DFW) if aquatic invasive species are discovered within the project boundary; and

(4) a provision to record and communicate incidental observation of aquatic invasive species to the BLM, FWS, NMFS, the Water Board, and California DFW within 24 hours, and to the Commission within 10 days.

The plan must be developed after consultation with BLM, FWS, NMFS, the Water Board, and California DFW. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 411. *Terrestrial Resources Management Plan*. Within one year of license issuance, the licensees must file, for Commission approval, a plan to manage terrestrial resources and provide guidance for the protection and management of terrestrial

resources with the potential to be affected by project operations and maintenance activities within the La Grange Project boundary.

The plan must include, but not necessarily be limited to, the following:

(1) Conducting a noxious weed survey of the La Grange Project in the first year of license issuance and every five years thereafter, with noxious weed surveys focusing on areas that support occurrences of special-status or threatened and endangered plants, and implementing control measures if noxious weeds are found, using manual control methods where feasible (instead of herbicides), in areas with sensitive resources.

(2) Implementing best management practices (BMPs) to minimize potential for pesticides[17] affecting non-target species and avoidance and minimization measures when project-related ground disturbance involving heavy machinery is planned within 300 feet of wetlands and riparian areas.

(3) Conducting a survey for special-status plants on project lands following California Department of Fish and Wildlife (California DFW) protocols (California DFW 2018e) at the La Grange Project facilities, recreation areas, and roads and trails that are predominately used for project-related purposes and preparing a summary report assessing the need for measures to protect special-status plants from project activities, including road and trail maintenance.

(4) Conducting pre-construction surveys for special-status or threatened and endangered plant species following U.S. Fish and Wildlife Service (FWS) and/or California DFW protocols (FWS 2017a, b, and c, and California DFW 2018e) prior to any project-related ground disturbance in areas with suitable habitat and establishing 50-foot buffers around special-status or threatened and endangered plant occurrences, marked with flagging or fencing, prior to implementing vegetation management or ground-disturbing activities.

(5) Recording incidental observations of any special-status or threatened and endangered species and reporting them to FWS; California DFW; U.S. Department of Interior, Bureau of Land Management (BLM).

(6) Conducting a bat survey of the La Grange Project focused on locations where the potential exists for conflict with humans, including a daytime visual assessment and nighttime emergence survey during the peak bat maternity season (July 1 through August 31) within 2 years after license issuance to determine where bats are present and/or roosting in the project; resurveying

[17] The use of the term “pesticide” in this license includes both herbicides and/or rodenticides.

project facilities with potential for bat occurrence every five years to look for evidence of bat use; and installation and annual inspection of bat exclusion devices at project facilities with evidence of bat roosting.

(7) Reporting any sick or dead bats found at the La Grange Project to California DFW and FWS as soon as possible; following accepted decontamination protocols when entering project areas with potential bat occurrence (found in appendix C of White-nose Syndrome Conservation and Recovery Working Group, 2015).

(8) Recording the locations of elderberry plants during pre-construction special-status plant surveys and surveying for elderberry plants in accordance with FWS protocols (FWS, 2017a) within 165 feet of project-related ground disturbance with potential to remove elderberry shrubs to protect valley elderberry longhorn beetle; following avoidance and minimization measures identified in the *Framework for Assessing Impacts to Valley Elderberry Longhorn Beetle* (FWS, 2017a) if elderberry plants are identified.

(9) Recording incidental observations of western pond turtles, evaluating habitat suitability for the species within the La Grange Project boundary, and developing protective measures.

(10) Decontaminating equipment in accordance with appendix B of FWS (2005)[18] during project activities that require movement from one waterbody to another to prevent the spread of chytrid fungus and invasive species.

(11) Conducting surveys for San Joaquin kit foxes in accordance with California FWS (FWS 2011) protocols prior to any ground disturbance activities that could destroy potential burrows and implementing avoidance measures for any occupied or potentially occupied burrows, and documenting any anecdotal evidence of San Joaquin kit fox, during other biological surveys

(12) Conducting surveys of ground squirrel burrows on project lands for occupancy by San Joaquin kit foxes, in accordance with and FWS protocols (FWS 2011) prior to any ground disturbance activities that could destroy potential burrows; implementing avoidance measures for any occupied or potentially occupied burrows; and documenting any anecdotal evidence of San Joaquin kit fox during other biological surveys for the purpose of

[18] FWS. 2005. Revised guidance on site assessments and field surveys for the California red-legged frog. Available at: https://www.fws.gov/sacramento/es/Survey-Protocols-Guidelines/Documents/crf_survey_guidance_aug2005.pdf. Accessed October 5, 2019.

tracking the status of occurrences in areas where project operation and maintenance occur and inform the need for additional protection measures.

(13) Avoiding use of pesticides on project lands within 500 feet of suitable aquatic or upland habitat for California tiger salamander;

- Implementing the following BMPs to protect California tiger salamander during project-related construction in suitable habitat: (1) conduct project-related ground disturbance or vegetation management within 300 feet of suitable salamander breeding habitat only during the dry season (approximately April 15 to October 15 depending on rainfall and site conditions); (2) conduct project-related ground disturbance or pesticide applications in suitable upland habitat only between July 1 and October 15; (3) provide training by a qualified biologist for all contractors, work crews, and on-site personnel; (4) inspect all construction pipe, culverts, or similar structures that are stored at the construction site for one or more overnight periods before the pipe is subsequently moved, buried, or capped, and if during inspection a salamander is discovered inside a pipe, refrain from moving that section of pipe until the biological monitor follows FWS protocols to safely move the animal; (5) inspect all vehicles and equipment for the presence of salamanders prior to moving, and if a salamander is found, follow FWS relocation protocols ; (6) at the end of each work day, cover all excavated, steep-walled holes or trenches with plywood or similar materials or provide one or more escape ramps constructed of wooden planks, inspect such holes or trenches for trapped animals prior to filling, and if at any time a trapped salamander is located, cease all work in the immediate area until the biological monitor follows FWS protocols to safely move the animal ; (7) refrain from using monofilament netting for erosion control measures in suitable habitat, and instead, use tightly woven (less than 0.25-inch diameter) biodegradable fiber netting or biodegradable coconut coir matting; and (8) provide a qualified biological monitor to monitor work sites to ensure BMPs are implemented.

The plan must be developed after consultation with BLM, FWS, and California DFW. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan

is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 412. *Bald Eagle and Special-status Bird Management Plan*. Within one year of license issuance, the licensees must file, for Commission approval, a bald eagle and special-status bird management plan to mitigate for potential disturbances to bald eagle and special-status bird foraging and nesting resulting from project operation and maintenance and project recreational use.

The plan must include, but not necessarily be limited to, the following:

(1) annual bald eagle nesting, wintering, and night roost surveys within suitable habitat on all lands within 0.25 mile of the shorelines of La Grange Reservoir to identify areas where limited operating periods[19] are needed, and in accordance with the California Department of Fish and Wildlife's (California DFW's) *Bald Eagle Breeding Survey Instructions* and the U.S. Fish and Wildlife Service's (FWS's) 2004 *Protocol for Evaluating Bald Eagle Habitat and Populations in California*;

(2) establish a 0.25 mile protective buffer on project lands around active bald eagle nests and communal roosting sites, unless consultation with the resource agencies allows for a reduced protective buffer if eagles nesting in the area demonstrate a greater tolerance;

(3) install signs on project lands to inform recreationists of any temporary closure(s) around active bald eagle nests to prevent disturbance to nesting birds;

(4) collect incidental observations of all raptor species at the project, while performing other activities within the La Grange Project boundary to determine if protective buffers are needed on project lands; and

(5) consult with the FWS and California DFW to identify suitable protective buffers on project lands around any active nests of other special-status birds.

The plan must be developed after consultation with BLM, FWS, and California DFW. The licensees must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensees must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

[19] Limited operating periods include seasonal restrictions on vegetation maintenance or other activities that result in loud noises that would have potential to disturb nesting or winter roosting bald eagles, as described in the National bald eagle management guidelines (FWS 2007).

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 413. *Fire Prevention and Response Management Plan*. Within six months of license issuance, the licensees must file, for Commission approval, a fire prevention and response management plan.

The plan must include, but not necessarily be limited to, the following descriptions of the Districts' actions, responsibilities, and access related to wildland fire preparedness and reporting:

(1) equipment, vehicles, and tools for District staff and job sites;

(2) fire index monitoring and activity curtailment, as appropriate;

(3) debris burning;

(4) vegetation clearance;

(5) communication systems;

(6) access routes, water sources, and helicopter landing areas;

(7) fire investigation;

(8) emergency contact information; and

(9) fire safety signage at recreational facilities.

The fire prevention and response management plan must be developed after consultation with the Bureau of Land Management (BLM). The licensees must include with the plan an implementation schedule, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to BLM, and specific descriptions of how BLM's comments are accommodated by the plan. The licensees must allow a minimum of 30 days for BLM to comment and to make recommendations before filing the plan with the Commission. If the licensees do not adopt a recommendation, the filing must include the licensees' reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensees are notified by the Commission that the plan is approved. Upon Commission approval, the licensees must implement the plan, including any changes required by the Commission.

Article 414. *Programmatic Agreement and Historic Properties Management Plan*. The licensees must implement the "Programmatic Agreement Between the Federal Energy Regulatory Commission and the California Historic Preservation Officer for Managing Historic Properties that May be Affected by Issuance of a License to the Turlock Irrigation District and Modesto Irrigation District for the Continued Operation of

the La Grange Hydroelectric Project in Stanislaus and Tuolumne Counties, California (FERC No. 14581-002)," executed on XXX, 2020, and including but not limited to the Historic Properties Management Plan (HPMP) for the project. In the event that the Programmatic Agreement is terminated, the licensee shall continue to implement the provisions of its approved HPMP. The Commission reserves the authority to require changes to the HPMP at any time during the term of the license.

Article 415. *Land Use and Occupancy*. (a) In accordance with the provisions of this article, the licensees must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensees may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensees must also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensees for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensees must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensees may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensees must require multiple use and occupancy of facilities for access to project lands or waters. The licensees must also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensees must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensees may, among other things, establish a program for issuing

permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensees' costs of administering the permit program. The Commission reserves the right to require the licensees to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensees may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69 kilovolt or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensees must file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensees may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is 5 acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensees must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date,

requires the licensees to file an application for prior approval, the licensees may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensees must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensees must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensees to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensees under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.

APPENDIX D

U.S. Bureau of Land Management Revised Conditions
for the Don Pedro Project

PRELIMINARY RECOMMENDATIONS, TERMS AND CONDITIONS FOR THE DON PEDRO HYDROELECTRIC PROJECT (FEDERAL ENERGY REGULATORY COMMISSION PROJECT NO. 2299)

Revised August 23, 2018

The BLM, through its preliminary recommendations, terms and conditions, and prescriptions seeks to ensure appropriate levels of resource protection are incorporated in any new license. The BLM recommends that the FERC include in any new license issued for the Don Pedro Hydroelectric Project 2299 the following BLM preliminary recommendations, terms and conditions. The BLM believes this comprehensive framework provides for the sustainable management and conservation of the natural resources of the Tuolumne watershed. This framework is within the context of agency statutory authorities under the FPA and other applicable laws. The agencies intent is to issue their protection, mitigation and enhancement measures, terms and conditions, and recommendations consistent with this framework.

Condition No. 1 – Consultation

Licensee shall annually consult with BLM regarding license implementation. Licensee shall set an agreed upon date beginning in the first full calendar year of the new license term and each year thereafter, meet with BLM at the MID office in Modesto, California, to discuss past and current year implementation of the license conditions affecting BLM land. The meeting will be open to the public, except during those parts of the meeting when confidential information (e.g., cultural resources or specific location of ESA-listed species) is discussed. In those instances, only Licensee and appropriate agencies shall be allowed to be in attendance. At least 30 days in advance of the meeting, Licensee shall notify via email or other written means BLM and other interested stakeholders (interested stakeholders are defined as anyone who sends a letter or email to the Licensee requesting to be a part of the consultation group. Any organized group will select an individual to represent them and will notify the Licensee who their representative will be when they are attending these meetings), confirming the meeting location, time and agenda. At the same time, Licensee shall also provide notice to the: United States Fish and Wildlife Service (USFWS); National Park Service (NPS); National Marine Fishery Service (NMFS); California State Department of Fish and Wildlife (CDFW); and the State Water Resources Control Board (SWRCB) who may choose to participate in the meeting.

Three weeks prior to each annual meeting, Licensee shall make available to BLM, interested stakeholders, and the agencies listed above an operations and maintenance plan for project activities that may affect BLM land for the calendar year in which the meeting occurs.

The purposes of the meeting are to conduct discussions about forthcoming year's operations and maintenance plans that may affect BLM land; to have the Licensee present results from the past/current year monitoring, as well as any additional

information that has been compiled for the project area including progress reports on any other issues related to preserving and protecting ecological values affected by the Project on or affecting BLM land; to share information on mutually agreed upon planned maintenance activities on or affecting BLM land; to identify concerns that BLM may have regarding project operations/activities and their potential effects on sensitive resources on or affecting BLM land, any measures required to avoid or mitigate those potential effects; and review and discuss the results of implementing Don Pedro Hydroelectric Projects -related conditions on or affecting BLM land.

Consultation shall include, but is not limited to, the items listed below as they pertain to project-effects on or affecting BLM land:

- A status report regarding implementation of license conditions.
- Discussion on any conditions that were not implemented, rationale on why they didn't get implemented, and when will they be implemented.
- Results of any monitoring studies performed over the previous year in formats agreed to by BLM and Licensee during development of implementation plans.
- Review of any non-routine maintenance.
- Discussion of any foreseeable changes to project facilities or features.
- Discussion of any necessary revisions or modifications to resource implementation plans approved as part of this license.
- Discussion of needed protection measures for species newly listed as threatened, endangered, or sensitive, or changes to existing management plans that may no longer be warranted due to de-listing of species or, to incorporate new knowledge about a species requiring protection.
- Discussion of needed protection measures for newly discovered cultural resource sites.
- Discussion of elements of current year maintenance plans, e.g. road and trail maintenance.
- Discussion of any proposed pesticide use.
- Discussion of BLM identified concerns regarding project operations/activities and their potential effects on sensitive resources, and any measures required to avoid or mitigate those potential effects.
- Discussion of information on mutually agreed upon planned maintenance activities.
- Discussion on upcoming permitted events that are scheduled for the year.
- Discussion on any planned burning activities on BLM land.
- Discussions on other issues regarding project effects on BLM land.

A record of the meeting shall be kept by Licensee and shall include any recommendations made by BLM for the protection of BLM land and resources. Licensee shall file the meeting record, if requested, with FERC no later than 60 days following the meeting.

A copy of the reports/records/studies on or affecting BLM land from the previous water year shall be provided to BLM by Licensee at least 90 days prior to the meeting date, unless otherwise agreed.

Copies of other non-CEII reports including, but not limited to, monitoring reports, non-compliance reports filed by Licensee, geologic or seismic reports, and structural safety reports for facilities affecting or on BLM land shall be submitted to BLM concurrently with submittal to the FERC, with the goal of providing the material to BLM no later than 90 days in advance of the annual meeting.

During the first several years of license implementation, it is likely that more consultation than just one annual meeting will be required, given the complexity of the project and the acreage of BLM land affected by project operations.

BLM will be included to be a participant on Technical Committees that focus on anadromous fish, inter-related resident fish and other ecological topics and issues that may have a direct or indirect effect on BLM managed lands. The Technical Committees shall develop a technical advisory plan or process for ground rules for decision making and implementing decisions. Members of the committee will include those agencies with direct management responsibilities for lands (riparian, wetland, recreation, fisheries, aquatics, water temperature and water quality), and the selection of an appropriate non-governmental representative. The Technical Committee will be finalized within one year of license issuance.

Condition No. 2 – Annual Employee Training

Licensee shall, beginning in the first full calendar year after license issuance, annually perform employee awareness training, and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensees' Operations and Maintenance (O&M) staff with special-status species, non-native invasive plants, and sensitive areas (e.g., special-status plant populations and invasive plant locations) that are known to occur within or adjacent to the FERC Project Boundary. Licensee shall provide to each O&M staff a confidential map showing these sensitive areas, including GPS coordinates, as well as pictures and other guides to assist staff in recognizing special-status species, non-native, invasive plants, and sensitive areas. It is not the intent of this measure that Licensees' O&M staff perform surveys or become specialists in the identification of special-status species or noxious weeds. Licensee shall direct its O&M staff to avoid disturbance to sensitive areas, and to advise all Licensees' contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, Licensee shall consult with BLM to minimize adverse effects to sensitive resources. This measure applies to employee training that is not otherwise covered by a specific plan.

Condition No. 3 – Erosion Control and Restoration Plan

Within one year of license issuance, Licensees shall develop and implement an Erosion Control and Restoration Plan for erosion and/or restoration actions to be carried out by

Licensees on or affecting BLM lands that are within or adjacent to the FERC Project boundary. Licensees must acquire BLM approval before submitting the Erosion Control and Restoration Plan for Commission approval. Licensees shall file the approved Erosion Control and Restoration Plan with the Commission at least 90-days in advance of initiating construction of recreation or other Project facilities. Upon Commission approval, Licensees shall implement the Erosion Control and Restoration Management Plan.

Condition No. 4 – Large Woody Debris Material Management

Licensees shall obtain and maintain a BLM-approved burn plan for any large woody debris stored and burned on BLM-administered lands. In furtherance of that burn plan, Licensees shall make all reasonable efforts to prevent large woody debris from interfering with accessible takeout areas for whitewater boaters at Wards Ferry.

Condition No. 5 – Reservation of Authority to Modify 4(e) Conditions in the Event of Anadromous Fish Re-introduction

BLM exercises its 4(e) authority by reserving that authority to modify these conditions to respond to any reintroduction of Chinook salmon or steelhead trout listed under the Endangered Species Act, to stream reaches through BLM lands where the flow is controlled by the Don Pedro Hydroelectric Project.

Condition No. 6 – Aquatic Invasive Species Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Aquatic Invasive Species Management Plan following consultation with the BLM. The BLM has provided an Aquatic Invasive Species Management Plan (Attachment 1) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Aquatic Invasive Species Management Plan as presented in Attachment 1, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Aquatic Invasive Species Plan shall be implemented.

Condition No. 7 – Terrestrial Resources Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Terrestrial Resources Management Plan following consultation with the BLM. The BLM has provided a Terrestrial Resources Management Plan (Attachment 2) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Terrestrial Resources Management Plan as presented in Attachment 2, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Terrestrial Resources Management Plan shall be implemented.

Condition No. 8 – Bald Eagle Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Bald Eagle Management Plan following consultation with the BLM. The BLM has provided a Bald

Eagle Management Plan (Attachment 3) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Bald Eagle Management Plan as presented in Attachment 3, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Bald Eagle Management Plan shall be implemented.

Condition No. 9 – Annual Review of Special-Status Species Lists and Assessment of New Species on Federal Land

Licensee shall consult with BLM within 3 months, after license issuance, and annually thereafter during the annual consultation meeting, to review the current list of special-status plant and wildlife species (species that are Federally Endangered or Threatened, Proposed Threatened or Endangered, BLM Sensitive, State Threatened or Endangered, State Species of Special Concern, and CDFW Fully Protected) that might occur on public land administered by BLM in the Project area that may be directly or indirectly affected by Project operations.

When a species is added to one or more of the lists, BLM shall determine if the species, or unsurveyed suitable habitat for the species, is likely to occur on public land administered by BLM in or around the Project area. For any such newly added species, if BLM determines that the species is likely present on public land administered by BLM that may be directly or indirectly affected by the Project, Licensee shall develop and implement a study plan in consultation with BLM, and other appropriate agencies, to reasonably assess the effects of the Project on the species. Licensee shall prepare a report on the study, including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide a draft of the final report to BLM and other appropriate agencies for review and approval. Licensee shall file the report, including evidence of consultation, with the Commission and shall implement those resource management measures required by the Commission.

If new occurrences of BLM special status plant or wildlife species as defined above are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM. If BLM determines that the Project-related activities are adversely affecting BLM sensitive or watch list species, Licensee shall, in consultation with BLM, develop and implement appropriate protection measures.

If new occurrences of state or federally listed or proposed threatened or endangered species are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM, FERC, and the relevant agency (USFWS or NMFS) for consultation or conference in accordance with the Endangered Species Act (USFWS 1988). If state listed or fully protected species are affected, CDFW shall be notified.

Threatened, Endangered, and Sensitive Species Objectives:

The following resource objectives are drawn from the BLM Sierra Resource Management Plan (RMP) and other relevant BLM regulations and documents (see References section).

- Ensure that proposed license conditions and recommended measures provide for well distributed, viable populations of special status species including threatened, endangered and BLM sensitive species, and are consistent with any applicable biological opinion issued under the federal or state Endangered Species Act (ESA). Ensure that proposed license conditions and recommended measures comply with BLM plans and policy.
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species.
- Manage special status species habitat to assist in the recovery of listed species.
- Maintain or improve habitat for special status species.
- Coordinate with the USFWS on implementation of recovery plans and conservation strategies for special status species.
- Manage sensitive species to ensure that species do not become threatened or endangered.
- Maintain and restore habitat to support viable populations of TES species. Work cooperatively to reduce impacts to native populations where invasive species are adversely affecting the viability of native species.
- Avoid impact to species designated as fully protected under FGC sections 3511(b) and 4700(b).
- Avoid or minimize impacts to species whose viability has been identified as a concern.
- If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
- Conserve ESA-listed species and the ecosystems on which they depend and to the extent possible recover these species so that ESA protection is no longer needed (BLM 2012).
- Minimize the effects of stream diversion or other flow modifications from hydroelectric projects on threatened, endangered, or sensitive species.
- Monitor populations and habitats of federally listed and BLM sensitive plant species to determine whether management objectives are being met (BLM 2012).
- Develop site-specific management objectives for each occurrence of listed threatened and endangered plant species and BLM sensitive plant species on BLM lands that will be affected by BLM actions (BLM 2012).

- Modify proposed actions, to the extent possible, to avoid adverse impacts to special status plant species; where avoidance is not possible, develop measures to mitigate impacts to these species (BLM 2012).
- Conduct inventories to determine the occurrence and status of all special status plant species on lands managed by BLM or affected by BLM actions to ensure compliance with NEPA and the ESA by having sufficient information to adequately assess the effects of proposed actions on special status plants. Inventories are to be conducted at the time of year when such plant species can be found and positively identified (BLM 2012).

Condition No. 10 – Licensee Contacts

The Licensee shall designate an individual as its liaison with BLM, whenever planning or construction of recreation facilities, other major Project improvements, or Project-related maintenance activities are taking place on BLM lands. The Licensee agrees to coordinate with BLM through this individual in contract review and work inspection.

Condition No. 11 – Annual Recreation Coordination Meeting

Each year during the term of the license, Licensees shall meet with BLM for an Annual Recreation Coordination Meeting to discuss the measures needed to ensure use and management, public safety, and protection and utilization of the recreation facilities and resources on BLM land. The date of the meeting will be mutually agreed to by Licensees and BLM but, in general, will be held within the first 90 days of each calendar year. A detailed agenda will be provided to BLM when the meeting date is proposed to assure that the appropriate parties are present.

The following will be discussed, at a minimum:

- Need for garbage collection based on the results of visitor surveys, evidence that wildlife is becoming habituated, and the status of garbage and litter left on site by users.
- Need for toilet facilities where dispersed camping is occurring will be discussed at least every 6 years (following submittal of Monitoring Report from the Recreation Resource Management Plan), and more frequently if warranted.
- Report on significant changes in sanitation issues and number and size of user-created dispersed camping areas.
- Other O&M issues identified by BLM or Licensees.
- Schedule and invite BLM to any recreation resource impact field evaluations and facility condition assessments to be conducted on BLM lands.
- Significant issues raised by the public.
- Any Licensee proposal for new or increases in recreation fees on BLM lands to help cover the costs of recreation facility construction, operation, and

maintenance, as allowed by FERC regulations, will be discussed for consideration and approval by BLM.

- Recreation use data that is available from Licensee or the BLM, which includes summary data, at a minimum; and, upon request, raw data.
- Licensees will provide BLM a copy of all documentation associated with FERC inspections of Project recreation facilities and use on BLM lands, including follow-up action taken by the Licensees.
- Status of recreation projects from the previous year, including rehabilitation of existing recreation facilities, the establishment of new recreation facilities, and any other recreation measures or programs that were implemented.
- List of the recreation facilities scheduled for rehabilitation and any other Recreation Facilities Plan measures or programs to be implemented, including:
    - Logistical and coordination planning.
    - Implementation schedule.
    - Coordination needs.
    - Permitting requirement.
    - Key resources that will need to be protected from potential impacts associated with the implementation of the scheduled recreation projects.
    - Potential adjustments in schedule.
- Licensees and BLM will identify any coordination needed with other projects being implemented in the area. Permitting requirements, additional required environmental documentation and key resources that will need to be protected from potential impacts associated with the implementation of the scheduled recreation projects will be addressed. Licensees shall submit for BLM approval any revisions to the Project's Recreation Facilities Plan schedule when BLM land is involved, and the revised schedule will be submitted to FERC. Within 60 days following the meeting, Licensees will file with FERC evidence of the meeting, which will summarize comments made by the agencies, and Plan revisions or other agreements that were reached by Licensees and the agencies. The Annual Recreation Coordination Meeting is a minimum requirement and it is anticipated that meetings may occur throughout each year as needed to implement the Recreation Facilities Plan.

Any adjustments in specific actions or schedules shall be approved by BLM and filed with FERC.

Condition No. 12 –

Intentionally omitted.

Condition No. 13 – Wards Ferry/Tuolumne River Take-Out Management Plan

No later than one year after license issuance, Licensees shall develop and submit to the Commission for approval a Wards Ferry/Tuolumne River Take-Out Management Plan ("Take-Out Plan"). Licensees shall submit the Take-Out Plan to BLM for review and approval before submission to the Commission. BLM's approval shall not be (1) unreasonably delayed or withheld, or (2) made conditional on Licensees agreeing to materially greater improvements, features, functions, or terms beyond those listed below. Licensees have the option to delay submission of the Take-Out Plan to the Commission until one year after the earlier of: (1) December 31, 2025; (2) the National Marine Fisheries Service's ("NMFS") and the U.S. Fish and Wildlife Service's ("FWS") confirmation of their respective decisions not to exercise their Federal Power Act Section 18 reservation of authority to prescribe fishways at the Project; or (3) NMFS' and FWS' respective exercise of such reservation of authority in a manner not significantly impacting the construction and utilization of the improvements at Wards Ferry. Licensees shall begin implementing the Take-Out Plan no later than one year after Commission approval of the Take-Out Plan and shall complete construction within five years of Commission approval of the Take-Out Plan, unless an extension is requested and approved by BLM and the Commission.

Take-Out Plan Components:

- Construction and maintenance of an elevated hoisting platform located on river left approximately 300 feet upstream from Wards Ferry Bridge (left and right determined by facing downstream on the Tuolumne River). The hoisting platform shall be sized and suitable to support no less than two and no more than three truck-mounted cranes and associated vehicles to allow commercial equipment and commercial boat extraction to occur. Licensees shall install and maintain signage to dissuade any use of the platform by non-boating users and non-commercial boating users.
- Construction and maintenance of an access road, approximately 12 feet wide, depending on site conditions, extending from Wards Ferry Road to the elevated platform for truck access to the platform. The access road shall have clear space, meaning no objects will intrude into the road path, and the river-facing side of the access road will have at least a three-foot high barrier. The other side of the access road will have a curb or, where Licensees believe site conditions warrant, barriers.
- Removal of the existing vault toilet on river left, and construction of a new, ADA-compliant two-vault toilet on river right. Licensees shall regularly clean and maintain the toilet facility during the May 1 – October 15 period. Licensees will provide keys to commercial rafting companies so that the toilet can be made available to commercial and private boaters during the afternoon hours when boaters are offloading at Wards Ferry during the May 1 – October 15 period.

- Improvement or creation, and maintenance, of pedestrian access trails on river left to facilitate egress from the river by commercial outfitter customers, employees, and guides. This includes the existing switchback trail on BLM land located downstream from the proposed platform and a new trail located upstream from the platform to allow commercial outfitter customers to reach the platform area. Trails shall be constructed and/or hardened. Hardening in this case shall consist of smoothing rock surfaces and/or adding spaced water bars but shall not include adding concrete or asphalt. Trails above elevation 830 feet shall be up to 10 feet wide, depending on site conditions. Trails below elevation 830 feet shall be up to 6 feet wide, depending on site conditions.
- Improvement and maintenance of pedestrian access trails on river right to facilitate egress from the river by private boaters. Trails shall be constructed and/or hardened. Hardening in this case shall consist of smoothing rock surfaces and/or adding spaced water bars but shall not include adding concrete or asphalt. Trails above elevation 830 feet to the service road described below shall be up to 10 feet wide, depending on site conditions. Trails below elevation 830 feet shall be up to 6 feet wide, depending on site conditions, start at approximately 770 feet elevation, and end near the former Wards Ferry Road bridge abutment.
- Construction and maintenance on river right of one gravel vehicular service road for private boaters. The service road shall be from 10-12 feet wide, depending on site conditions, and shall extend from the interface area described below to elevation 835-840 feet (extending upstream 250-350 feet from Wards Ferry Road). At or near the upstream terminus of the service road, Licensees shall construct an apron or spur sufficient to allow automobiles and pickup trucks with no more than two axles to execute three-point turns. The service road shall have clear space, meaning no objects will intrude into the road path. The river-facing side of the service road will have at least a three-foot high barrier. The other side of the service road will have a curb or, where Licensees believe site conditions warrant, barriers.
- Hardening, either through laying asphalt or adding gravel, and maintenance of the interface between Wards Ferry Road and the new service road on river right to permit a bus/vehicle capable of holding 20-30 passengers to pull off of Wards Ferry Road. The interface shall be designed not to interfere with the service road for private boaters or with access to the vault toilet. Licensees shall not be responsible for ensuring that private boaters or third parties do not interfere with the commercial rafters' use of the interface area.
- Enhancement and maintenance of 4-8 parking spaces, if such spaces reasonably can be improved compliant with State, Federal, and local requirements, utilizing currently available parking pullout locations on each side of the river downstream

of Wards Ferry Bridge on Wards Ferry Road. Enhancements should include hardened surfaces (up to or including asphalt), parking space indicators to maximize parking utilization, and berms/barriers to prevent vehicle entry into the reservoir, but shall not require the construction of retaining walls or placement of fill material. The design and exact location for these spaces must be coordinated with BLM and Tuolumne County. This element can be fulfilled through a program under which Licensees pay Tuolumne County for the enhancement and maintenance of the parking spaces.

- Licensees shall facilitate the operation and maintenance of these Wards Ferry take-out facilities by providing for the proper personnel to coordinate the safe and effective use of such resources. This element can be fulfilled through the establishment of a program under which Licensees provide annual funding to Tuolumne County or other appropriate entities for such services in the vicinity of Wards Ferry Bridge.
- Any facilities required to be constructed by this Condition No. 13 shall not be subject to Condition No. 14. The Take-Out Plan shall not be subject to Condition No. 39. Condition No. 19 shall only apply to any post-construction changes to those facilities.

Condition No. 14 – Recreation Resource Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Recreation Resource Management Plan following consultation with the BLM. The BLM has provided a Recreation Resource Management Plan (Attachment 4) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Recreation Resource Management Plan as presented in Attachment 4, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Recreation Resource Management Plan shall be implemented.

Condition No. 15 – Historic Properties Management Plan

Upon the Commission approval, Licensee shall implement the Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC.

Condition No. 16 - Transportation System Management Plan

Within one year of license issuance, Licensees shall file a BLM approved Transportation System Management Plan for the BLM land within the FERC Project Boundary. Upon Commission approval, Licensees shall implement the Transportation System Management Plan.

Condition No. 17 – Fire Prevention and Response Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Fire Prevention and Response Management Plan following consultation with the BLM. The BLM has

provided a Fire Prevention and Response Management Plan (Attachment 5) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Fire Prevention and Response Management Plan as presented in Attachment 5, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Fire Prevention and Response Management Plan shall be implemented.

Condition No. 18 – Visual Resources Management Plan

Within one year of license issuance, Licensees shall develop and implement a Visual Resources Management Plan on BLM-administered lands that are within the FERC Project boundary. Licensees must acquire BLM approval before submitting the Visual Resources Management Plan for Commission approval. Upon the Commission approval, Licensees shall implement a Visual Resources Management Plan.

BLM PRELIMINARY 4(e) ADMINISTRATIVE CONDITIONS

The following Section 4(e) Conditions include requirements that serve to address the statutory and administrative rights and responsibilities of the BLM pursuant to Federal, State, and local laws.

Condition No. 19 – Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes directly affect BLM lands the Licensee shall obtain written approval from BLM prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from BLM, and a minimum of 60 days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of BLM for such changes. The Licensee shall file an exact copy of this report with BLM at the same time it is filed with the Commission.

Condition No. 20 – Maintenance of Improvements on or Affecting Bureau of Land Management Lands

The Licensee shall maintain all its improvements and premises on BLM lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to BLM. Disposal of all materials will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 21 – Existing Claims

The License shall be subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 22 – Compliance with Regulations

The Licensee shall comply with the regulations of the Department of the Interior on BLM lands for activities on BLM lands, and all applicable Federal, State, county, and

municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting BLM lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 23 – Surrender of License or Transfer of Ownership

Prior to any surrender of this License, the Licensee shall provide assurance acceptable to BLM that Licensee shall restore any Project area directly affecting BLM lands to a condition satisfactory to BLM upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan which shall identify the measures to be taken to restore such BLM lands and shall include or identify adequate financial mechanisms to ensure performance of the restoration measures.

In the event of any transfer of the License or sale of the Project, the Licensee shall assure that, in a manner satisfactory to BLM, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by BLM to assist it in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by BLM, to estimate the potential costs associated with surrender and restoration of any Project area directly affecting BLM lands to BLM specifications. In addition, BLM may require the Licensee to pay for an independent audit of the transferee to assist BLM in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 24 – Protection of United States Property

The Licensee, including any agents or employees of the Licensee acting within the scope of their employment, shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this License.

Condition No. 25 – Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

The Licensee’s indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire

suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee's obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 26 – Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or operation of the Project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to BLM lands shall be determined in accordance with the Federal Power Act and standard Form L-1 Articles 22 and 24.

Condition No. 27 – Risks and Hazards on Bureau of Land Management Lands

As part of the occupancy and use of the Project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting BLM lands within the Project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any nonemergency actions to abate such hazards on BLM lands shall be performed after consultation with BLM. In emergency situations, the Licensee shall notify BLM of its actions as soon as possible, but not more than 48 hours after such actions have been taken. Whether or not BLM is notified or provides consultation, the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 28 – Protection of Bureau of Land Management Special Status Species

Before taking actions to construct new Project features on BLM lands that were not addressed in the Commission's NEPA processes for relicensing that may affect BLM threatened and endangered species or BLM special status species or their critical habitat, the Licensee shall prepare and submit a biological evaluation (BE) for BLM approval. The BE shall evaluate the potential impact of the action on the species or its habitat. In coordination with the Commission, BLM may require mitigation measures for the protection of the affected species.

The biological evaluation shall:

- Include procedures to minimize adverse effects to threatened and endangered species and special status species and their critical habitat.

- Include information on the current status of the special-status species within the project area, a full description of the Project and potential effects, if BLM determines that existing information is out of date.
- Ensure project-related activities shall meet restrictions included in site management plans for threatened and endangered species and special-status species and their habitat.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 29 – Access

Subject to the limitations set forth under the heading of "Access By The United States" in Condition No. 29 hereof, BLM reserves the right to use or permit others to use any part of the licensed area on BLM lands for any purpose, provided such use does not interfere with the rights and privileges authorized by this license or the Federal Power Act.

Condition No. 30 – Crossings

The Licensee shall maintain suitable crossings as required by BLM for all roads and trails that intersect the right-of-way occupied by linear Project facilities (power lines, penstocks, ditches, and pipelines).

Condition No. 31 – Surveys, Land Corners

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on BLM lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of BLM. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 32 – Pesticide-Use Restrictions on Bureau of Land Management Lands

Pesticides may not be used on BLM lands or in areas affecting BLM lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of BLM. During the Annual Consultation Meeting described in Condition No. 1, the Licensee shall submit a request for approval of planned uses of pesticides for the upcoming year. The Licensee shall provide at a minimum the following information essential for review:

- whether pesticide applications are essential for use on BLM lands;
- specific locations of use;
- specific herbicides proposed for use;

- application rates;
- dose and exposure rates; and
- safety risk and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

Any pesticide use that is deemed necessary to use on BLM lands within 500 feet of known locations of western pond turtles, California red-legged frog, or known locations of BLM Special Status or culturally significant plant populations will be designed to avoid adverse effects to individuals and their habitats. Application of pesticides must be consistent with BLM riparian conservation objectives.

On BLM lands, the Licensee shall only use those materials registered by the U.S. Environmental Protection Agency and consistent with those applied by BLM and approved through BLM review for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers. The Licensee may also submit Pesticide Use Proposal(s) with accompanying risk assessment and other BLM required documents to use pesticides on a regular basis for the term of the license as addressed further in Condition No. 7 – Terrestrial Resources Management Plan. Submission of this plan will not relieve the Licensee of the responsibility of annual notification and review.

Condition No. 33 – Modifications of 4(e) Conditions after Biological Opinion or Water Quality Certification

BLM exercises its 4(e) authority by reserving that authority to modify these conditions, if necessary, to respond to any Final Biological Opinion issued for this Project by the National Marine Fisheries Service, United States Fish and Wildlife Service; or any Certification issued for this Project by the State Water Resources Control Board.

Condition No. 34 – Signs

The Licensee shall consult with BLM prior to erecting signs related to safety issues on BLM lands covered by the License. Prior to the Licensee erecting any other signs or advertising devices on BLM lands covered by the License, the Licensee must obtain the approval of BLM as to location, design, size, color, and message. The Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

Condition No. 35 – Ground Disturbing Activities

If the Licensee proposes ground-disturbing activities on or directly lands that were not specifically addressed in the Commission's NEPA processes, the Licensee, in consultation with BLM, shall determine the scope of work and potential for Project-related effects, and whether additional information is required to proceed with the planned activity. Upon BLM request, the Licensee shall enter into an agreement with

BLM under which the Licensee shall fund a reasonable portion of BLM staff time and expenses related to the proposed activities.

Condition No. 36 – Use of Bureau of Land Management Roads for Project Access

The Licensee shall obtain suitable authorization for all project access roads and BLM roads needed for Project access. The term of the permit shall be the same as the term of the License. The authorization shall require road maintenance and cost sharing in reconstruction commensurate with the Licensees' use and project-related use. The authorization shall specify road maintenance and management standards that provide for traffic safety, minimize erosion and damage to natural resources, and that are acceptable to BLM.

The Licensee shall pay BLM for its share of maintenance costs or perform maintenance or other agreed to services, as determined by BLM for all use of roads related to project operations, project-related public recreation, or related activities. The maintenance obligation of the Licensee shall be proportionate to total use and commensurate with its use. Any maintenance to be performed by the Licensee shall be authorized by and shall be performed in accordance with an approved maintenance plan and applicable BMPs. In the event a road requires maintenance, restoration, or reconstruction work to accommodate the Licensee's needs, the Licensee shall perform such work at its own expense after securing BLM authorization.

The Licensee shall complete a condition survey and a proposed maintenance plan subject to BLM review and approval as appropriate once each year. The plan may take the format of a road maintenance agreement provided all of the above conditions are met as well as the conditions set forth in the proposed agreement.

In addition, all BLM roads used as Project Access roads and Right-of-Way access roads shall:

- Have a current condition survey.
- Be mapped at a scale to allow identification of specific routes or segments.
- Have BLM assigned road numbers to be used for reference on the maps, tables, and in the field.
- Have GIS compatible files of GPS alignments of all roads used for Project access be provided to BLM.
- Have adequate signage installed and maintained by the Licensee at each road or route, identifying the road by BLM road number.

Condition No. 37 – Access By The United States

The United States shall have unrestricted use of any road over which the Licensee has control within the project area for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of Federal lands or resources. When needed for the protection, administration, and management of Federal lands or resources the United States shall have the right to extend rights and

privileges for use of the right-of-way and road thereon to States and local subdivisions thereof, as well as to other users. The United States shall control such use so as not to unreasonably interfere with the safety or security uses, or cause the Licensee to bear a share of costs disproportionate to the Licensee's use in comparison to the use of the road by others.

Condition No. 38 – Road Use

The Licensee shall confine all vehicles being used for project purposes, including but not limited to administrative and transportation vehicles and construction and inspection equipment, to roads or specifically designed access routes, as identified in the Transportation System Management Plan (Condition No. 16). BLM, as appropriate, reserves the right to close any and all such routes where damage is occurring to the soil or vegetation, or, if requested by Licensee, to require construction by the Licensee to the extent needed to accommodate the Licensee's use. BLM agrees to provide notice to the Licensee and the Commission prior to road closures, except in an emergency, in which case notice will be provided as soon as practicable.

Condition No. 39 – Bureau of Land Management Approval of Final Design

Before any new construction of the Project occurs on Bureau of Land Management lands, the Licensee shall obtain prior written approval of BLM for all final design plans for Project components, which BLM deems as affecting or potentially affecting Bureau of Land Management lands within the Project boundary. The Licensee shall follow the schedules and procedures for design review and approval specified in the conditions herein. As part of such written approval, BLM may require adjustments to the final plans and facility locations to preclude or mitigate impacts and to insure that the Project is either compatible with on-the-ground conditions or approved by BLM based on agreed upon compensation or mitigation measures to address compatibility issues. Should such necessary adjustments be deemed by BLM, FERC, or the Licensee to be a substantial change, the Licensee shall follow the procedures of FERC Standard Article 2 of the license. Any changes to the license made for any reason pursuant to FERC Standard Article 2 or Article 3 shall be made subject to any new terms and conditions of the Secretary of Interior made pursuant to Section 4(e) of the Federal Power Act to address Project effects within the Project boundary.

Condition No. 40 – Unattended Construction Equipment

The Licensee shall not place construction equipment on BLM lands prior to actual use or allow it to remain on BLM lands subsequent to actual use, except for a reasonable mobilization and demobilization period agreed to by BLM.

Condition No. 41 – Maintenance of Improvements

The Licensee shall maintain the improvements and premises on BLM lands within the Project boundary and Licensee adjoining property to standards of repair, orderliness, neatness, sanitation, and safety. For example, trash, debris, and unusable machinery will be disposed of separately; other materials will be stacked, stored neatly, or placed within

buildings. Disposal will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 42 - Construction Inspections

Within 60 days of planned ground-disturbing activity on or affecting BLM lands, Licensee shall file with the Commission a Safety During Construction Plan that identifies potential hazard areas and measures necessary to address public safety. Areas to consider include construction activities near public roads, trails, and recreation areas and facilities.

Licensee shall perform daily (or on a schedule otherwise agreed to by BLM in writing) inspections of Licensee's construction operations on BLM lands and Licensee adjoining property while construction is in progress. Licensee shall document these inspections (informal writing sufficient) and shall deliver such documentation to BLM on a schedule agreed to by BLM. The inspections must specifically include fire plan compliance, public safety, and environmental protection. Licensee shall act immediately to correct any items found which need correction.

A registered professional engineer or other qualified employee of the appropriate specialty shall regularly conduct construction inspections of structural improvements on a schedule approved by BLM.

Condition No. 43 - Hazardous Substances Plan

Within 1 year of license issuance or prior to undertaking activities on BLM lands the Licensee shall file with FERC a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup. In addition, during planning and prior to any new construction or maintenance not addressed in an existing plan, the Licensee shall notify BLM and these entities shall make a determination whether a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup is needed. Any such plan shall be filed with FERC.

At a minimum, the plan must require the Licensee to (1) maintain in the Project area, a cache of spill cleanup equipment suitable to contain any spill from the Project; (2) to periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the Project area; and (3) to inform BLM immediately of the magnitude, nature, time, date, location, and action taken for any spill. The plan shall include a monitoring plan that details corrective measures that will be taken if spills occur. The plan shall include a requirement for a weekly written report during construction documenting the results of the monitoring.

Condition No. 44 - Use of Explosives

Use of explosives shall be consistent with state and local requirements.

1. The Licensee shall use only electronic detonators for blasting on BLM lands and Licensee adjoining property, except near high-voltage powerlines. BLM may allow specific exceptions when in the public interest.

2. In the use of explosives, the Licensee shall exercise the utmost care not to endanger life or property and shall comply with the requirements of BLM. The Licensee shall contact BLM prior to blasting to obtain the requirements from BLM. The Licensee shall be responsible for any and all damages resulting from the use of explosives and shall adopt precautions to prevent damage to surrounding objects. The Licensee shall furnish and erect special signs to warn the public of the Licensee's blasting operations. The Licensee shall place and maintain such signs so they are clearly evident to the public during all critical periods of the blasting operations and shall ensure that they include a warning statement to have radio transmitters turned off.
3. The Licensee shall store all explosives on BLM lands in a secure manner, in compliance with State and local laws and ordinances, and shall mark all such storage places “DANGEROUS - EXPLOSIVES.” Where no local laws or ordinances apply, the Licensee shall provide storage that is satisfactory to BLM and in general not closer than 1,000 feet from the road or from any building or camping area.
4. When using explosives on BLM lands, the Licensee shall adopt precautions to prevent damage to landscape features and other surrounding objects. When directed by the BLM, the Licensee shall leave trees within an area designated to be cleared as a protective screen for surrounding vegetation during blasting operations. The Licensee shall remove and dispose of trees left when blasting is complete. When necessary, and at any point of special danger, the Licensee shall use suitable mats or some other approved method to smother blasts.

APPENDIX E

U.S. Bureau of Land Management Preliminary Conditions
for the La Grange Project

PRELIMINARY RECOMMENDATIONS, TERMS AND CONDITIONS FOR THE LA GRANGE HYDROELECTRIC PROJECT (FEDERAL ENERGY REGULATORY COMMISSION PROJECT NO. 14581)

The BLM through its preliminary recommendations, terms and conditions and prescriptions seeks to ensure appropriate levels of resource protection are incorporated in any new license. The BLM recommends that the FERC include in any new license issued for the La Grange Hydroelectric Project 14581 the following BLM preliminary recommendations, terms and conditions. The BLM believes this comprehensive framework provides for the sustainable management and conservation of the natural resources of the Tuolumne watershed. This framework is within the context of agency statutory authorities under the FPA and other applicable laws. The agencies intent is to issue their protection, mitigation and enhancement measures, terms and conditions, and recommendations consistent with this framework.

Condition No. 1 – Consultation

Licensee shall annually consult with BLM regarding license implementation. Licensee shall set an agreed upon date beginning in the first full calendar year of the new license term and each year thereafter, meet with BLM at the MID office in Modesto, California, to discuss past and current year implementation of the license conditions affecting BLM land. The meeting will be open to the public, except during those parts of the meeting when confidential information (e.g., cultural resources or specific location of ESA-listed species) is discussed. In those instances, only Licensee and appropriate agencies shall be allowed to be in attendance. At least 30 days in advance of the meeting, Licensee shall notify via email or other written means BLM and other interested stakeholders (interested stakeholders are defined as anyone who sends a letter or email to the Licensee requesting to be a part of the consultation group). Any organized group will select an individual to represent them and will notify the Licensee who their representative will be when they are attending these meetings, confirming the meeting location, time and agenda. At the same time, Licensee shall also provide notice to the: United States Fish and Wildlife Service (USFWS); National Park Service (NPS); National Marine Fishery Service (NMFS); California State Department of Fish and Wildlife (CDFW); and the State Water Resources Control Board (SWRCB) who may choose to participate in the meeting.

Three weeks prior to each annual meeting, Licensee shall make available to BLM, interested stakeholders, and the agencies listed above an operations and maintenance plan for project activities that may affect BLM land for the calendar year in which the meeting occurs.

The purposes of the meeting are to conduct discussions about forthcoming year's operations and maintenance plans that may affect BLM land; to have the Licensee present results from the past/current year monitoring, as well as any additional information that has been compiled for the project area including progress reports on any

other issues related to preserving and protecting ecological values affected by the Project on or affecting BLM land; to share information on mutually agreed upon planned maintenance activities on or affecting BLM land; to identify concerns that BLM may have regarding project operations/activities and their potential effects on sensitive resources on or affecting BLM land, any measures required to avoid or mitigate those potential effects; and review and discuss the results of implementing La Grange Hydroelectric Projects -related conditions on or affecting BLM land.

Consultation shall include, but is not limited to, the items listed below as they pertain to project-effects on or affecting BLM land:

- A status report regarding implementation of license conditions.
- Discussion on any conditions that were not implemented, rationale on why they didn't get implemented, and when will they be implemented.
- Results of any monitoring studies performed over the previous year in formats agreed to by BLM and Licensee during development of implementation plans.
- Review of any non-routine maintenance.
- Discussion of any foreseeable changes to project facilities or features.
- Discussion of any necessary revisions or modifications to resource implementation plans approved as part of this license.
- Discussion of needed protection measures for species newly listed as threatened, endangered, or sensitive, or changes to existing management plans that may no longer be warranted due to de-listing of species or, to incorporate new knowledge about a species requiring protection.
- Discussion of needed protection measures for newly discovered cultural resource sites.
- Discussion of elements of current year maintenance plans, e.g. road and trail maintenance.
- Discussion of any proposed pesticide use.
- Discussion of BLM identified concerns regarding project operations/activities and their potential effects on sensitive resources, and any measures required to avoid or mitigate those potential effects.
- Discussion of information on mutually agreed upon planned maintenance activities.
- Discussion on upcoming permitted events that are scheduled for the year.
- Discussion on any planned burning activities on BLM land.
- Discussions on other issues regarding project effects on BLM land.

A record of the meeting shall be kept by Licensee and shall include any recommendations made by BLM for the protection of BLM land and resources. Licensee shall file the meeting record, if requested, with FERC no later than 60 days following the meeting.

A copy of the reports/records/studies on or affecting BLM land from the previous water year shall be provided to BLM by Licensee at least 90 days prior to the meeting date, unless otherwise agreed.

Copies of other non-CEII reports including, but not limited to, monitoring reports, non-compliance reports filed by Licensee, geologic or seismic reports, and structural safety reports for facilities affecting or on BLM land shall be submitted to BLM concurrently with submittal to the FERC, with the goal of providing the material to BLM no later than 90 days in advance of the annual meeting.

During the first several years of license implementation, it is likely that more consultation than just one annual meeting will be required, given the complexity of the project and the acreage of BLM land affected by project operations.

BLM will be included to be a participant on Technical Committees that focus on anadromous fish, inter-related resident fish and other ecological topics and issues that may have a direct or indirect effect on BLM managed lands. The Technical Committees shall develop a technical advisory plan or process for ground rules for decision making and implementing decisions. Members of the committee will include those agencies with direct management responsibilities for lands (riparian, wetland, recreation, fisheries, aquatics, water temperature and water quality), and the selection of an appropriate non-governmental representative. The Technical Committee will be finalized within one year of license issuance.

Condition No. 2 – Annual Employee Training

Licensee shall, beginning in the first full calendar year after license issuance, annually perform employee awareness training, and shall also perform such training when a staff member is first assigned to the Project. The goal of the training shall be to familiarize Licensees' Operations and Maintenance (O&M) staff with special-status species, non-native invasive plants, and sensitive areas (e.g., special-status plant populations and invasive plant locations) that are known to occur within or adjacent to the FERC Project Boundary. Licensee shall provide to each O&M staff a confidential map showing these sensitive areas, including GPS coordinates, as well as pictures and other guides to assist staff in recognizing special-status species, non-native, invasive plants, and sensitive areas. It is not the intent of this measure that Licensees' O&M staff perform surveys or become specialists in the identification of special-status species or noxious weeds. Licensee shall direct its O&M staff to avoid disturbance to sensitive areas, and to advise all Licensees' contractors to avoid sensitive areas. If Licensee determines that disturbance of a sensitive area is unavoidable, Licensee shall consult with BLM to minimize adverse effects to sensitive resources. This measure applies to employee training that is not otherwise covered by a specific plan.

Condition No. 3 – Erosion Control and Restoration Plan

Within one year of license issuance, Licensees shall develop and implement an Erosion Control and Restoration Plan for erosion and/or restoration actions to be carried out by

Licensees on or affecting BLM lands that are within or adjacent to the FERC Project boundary. Licensees must acquire BLM approval before submitting the Erosion Control and Restoration Plan for Commission approval. Licensees shall file the approved Erosion Control and Restoration Plan with the Commission at least 90-days in advance of initiating construction of recreation or other Project facilities. Upon Commission approval, Licensees shall implement the Erosion Control and Restoration Management Plan.

Condition No. 4 – Reservation of Authority to Modify 4(e) Conditions in the Event of Anadromous Fish Re-introduction

BLM exercises its 4(e) authority by reserving that authority to modify these conditions to respond to any reintroduction of Chinook salmon or steelhead trout, listed under the Endangered Species Act, to stream reaches through BLM lands where the flow is controlled by the La Grange Hydroelectric Project.

Condition No. 5 – Terrestrial Resources Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Terrestrial Resources Management Plan following consultation with the BLM. The BLM has provided a Terrestrial Resources Management Plan (Attachment 1) for implementation on BLM-administered lands within the FERC Project Boundary. If changes are made to the Terrestrial Resources Management Plan as presented in Attachment 1, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Terrestrial Resources Management Plan shall be implemented.

Condition No. 6 – Annual Review of Special-Status Species Lists and Assessment of New Species on Federal Land

Licensee shall consult with BLM within 3 months, after license issuance, and annually thereafter during the annual consultation meeting, to review the current list of special-status plant and wildlife species (species that are Federally Endangered or Threatened, Proposed Threatened or Endangered, BLM Sensitive, State Threatened or Endangered, State Species of Special Concern, and CDFW Fully Protected) that might occur on public land administered by BLM in the Project area that may be directly or indirectly affected by Project operations.

When a species is added to one or more of the lists, BLM shall determine if the species, or unsurveyed suitable habitat for the species, is likely to occur on public land administered by BLM in or around the Project area. For any such newly added species, if BLM determines that the species is likely present on public land administered by BLM that may be directly or indirectly affected by the Project, Licensee shall develop and implement a study plan in consultation with BLM, and other appropriate agencies, to reasonably assess the effects of the Project on the species. Licensee shall prepare a report on the study, including objectives, methods, results, recommended resource measures where appropriate, and a schedule of implementation, and shall provide a draft of the

final report to BLM and other appropriate agencies for review and approval. Licensee shall file the report, including evidence of consultation, with the Commission and shall implement those resource management measures required by the Commission.

If new occurrences of BLM special status plant or wildlife species as defined above are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM. If BLM determines that the Project-related activities are adversely affecting BLM sensitive or watch list species, Licensee shall, in consultation with BLM, develop and implement appropriate protection measures.

If new occurrences of state or federally listed or proposed threatened or endangered species are detected prior to or during ongoing construction, operation, or maintenance of the Project, Licensee shall immediately notify BLM, FERC, and the relevant agency (USFWS or NMFS) for consultation or conference in accordance with the Endangered Species Act (USFWS 1988). If state listed or fully protected species are affected, CDFW shall be notified.

Threatened, Endangered, and Sensitive Species Objectives:

The following resource objectives are drawn from the BLM Sierra Resource Management Plan (RMP) and other relevant BLM regulations and documents (see References section).

- Ensure that proposed license conditions and recommended measures provide for well distributed, viable populations of special status species including threatened, endangered and BLM sensitive species, and are consistent with any applicable biological opinion issued under the federal or state Endangered Species Act (ESA). Ensure that proposed license conditions and recommended measures comply with BLM plans and policy.
- Ensure all management activities and BLM authorizations are consistent with the conservation needs for special status species.
- Manage special status species habitat to assist in the recovery of listed species.
- Maintain or improve habitat for special status species.
- Coordinate with the USFWS on implementation of recovery plans and conservation strategies for special status species.
- Manage sensitive species to ensure that species do not become threatened or endangered.
- Maintain and restore habitat to support viable populations of TES species. Work cooperatively to reduce impacts to native populations where invasive species are adversely affecting the viability of native species.
- Avoid impact to species designated as fully protected under FGC sections 3511(b) and 4700(b).
- Avoid or minimize impacts to species whose viability has been identified as a concern.

- If impacts cannot be avoided, analyze the significance of potential adverse effects on the population or its habitat within the area of concern and on the species as a whole.
- Conserve ESA-listed species and the ecosystems on which they depend and to the extent possible recover these species so that ESA protection is no longer needed (BLM 2012).
- Minimize the effects of stream diversion or other flow modifications from hydroelectric projects on threatened, endangered, or sensitive species.
- Monitor populations and habitats of federally listed and BLM sensitive plant species to determine whether management objectives are being met (BLM 2012).
- Develop site-specific management objectives for each occurrence of listed threatened and endangered plant species and BLM sensitive plant species on BLM lands that will be affected by BLM actions (BLM 2012).
- Modify proposed actions, to the extent possible, to avoid adverse impacts to special status plant species; where avoidance is not possible, develop measures to mitigate impacts to these species (BLM 2012).
- Conduct inventories to determine the occurrence and status of all special status plant species on lands managed by BLM or affected by BLM actions to ensure compliance with NEPA and the ESA by having sufficient information to adequately assess the effects of proposed actions on special status plants. Inventories are to be conducted at the time of year when such plant species can be found and positively identified (BLM 2012).

Condition No. 7 – Historic Properties Management Plan

Upon the Commission approval, Licensee shall implement the Amended Historic Properties Management Plan that was included in the letter TID/MID filed with FERC.

Condition No. 8 – Public Access and Hiking Trail

Within 3 years of License issuance, the Licensee shall construct and maintain the following public recreation facilities on BLM land:

1. A 36-inch-wide trail that meets a grade of 5 - 8 percent or less from the parking area of La Grange Headquarters to the Tuolumne River.
2. A kiosk sign near the beginning of the trail, explaining the rules of the area.
3. Two picnic tables of coated wire mesh material in a level area that is above the Tuolumne River flood plain located near the shore of the river.

Condition No. 9 – Bald Eagle Management Plan

Within one year of license issuance, Licensees shall file a BLM-approved Bald Eagle Management Plan following consultation with the BLM. The BLM has provided a Bald Eagle Management Plan (Attachment 2) for implementation on BLM-administered lands

within the FERC Project Boundary. If changes are made to the Bald Eagle Management Plan as presented in Attachment 2, the modified plan shall be submitted to the BLM for review and approval prior to submitting the final plan to the Commission. Upon Commission approval, the Bald Eagle Management Plan shall be implemented.

PRELIMINARY 4(e) ADMINISTRATIVE CONDITIONS

The following Section 4(e) Conditions include requirements that serve to address the statutory and administrative rights and responsibilities of the BLM pursuant to Federal, State, and local laws.

Condition No. 10 – Approval of Changes

Notwithstanding any license authorization to make changes to the Project, when such changes directly affect BLM lands the Licensee shall obtain written approval from BLM prior to making any changes in any constructed Project features or facilities, or in the uses of Project lands and waters or any departure from the requirements of any approved exhibits filed with the Commission. Following receipt of such approval from BLM, and a minimum of 60 days prior to initiating any such changes, the Licensee shall file a report with the Commission describing the changes, the reasons for the changes, and showing the approval of BLM for such changes. The Licensee shall file an exact copy of this report with BLM at the same time it is filed with the Commission.

Condition No. 11– Maintenance of Improvements on or Affecting Bureau of Land Management Lands

The Licensee shall maintain all its improvements and premises on BLM lands to standards of repair, orderliness, neatness, sanitation, and safety acceptable to BLM. Disposal of all materials will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 12 – Existing Claims

The License shall be subject to all valid claims and existing rights of third parties. The United States is not liable to the Licensee for the exercise of any such right or claim.

Condition No. 13 – Compliance with Regulations

The Licensee shall comply with the regulations of the Department of the Interior on BLM lands for activities on BLM lands, and all applicable Federal, State, county, and municipal laws, ordinances, or regulations in regards to the area or operations on or directly affecting BLM lands, to the extent those laws, ordinances or regulations are not preempted by federal law.

Condition No. 14 – Surrender of License or Transfer of Ownership

Prior to any surrender of this License, the Licensee shall provide assurance acceptable to BLM that Licensee shall restore any Project area directly affecting BLM lands to a condition satisfactory to BLM upon or after surrender of the license, as appropriate. To the extent restoration is required, Licensee shall prepare a restoration plan which shall

identify the measures to be taken to restore such BLM lands and shall include or identify adequate financial mechanisms to ensure performance of the restoration measures.

In the event of any transfer of the License or sale of the Project, the Licensee shall assure that, in a manner satisfactory to BLM, the Licensee or transferee will provide for the costs of surrender and restoration. If deemed necessary by BLM to assist it in evaluating the Licensee's proposal, the Licensee shall conduct an analysis, using experts approved by BLM, to estimate the potential costs associated with surrender and restoration of any Project area directly affecting BLM lands to BLM specifications. In addition, BLM may require the Licensee to pay for an independent audit of the transferee to assist BLM in determining whether the transferee has the financial ability to fund the surrender and restoration work specified in the analysis.

Condition No. 15 – Protection of United States Property

The Licensee, including any agents or employees of the Licensee acting within the scope of their employment, shall exercise diligence in protecting from damage the land and property of the United States covered by and used in connection with this License.

Condition No. 16 - Indemnification

The Licensee shall indemnify, defend, and hold the United States harmless for:

- any violations incurred under any laws and regulations applicable to, or
- judgments, claims, penalties, fees, or demands assessed against the United States caused by, or
- costs, damages, and expenses incurred by the United States caused by, or
- the releases or threatened release of any solid waste, hazardous substances, pollutant, contaminant, or oil in any form in the environment related to the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license.

The Licensee’s indemnification of the United States shall include any loss by personal injury, loss of life or damage to property caused by the construction, maintenance, or operation of the Project works or of the works appurtenant or accessory thereto under the license. Indemnification shall include, but is not limited to, the value of resources damaged or destroyed; the costs of restoration, cleanup, or other mitigation; fire suppression or other types of abatement costs; third party claims and judgments; and all administrative, interest, and other legal costs. Upon surrender, transfer, or termination of the license, the Licensee’s obligation to indemnify and hold harmless the United States shall survive for all valid claims for actions that occurred prior to such surrender, transfer or termination.

Condition No. 17 – Damage to Land, Property, and Interests of the United States

The Licensee has an affirmative duty to protect the land, property, and interests of the United States from damage arising from the Licensee's construction, maintenance, or

operation of the Project works or the works appurtenant or accessory thereto under the license. The Licensee's liability for fire and other damages to BLM lands shall be determined in accordance with the Federal Power Act and standard Form L-1 Articles 22 and 24.

Condition No. 18 – Risks and Hazards on Bureau of Land Management Lands

As part of the occupancy and use of the Project area, the Licensee has a continuing responsibility to reasonably identify and report all known or observed hazardous conditions on or directly affecting BLM lands within the Project boundary that would affect the improvements, resources, or pose a risk of injury to individuals. Licensee will abate those conditions, except those caused by third parties or not related to the occupancy and use authorized by the License. Any non-emergency actions to abate such hazards on BLM lands shall be performed after consultation with BLM. In emergency situations, the Licensee shall notify BLM of its actions as soon as possible, but not more than 48 hours after such actions have been taken. Whether or not BLM is notified or provides consultation, the Licensee shall remain solely responsible for all abatement measures performed. Other hazards should be reported to the appropriate agency as soon as possible.

Condition No. 19 – Protection of Bureau of Land Management Special Status Species

Before taking actions to construct new Project features on BLM lands that were not addressed in the Commission's NEPA processes for relicensing that may affect BLM threatened and endangered species or BLM special status species or their critical habitat, the Licensee shall prepare and submit a biological evaluation (BE) for BLM approval. The BE shall evaluate the potential impact of the action on the species or its habitat. In coordination with the Commission, BLM may require mitigation measures for the protection of the affected species.

The biological evaluation shall:

- Include procedures to minimize adverse effects to threatened and endangered species and special status species and their critical habitat.
- Include information on the current status of the special-status species within the project area, a full description of the Project and potential effects, if BLM determines that existing information is out of date.
- Ensure project-related activities shall meet restrictions included in site management plans for threatened and endangered species and special-status species and their habitat.
- Develop implementation and effectiveness monitoring of measures taken or employed to reduce effects to special status species.

Condition No. 20 – Access

Subject to the limitations set forth under the heading of "Access By The United States" in Condition No. 20 hereof, BLM reserves the right to use or permit others to use any part of the licensed area on BLM lands for any purpose, provided such use does not interfere with the rights and privileges authorized by this license or the Federal Power Act.

Condition No. 21 – Crossings

The Licensee shall maintain suitable crossings as required by BLM for all roads and trails that intersect the right-of-way occupied by linear Project facilities (power lines, penstocks, ditches, and pipelines).

Condition No. 22 – Surveys, Land Corners

The Licensee shall avoid disturbance to all public land survey monuments, private property corners, and forest boundary markers. In the event that any such land markers or monuments on BLM lands are destroyed by an act or omission of the Licensee, in connection with the use and/or occupancy authorized by this license, depending on the type of monument destroyed, the Licensee shall reestablish or reference same in accordance with (1) the procedures outlined in the "Manual of Instructions for the Survey of the Public Land of the United States," (2) the specifications of the County Surveyor, or (3) the specifications of BLM. Further, the Licensee shall ensure that any such official survey records affected are amended as provided by law.

Condition No. 23 – Pesticide-Use Restrictions on Bureau of Land Management Lands

Pesticides may not be used on BLM lands or in areas affecting BLM lands to control undesirable woody and herbaceous vegetation, aquatic plants, insects, rodents, non-native fish, etc., without the prior written approval of BLM. During the Annual Consultation Meeting described in Condition No. 1, the Licensee shall submit a request for approval of planned uses of pesticides for the upcoming year. The Licensee shall provide at a minimum the following information essential for review:

- whether pesticide applications are essential for use on BLM lands;
- specific locations of use;
- specific herbicides proposed for use;
- application rates;
- dose and exposure rates; and
- safety risk and timeframes for application.

Exceptions to this schedule may be allowed only when unexpected outbreaks of pests require control measures that were not anticipated at the time the report was submitted. In such an instance, an emergency request and approval may be made.

Any pesticide use that is deemed necessary to use on BLM lands within 500 feet of known locations of western pond turtles, California red-legged frog, or known locations

of BLM Special Status or culturally significant plant populations will be designed to avoid adverse effects to individuals and their habitats. Application of pesticides must be consistent with BLM riparian conservation objectives.

On BLM lands, the Licensee shall only use those materials registered by the U.S. Environmental Protection Agency and consistent with those applied by BLM and approved through BLM review for the specific purpose planned. The Licensee must strictly follow label instructions in the preparation and application of pesticides and disposal of excess materials and containers. The Licensee may also submit Pesticide Use Proposal(s) with accompanying risk assessment and other BLM required documents to use pesticides on a regular basis for the term of the license as addressed further in Condition No. 5 – Terrestrial Resources Management Plan. Submission of this plan will not relieve the Licensee of the responsibility of annual notification and review.

Condition No. 24 – Modifications of 4(e) Conditions after Biological Opinion or Water Quality Certification

BLM exercises its 4(e) authority by reserving that authority to modify these conditions, if necessary, to respond to any Final Biological Opinion issued for this Project by the National Marine Fisheries Service, United States Fish and Wildlife Service; or any Certification issued for this Project by the State Water Resources Control Board.

Condition No. 25 – Signs

The Licensee shall consult with BLM prior to erecting signs related to safety issues on BLM lands covered by the License. Prior to the Licensee erecting any other signs or advertising devices on BLM lands covered by the License, the Licensee must obtain the approval of BLM as to location, design, size, color, and message. The Licensee shall be responsible for maintaining all Licensee-erected signs to neat and presentable standards.

Condition No. 26 – Ground Disturbing Activities

If the Licensee proposes ground-disturbing activities on or directly affecting BLM lands that were not specifically addressed in the Commission's NEPA processes, the Licensee, in consultation with BLM, shall determine the scope of work and potential for Project-related effects, and whether additional information is required to proceed with the planned activity. Upon BLM request, the Licensee shall enter into an agreement with BLM under which the Licensee shall fund a reasonable portion of BLM staff time and expenses related to the proposed activities.

Condition No. 27 – Use of Bureau of Land Management Roads for Project Access

The Licensee shall obtain suitable authorization for all project access roads and BLM roads needed for Project access. The term of the permit shall be the same as the term of the License. The authorization shall require road maintenance and cost sharing in reconstruction commensurate with the Licensees' use and project-related use. The authorization shall specify road maintenance and management standards that provide for

traffic safety, minimize erosion and damage to natural resources, and that are acceptable to BLM.

The Licensee shall pay BLM for its share of maintenance costs or perform maintenance or other agreed to services, as determined by BLM for all use of roads related to project operations, project-related public recreation, or related activities. The maintenance obligation of the Licensee shall be proportionate to total use and commensurate with its use. Any maintenance to be performed by the Licensee shall be authorized by and shall be performed in accordance with an approved maintenance plan and applicable BMPs. In the event a road requires maintenance, restoration, or reconstruction work to accommodate the Licensee's needs, the Licensee shall perform such work at its own expense after securing BLM authorization.

The Licensee shall complete a condition survey and a proposed maintenance plan subject to BLM review and approval as appropriate once each year. The plan may take the format of a road maintenance agreement provided all of the above conditions are met as well as the conditions set forth in the proposed agreement.

In addition, all BLM roads used as Project Access roads and Right-of-Way access roads shall:

- Have a current condition survey.
- Be mapped at a scale to allow identification of specific routes or segments.
- Have BLM assigned road numbers to be used for reference on the maps, tables, and in the field.
- Have GIS compatible files of GPS alignments of all roads used for Project access be provided to BLM.
- Have adequate signage installed and maintained by the Licensee at each road or route, identifying the road by BLM road number.

Condition No. 28 – Access By The United States

The United States shall have unrestricted use of any road over which the Licensee has control within the project area for all purposes deemed necessary and desirable in connection with the protection, administration, management, and utilization of Federal lands or resources. When needed for the protection, administration, and management of Federal lands or resources the United States shall have the right to extend rights and privileges for use of the right-of-way and road thereon to States and local subdivisions thereof, as well as to other users. The United States shall control such use so as not to unreasonably interfere with the safety or security uses, or cause the Licensee to bear a share of costs disproportionate to the Licensee’s use in comparison to the use of the road by others.

Condition No. 29 – Road Use

The Licensee shall confine all vehicles being used for project purposes, including but not limited to administrative and transportation vehicles and construction and inspection

equipment, to roads or specifically designed access routes. BLM, as appropriate, reserves the right to close any and all such routes where damage is occurring to the soil or vegetation, or, if requested by Licensee, to require construction by the Licensee to the extent needed to accommodate the Licensee's use. BLM agrees to provide notice to the Licensee and the Commission prior to road closures, except in an emergency, in which case notice will be provided as soon as practicable.

Condition No. 30 – Bureau of Land Management Approval of Final Design

Before any new construction of the Project occurs on Bureau of Land Management lands, the Licensee shall obtain prior written approval of BLM for all final design plans for Project components, which BLM deems as affecting or potentially affecting Bureau of Land Management lands within the Project boundary. The Licensee shall follow the schedules and procedures for design review and approval specified in the conditions herein. As part of such written approval, BLM may require adjustments to the final plans and facility locations to preclude or mitigate impacts and to insure that the Project is either compatible with on-the-ground conditions or approved by BLM based on agreed upon compensation or mitigation measures to address compatibility issues. Should such necessary adjustments be deemed by BLM, FERC, or the Licensee to be a substantial change, the Licensee shall follow the procedures of FERC Standard Article 2 of the license. Any changes to the license made for any reason pursuant to FERC Standard Article 2 or Article 3 shall be made subject to any new terms and conditions of the Secretary of Interior made pursuant to Section 4(e) of the Federal Power Act to address Project effects within the Project boundary.

Condition No. 31 – Unattended Construction Equipment

The Licensee shall not place construction equipment on BLM lands prior to actual use or allow it to remain on BLM lands subsequent to actual use, except for a reasonable mobilization and demobilization period agreed to by BLM.

Condition No. 32 – Maintenance of Improvements

The Licensee shall maintain the improvements and premises on BLM lands within the Project boundary and Licensee adjoining property to standards of repair, orderliness, neatness, sanitation, and safety. For example, trash, debris, and unusable machinery will be disposed of separately; other materials will be stacked, stored neatly, or placed within buildings. Disposal will be at an approved existing location, except as otherwise agreed to by BLM.

Condition No. 33 - Construction Inspections

Within 60 days of planned ground-disturbing activity on or affecting BLM lands, Licensee shall file with the Commission a Safety During Construction Plan that identifies potential hazard areas and measures necessary to address public safety. Areas to consider include construction activities near public roads, trails, and recreation areas and facilities.

Licensee shall perform daily (or on a schedule otherwise agreed to by BLM in writing) inspections of Licensee's construction operations on BLM lands and Licensee adjoining property while construction is in progress. Licensee shall document these inspections (informal writing sufficient) and shall deliver such documentation to BLM on a schedule agreed to by BLM. The inspections must specifically include fire plan compliance, public safety, and environmental protection. Licensee shall act immediately to correct any items found which need correction.

A registered professional engineer or other qualified employee of the appropriate specialty shall regularly conduct construction inspections of structural improvements on a schedule approved by BLM.

Condition No. 34 - Hazardous Substances Plan

Within 1 year of license issuance or prior to undertaking activities on BLM lands the Licensee shall file with FERC a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup. In addition, during planning and prior to any new construction or maintenance not addressed in an existing plan, the Licensee shall notify BLM and these entities shall make a determination whether a plan approved by BLM for oil and hazardous substances storage and spill prevention and cleanup is needed. Any such plan shall be filed with FERC.

At a minimum, the plan must require the Licensee to (1) maintain in the Project area, a cache of spill cleanup equipment suitable to contain any spill from the Project; (2) to periodically inform BLM of the location of the spill cleanup equipment on BLM lands and of the location, type, and quantity of oil and hazardous substances stored in the Project area; and (3) to inform BLM immediately of the magnitude, nature, time, date, location, and action taken for any spill. The plan shall include a monitoring plan that details corrective measures that will be taken if spills occur. The plan shall include a requirement for a weekly written report during construction documenting the results of the monitoring.

Condition No. 35 - Use of Explosives

Use of explosives shall be consistent with state and local requirements.

1. The Licensee shall use only electronic detonators for blasting on BLM lands and Licensee adjoining property, except near high-voltage powerlines. BLM may allow specific exceptions when in the public interest.
2. In the use of explosives, the Licensee shall exercise the utmost care not to endanger life or property and shall comply with the requirements of BLM. The Licensee shall contact BLM prior to blasting to obtain the requirements from BLM. The Licensee shall be responsible for any and all damages resulting from the use of explosives and shall adopt precautions to prevent damage to surrounding objects. The Licensee shall furnish and erect special signs to warn the public of the Licensee's blasting operations. The Licensee shall place and maintain such signs so they are clearly evident to the

public during all critical periods of the blasting operations and shall ensure that they include a warning statement to have radio transmitters turned off.

3. The Licensee shall store all explosives on BLM lands in a secure manner, in compliance with State and local laws and ordinances, and shall mark all such storage places “DANGEROUS - EXPLOSIVES.” Where no local laws or ordinances apply, the Licensee shall provide storage that is satisfactory to BLM and in general not closer than 1,000 feet from the road or from any building or camping area.
4. When using explosives on BLM lands, the Licensee shall adopt precautions to prevent damage to landscape features and other surrounding objects. When directed by the BLM, the Licensee shall leave trees within an area designated to be cleared as a protective screen for surrounding vegetation during blasting operations. The Licensee shall remove and dispose of trees left when blasting is complete. When necessary, and at any point of special danger, the Licensee shall use suitable mats or some other approved method to smother blasts.

APPENDIX F

California State Water Resources Control Board Preliminary Conditions for the Don Pedro and La Grange Projects

PRELIMINARY TERMS AND CONDITIONS FOR

DON PEDRO AND LA GRANGE HYDROELECTRIC PROJECTS

(FEDERAL ENERGY REGULATORY COMMISSION PROJECTS NOS. 2299 & 14581)

In accordance with the memorandum of understanding (MOU) executed between the Federal Energy Regulatory Commission (FERC) and the State Water Resources Control Board (State Water Board) on November 19, 2013, and to the extent that information is available, State Water Board staff is providing water quality certification (certification) preliminary terms and conditions in response to the notice of Ready for Environmental Analysis (REA) by FERC for the Don Pedro and La Grange Hydroelectric Projects (collectively, Projects), FERC Projects Nos. 2299 & 14581. The Projects are owned and operated by co-licensees Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, Districts). This document is strictly preliminary in nature, and is being sent to further coordination regarding information needs and potential conditions between FERC and the State Water Board. Contrary to other recent relicensing projects, State Water Board staff reserves full analysis of the impacts of all proposed Protection, Mitigation, and Enhancement measures until more coordination has taken place between the Districts and resource agencies. This document does not reflect a decision by the State Water Board to adopt any particular term or condition, nor does it limit the State Water Board's consideration of terms or conditions different from or in addition to those presented here.

1. **Minimum Instream Flows**

   The State Water Board will likely condition minimum instream flows in light of the whole record. The whole record includes, but is not limited to, the FERC record (including recommendations by resource agencies), the final National Environmental Policy Act (NEPA) document, the final California Environmental Quality Act (CEQA) document, the updated Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan), and the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan).

2. **Water Year Type Classification**

   The State Water Board will likely determine the criteria to classify water year types for the Projects-affected reaches. Water year type classification criteria for Projects-affected waters downstream of La Grange Dam will likely be based on the San Joaquin Valley 60-20-20 Index.

3. **Streamflow and Reservoir Level Compliance**

   The State Water Board will likely require the Districts to develop and implement a Stream Flow and Reservoir Level Compliance Plan to document compliance with

streamflow and reservoir level requirements in the new FERC license. At a minimum, this plan should include:

1. Locations where the Districts monitors streamflow and reservoir levels;
2. Equipment to be used by the Districts to monitor streamflow and reservoir levels in compliance with requirements of this certification;
3. A description of how the equipment used by the Districts to monitor streamflow and reservoir levels in compliance with the requirements of this certification is deployed, set (e.g., frequency of data collection), operated, calibrated, and maintained.
4. A description of how the data will be retrieved from the equipment used by the Districts to monitor compliance with the requirements in the certification related to streamflow and reservoir levels, including frequency of data downloads, quality assurance/quality control procedures, and data storage.
5. A description of how streamflow and reservoir level data are provided to the State Water Board.

4. Large Woody Material Management Plans

The State Water Board will likely require the Districts, in consultation with relevant resource agencies, to develop and implement a plan to address for the reduction of LWM downstream of La Grange Dam. The goal of this plan is to increase the amount of LWM below La Grange Dam in order to improve downstream aquatic habitat. The Districts shall consult with representatives from the boating community (e.g., American Whitewater) to ensure LWM placement in the river is not hazardous to boaters. The Districts may also be required to monitor the implementation and effectiveness of LWM augmentation and to submit associated reports to the Deputy Director. Best management practices (BMPs) should be developed to minimize the impact to beneficial uses (e.g., turbidity and wildlife) from LWM placement and installation.

This condition will recognize that it is subordinate to safety determinations by FERC and the California Division of Safety of Dams and shall include provisions related to safety concerns by other government entities.

5. Sediment Management Plans

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to facilitate coarse and fine sediment transport past La Grange Dam in the Tuolumne River. The goal of this plan is to replace sediment lost downstream of La Grange Dam in order to improve downstream habitat. The Districts may also be required to monitor implementation and effectiveness of the sediment augmentation and submit associated reports to the Deputy Director. BMPs should be developed to minimize

the impact to beneficial uses (e.g., turbidity and wildlife) from initial sediment placement.

6. Water Quality Monitoring Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to monitor water quality. This plan should include monitoring sites at the Projects' reservoirs and locations throughout affected river reaches. The monitoring sites should be adequately abundant and spatially distributed to provide data that measures potential impacts to water quality as a result of the Projects' operations. Water quality monitoring should occur at intervals during the license term to document trends in time and changes in water quality related to operational changes that may impact water quality or designated beneficial uses of water. This plan should consider in-situ, dissolved oxygen, recreation related water quality, and bioaccumulation monitoring components. If at any point monitoring suggests water quality conditions are in exceedance of Basin Plan water quality objectives, the Districts shall immediately notify the State Water Board and Central Valley Regional Water Quality Control Board.

7. Water Temperature Monitoring Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to monitor potential effects on water temperature from the Projects. The objective of this plan is to monitor water temperature in Don Pedro Reservoir, La Grange Pool, and Lower Tuolumne River. This plan should include an adequate number of sites to track the changes in water temperature stored in impoundments and released below impoundments. In flowing water, the Districts should install and anchor appropriate devices to continuously record water temperature seasonally or throughout the year. In reservoirs, the Districts should monitor water temperature and thermocline depth by profile sampling near the dam to determine reservoir stratification depths. Water temperature data will be used to help determine the effects of the Projects' operations on thermal conditions.

8. Aquatic Invasive Species Management Plan

The State Water Board will likely require the Districts, in consultation with relevant resource agencies, to develop and implement a plan to manage aquatic invasive species (AIS). The goal of this plan is to establish a framework with specific activities to minimize the spread and impact of AIS on native fauna and habitats. This plan should identify and describe AIS currently established within the Projects' area and AIS with high potential to become established within the Projects' area. This plan may include, but is not limited to, the following measures:

1. Implement actions to minimize and prevent the introduction and spread of AIS into and throughout Projects'-affected waters.
2. Provide education and outreach to ensure public awareness of AIS effects and management throughout Projects'-affected waters.
3. Implement monitoring programs for early detection of AIS.
4. Ensure all the Projects' AIS management activities comply with federal and State of California laws, regulations, policies, and management plans, and with Forest Service directives and orders regarding AIS.
5. Monitor and minimize the spread of established AIS.

9. Erosion and Sediment Control Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan to minimize undesirable erosion or sedimentation conditions near river reaches and reservoirs caused from the Projects' operations and maintenance. This plan should contain erosion and sediment reduction protocols for ground-disturbing activities that include, but are not limited to, routine operations, maintenance, any new construction, and recreation improvements. Protocols shall abide by applicable regulations and reduce impacts to water quality within the Projects' area.

10. Hazardous Material Plan

The State Water Board will likely require the Districts, in consultation with the relevant resource agencies, to develop and implement a plan for storage, use, transportation, and disposal of hazardous materials in the Projects' area. This plan should discuss appropriate measures and equipment required to prevent the extent of any hazardous material spill. This plan should also include protocols to prevent adverse impacts to beneficial uses in the event that hazardous materials are spilled. On-site containment for hazardous-chemical storage shall be placed away from watercourses and include secondary containment and appropriate management as specified in California Code of Regulations, title 27, section 20320. Protocols and methods in this plan shall abide by federal, state and local laws and policies.

11. Additional Conditions

In order to ensure that the Projects operate to meet water quality standards as anticipated, to ensure compliance with other relevant state and federal laws, and to ensure that the Projects will continue to meet state water quality standards and other appropriate requirements of state law over its lifetime, the certification will consider conditions regarding monitoring, enforcement, and potential future revisions. Additionally, California Code of Regulations, title 23, section 3860 requires imposition of certain mandatory conditions for all water quality certifications.

APPENDIX G

Analysis of Simulated Daily Average Temperatures in the Lower Tuolumne River

To address comments on the draft environmental impact statement (EIS), we conducted a quantitative analysis of simulated daily average temperatures and incorporated the results into the final EIS.[20] This appendix includes our complete analysis of simulated daily average temperatures.

This analysis consists of:

1. Computing daily average values from hourly values filed by Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) for each alternative operations scenario evaluated in the final EIS.

2. Conducting an annual frequency analysis for each scenario (table G-1).

3. Determining each scenario's frequency of exceeding 25 degrees Celsius (°C) for each river mile reported (table G-2).

4. Creating time-series charts that cover the range of water year types for the base case and the Districts' scenarios (figures G-1 and G-2).

5. Creating monthly frequency exceedance charts for May, June, July, August, September, and October under the base case scenario that include all river miles with reported temperatures (figure G-3).

6. Creating monthly frequency exceedance charts for May, June, July, August, September, and October under the base case and the Districts' scenarios at selected river miles (figure G-4 to G-7).

These results show that simulated daily average temperatures follow the same general trends for all evaluated scenarios, but alternative operation scenarios generally tend to be cooler at low-exceedance frequencies (table G-1).

Comparison of simulated daily average temperatures for the Districts' scenarios, including the draft Voluntary Agreement (VA scenario, figures G-1 and G-2), indicates that increased flows below the La Grange Powerhouse in June–September tend to reduce temperature at river mile (RM) 46 by the most in dry, and below normal water years, although reductions in temperature are also evident, to a lesser degree, in an above normal water year. The coolest simulated June–September conditions generally occur under the draft Voluntary Agreement scenario. This comparison also indicates that spring pulse flows in late March to early April tend to have little effect on simulated daily average temperature at RM 46 in many years, probably because the release temperature and equilibrium temperature are close to one another during this period.

[20] Section 3.3.2.2, *Aquatic Resources, Environmental Effects* of the final EIS summarizes the models used and each scenario analyzed.

Figure G-3 shows longitudinal and monthly changes in daily average temperature exceedances under base case conditions. As expected, simulated temperatures generally increase in a downstream direction, tend to increase from May to July, and decrease from July to October. The exception to this is RM 3, which is cooler than RM 16 about 50 percent of the time in June, July, and August; and about 40 percent of the time in September. This condition may be partially due to the temperature at RM 16 being increased by warm inflows from Dry Creek, which is less than 1 mile upstream.

Comparison of monthly exceedance frequencies for the Districts' proposed and draft Voluntary Agreement operations (figures G-4 to G-9) shows that the temperature regime is nearly the same for the draft Voluntary Agreement and the Districts' proposed with-infiltration galleries operations at each RM analyzed. Although daily average temperatures released from La Grange Dam would be nearly the same under the Districts' two proposed operations and the draft Voluntary Agreement, the Districts' proposed interim operations scenario frequently has substantially warmer simulated conditions downstream of RM 51.5 during June, July, August, and September.

The farthest upstream extent of simulated daily average temperature exceeding 25.0°C under the base case is RM 39. Simulated exceedance of 25.0°C first occur further downstream at RM 26 under the Districts' two proposed operations and draft Voluntary Agreement scenario (table G-2). However, the draft Voluntary Agreement and Districts' proposed operations with infiltration galleries exceed 25.0°C less frequently than both the Districts' interim proposal (table G-2).

Alternative operations have little effect at RM 3 during the low-flow season of July-October, which is not surprising given it is nearly 50 miles downstream of releases from the projects and in the zone of backwater effects from the San Joaquin River.

Table G-1. Annual frequency analysis of simulated daily average temperature in the lower Tuolumne River below the La Grange Powerhouse (RM 51.5) under alternative flow scenarios, water years 1971–2012 (Source: Districts, 2018b,f; 2020).

Percent Exceedance	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWBREA	CGREA10%	TBIREA-NoIG-AIR	ECHOREA-NoIG
0%	19.2	***18.1***	**18.2**	***17.9***	***18.6***	***17.9***	***17.7***	**20.4**	***18.1***	***17.7***	18.9
1%	17.8	***17.0***	**16.6**	***16.5***	***16.7***	***16.6***	***16.5***	***17.1***	17.3	***16.2***	17.5
2%	17.3	***16.4***	**15.9**	***15.7***	***15.9***	***15.8***	***15.7***	***16.2***	***16.6***	***15.2***	16.9
3%	16.7	***15.7***	**15.4**	***15.2***	***15.3***	***15.5***	***15.2***	***15.7***	***16.1***	***14.5***	16.3
4%	16.1	***15.3***	**15.0**	***14.7***	***14.9***	***15.2***	***14.4***	***15.3***	15.8	***13.9***	15.8
5%	15.6	***14.7***	**14.4**	***14.1***	***14.6***	***14.9***	***14.0***	15.1	15.5	***13.5***	15.5
6%	15.1	***14.0***	**13.8**	***13.6***	***14.3***	14.6	***13.7***	14.9	15.2	***13.3***	15.1
7%	14.8	***13.6***	**13.4**	***13.3***	***14.1***	14.4	***13.5***	14.7	14.9	***13.1***	14.8
8%	14.5	***13.3***	**13.1**	***13.1***	***13.8***	14.2	***13.3***	14.5	14.5	***13.0***	14.4
9%	14.3	***13.2***	**13.0**	***13.0***	***13.6***	14.0	***13.1***	14.4	14.1	***12.9***	14.1
10%	14.1	***13.1***	**12.9**	***12.9***	***13.4***	13.8	***13.0***	14.2	13.8	***12.8***	13.9
11%	13.9	***13.0***	**12.8**	***12.8***	***13.3***	13.5	***12.9***	14.1	13.6	***12.8***	13.6
12%	13.7	***12.9***	**12.7**	***12.8***	13.2	13.3	***12.8***	14.0	13.3	***12.8***	13.5
13%	13.5	***12.8***	**12.6**	***12.7***	13.1	13.2	***12.8***	13.9	13.2	***12.7***	13.4
14%	13.4	***12.8***	**12.6**	***12.6***	13.0	13.1	***12.7***	13.7	13.1	***12.7***	13.3
15%	13.3	***12.7***	**12.5**	***12.5***	12.9	13.0	***12.7***	13.6	13.0	***12.6***	13.2
16%	13.2	***12.6***	**12.5**	***12.5***	12.9	12.9	***12.6***	13.5	12.9	***12.6***	13.1
17%	13.1	12.6	**12.4**	***12.4***	12.8	12.9	12.6	13.3	12.9	12.6	13.0
18%	13.0	12.5	**12.4**	***12.4***	12.7	12.8	12.6	13.2	12.8	12.5	12.9
19%	13.0	12.5	**12.3**	***12.3***	12.7	12.8	12.5	13.1	12.8	12.5	12.9
20%	12.9	12.4	**12.3**	***12.3***	12.6	12.7	12.5	13.0	12.8	12.4	12.8
21%	12.8	12.4	**12.2**	***12.2***	12.6	12.7	12.5	12.9	12.7	12.4	12.8
22%	12.7	12.4	*12.2*	12.2	12.5	12.6	12.4	12.8	12.7	12.4	12.7
23%	12.6	12.3	12.2	12.2	12.5	12.6	12.4	12.7	12.7	12.3	12.7
24%	12.6	12.3	12.1	12.1	12.4	12.6	12.3	12.6	12.6	12.3	12.6
25%	12.5	12.2	12.1	12.1	12.4	12.5	12.3	12.6	12.6	12.2	12.6

Percent Exceedance	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWBREA	CGREA10%	TBIREA-NoIG-AIR	ECHOREA-NoIG
26%	12.4	12.2	12.0	12.1	12.4	12.5	12.2	12.5	12.5	12.2	12.5
27%	12.3	12.2	12.0	12.0	12.3	12.4	12.2	12.4	12.5	12.1	12.4
28%	12.3	12.1	12.0	12.0	12.3	12.4	12.2	12.4	12.5	12.1	12.4
29%	12.2	12.1	12.0	12.0	12.3	12.4	12.1	12.3	12.4	12.1	12.3
30%	12.2	12.1	11.9	12.0	12.2	12.3	12.1	12.2	12.4	12.0	12.2
31%	12.1	12.0	11.9	11.9	12.2	12.3	12.0	12.2	12.3	12.0	12.2
32%	12.1	12.0	11.9	11.9	12.2	12.2	12.0	12.1	12.3	12.0	12.1
33%	12.0	12.0	11.9	11.9	12.1	12.2	12.0	12.1	12.2	11.9	12.1
34%	12.0	12.0	11.8	11.9	12.1	12.2	11.9	12.1	12.2	11.9	12.1
35%	12.0	11.9	11.8	11.8	12.1	12.1	11.9	12.0	12.2	11.9	12.0
36%	11.9	11.9	11.8	11.8	12.1	12.1	11.9	12.0	12.1	11.9	12.0
37%	11.9	11.9	11.8	11.8	12.0	12.1	11.9	12.0	12.1	11.9	12.0
38%	11.9	11.8	11.7	11.8	12.0	12.1	11.8	12.0	12.0	11.8	11.9
39%	11.8	11.8	11.7	11.7	12.0	12.0	11.8	11.9	12.0	11.8	11.9
40%	11.8	11.8	11.7	11.7	11.9	12.0	11.8	11.9	12.0	11.8	11.9
41%	11.8	11.8	11.7	11.7	11.9	12.0	11.8	11.9	11.9	11.8	11.9
42%	11.7	11.7	11.6	11.7	11.9	12.0	11.8	11.9	11.9	11.8	11.8
43%	11.7	11.7	11.6	11.6	11.9	11.9	11.7	11.9	11.9	11.7	11.8
44%	11.7	11.7	11.6	11.6	11.8	11.9	11.7	11.8	11.9	11.7	11.8
45%	11.7	11.6	11.6	11.6	11.8	11.9	11.7	11.8	11.8	11.7	11.8
46%	11.6	11.6	11.5	11.5	11.8	11.9	11.7	11.8	11.8	11.7	11.8
47%	11.6	11.6	11.5	11.5	11.7	11.8	11.7	11.8	11.8	11.7	11.7
48%	11.6	11.6	11.5	11.5	11.7	11.8	11.6	11.8	11.8	11.6	11.7
49%	11.6	11.5	11.5	11.5	11.7	11.8	11.6	11.7	11.8	11.6	11.7
50%	11.5	11.5	11.4	11.4	11.7	11.8	11.6	11.7	11.7	11.6	11.7
51%	11.5	11.5	11.4	11.4	11.6	11.7	11.6	11.7	11.7	11.6	11.7
52%	11.5	11.5	11.4	11.4	11.6	11.7	11.5	11.7	11.7	11.6	11.6
53%	11.5	11.4	11.4	11.4	11.6	11.7	11.5	11.7	11.7	11.5	11.6
54%	11.4	11.4	11.3	11.3	11.6	11.7	11.5	11.6	11.6	11.5	11.6

Percent Exceedance	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWBREA	CGREA10%	TBIREA-NoIG-AIR	ECHOREA-NoIG
55%	11.4	11.4	11.3	11.3	11.5	11.6	11.5	11.6	11.6	11.5	11.6
56%	11.4	11.3	11.3	11.3	11.5	11.6	11.5	11.6	11.6	11.5	11.5
57%	11.3	11.3	11.2	11.3	11.5	11.6	11.4	11.6	11.6	11.5	11.5
58%	11.3	11.3	11.2	11.2	11.5	11.6	11.4	11.5	11.5	11.4	11.5
59%	11.3	11.3	11.2	11.2	11.5	11.5	11.4	11.5	11.5	11.4	11.5
60%	11.2	11.2	11.1	11.2	11.4	11.5	11.4	11.4	11.5	11.4	11.4
61%	11.2	11.2	11.1	11.1	11.4	11.5	11.3	11.4	11.4	11.3	11.4
62%	11.2	11.2	11.1	11.1	11.4	11.5	11.3	11.4	11.4	11.3	11.4
63%	11.1	11.1	11.0	11.1	11.4	11.4	11.3	11.3	11.4	11.3	11.3
64%	11.1	11.1	11.0	11.0	11.3	11.4	11.3	11.3	11.3	11.3	11.3
65%	11.0	11.0	11.0	11.0	11.3	11.3	11.2	11.2	11.3	11.2	11.2
66%	11.0	11.0	10.9	11.0	11.3	11.3	11.2	11.2	11.2	11.2	11.2
67%	11.0	11.0	10.9	10.9	11.2	11.2	11.2	11.1	11.2	11.2	11.1
68%	10.9	10.9	10.9	10.9	11.2	11.2	11.1	11.1	11.2	11.1	11.1
69%	10.9	10.9	10.8	10.9	11.2	11.1	11.1	11.0	11.1	11.1	11.0
70%	10.8	10.8	10.8	10.8	11.1	11.1	11.0	11.0	11.1	11.1	11.0
71%	10.8	10.8	10.7	10.8	11.1	11.0	11.0	10.9	11.0	11.0	10.9
72%	10.8	10.7	10.7	10.7	11.0	11.0	10.9	10.8	10.9	11.0	10.8
73%	10.7	10.7	10.6	10.7	11.0	10.9	10.9	10.8	10.9	10.9	10.8
74%	10.6	10.6	10.6	10.6	10.9	10.8	10.8	10.7	10.8	10.9	10.7
75%	10.6	10.6	10.5	10.6	10.9	10.7	10.7	10.6	10.7	10.8	10.7
76%	10.5	10.5	10.4	10.5	10.8	10.7	10.7	10.6	10.7	10.8	10.6
77%	10.5	10.4	10.4	10.4	10.7	10.6	10.6	10.5	10.6	10.7	10.5
78%	10.4	10.4	10.3	10.4	10.6	10.6	10.5	10.5	10.5	10.6	10.5
79%	10.4	10.3	10.3	10.3	10.6	10.5	10.5	10.4	10.5	10.5	10.4
80%	10.3	10.3	10.2	10.3	10.5	10.4	10.4	10.3	10.4	10.5	10.3
81%	10.3	10.2	10.2	10.2	10.4	10.4	10.4	10.3	10.3	10.4	10.3
82%	10.2	10.2	10.1	10.2	10.4	10.3	10.3	10.2	10.2	10.3	10.2
83%	10.2	10.1	10.1	10.1	10.3	10.2	10.2	10.2	10.2	10.2	10.2

Percent Exceedance	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWBREA	CGREA10%	TBIREA-NoIG-AIR	ECHOREA-NoIG
84%	10.1	10.1	10.0	10.0	10.3	10.2	10.2	10.1	10.1	10.2	10.1
85%	10.0	10.0	9.9	10.0	10.2	10.1	10.1	10.1	10.1	10.1	10.0
86%	10.0	9.9	9.9	9.9	10.1	10.0	10.0	10.0	10.0	10.0	10.0
87%	9.9	9.9	9.8	9.8	10.1	10.0	10.0	10.0	9.9	9.9	9.9
88%	9.8	9.8	9.8	9.8	10.0	9.9	9.9	9.9	9.9	9.9	9.8
89%	9.8	9.8	9.7	9.7	9.9	9.8	9.8	9.9	9.8	9.8	9.7
90%	9.7	9.7	9.7	9.7	9.9	9.7	9.8	9.8	9.7	9.7	9.7
91%	9.6	9.6	9.6	9.6	9.8	9.6	9.7	9.7	9.6	9.7	9.6
92%	9.5	9.5	9.5	9.5	9.7	9.5	9.6	9.7	9.6	9.6	9.4
93%	9.4	9.5	9.4	9.5	9.6	9.4	9.5	9.6	9.5	9.5	9.3
94%	9.4	9.4	9.3	9.4	9.5	9.3	9.4	9.5	9.4	9.4	9.2
95%	9.2	9.2	9.2	9.3	9.4	9.1	9.3	9.4	9.2	9.2	9.0
96%	9.1	9.1	9.0	9.1	9.2	9.0	9.1	9.2	9.0	9.1	8.9
97%	8.9	8.8	8.8	8.9	9.0	8.8	9.0	9.0	8.6	8.8	8.6
98%	8.5	8.5	8.6	8.5	8.7	8.5	8.7	8.7	8.5	8.5	8.4
99%	8.3	8.3	8.4	8.3	8.5	8.3	8.5	8.5	8.3	8.3	8.3
100%	7.4	7.3	**8.2**	7.5	**8.2**	***6.8***	**8.2**	**8.3**	7.5	7.9	**8.0**

Note: Temperatures shown in bold italic are more than 0.5°C cooler than the base case, and bold shaded values are more than 0.5°C warmer than the base case.

Table G-2. Annual frequency of simulated daily average temperature exceeding 25.0°C in the lower Tuolumne River, water years 1971–2012 (Source: Districts, 2018b,f; 2020a,b).

RM	Base Case	DPP-1r-NoIG	DPP-1r	VA	FWS REA	NMFS REA	DFW REA	SWBREA	CGREA10%	TBIREA-NoIG-AIR	ECHOREA-NoIG
51.5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
46	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
43	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
39	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.4%
26	9%	3%	0.3%	0.3%	0.0%	0.0%	0.0%	6%	0.1%	1%	6%
16	14%	11%	7%	7%	3%	1%	2%	10%	4%	4%	11%
3	14%	13%	11%	11%	7%	4%	6%	9%	8%	6%	11%

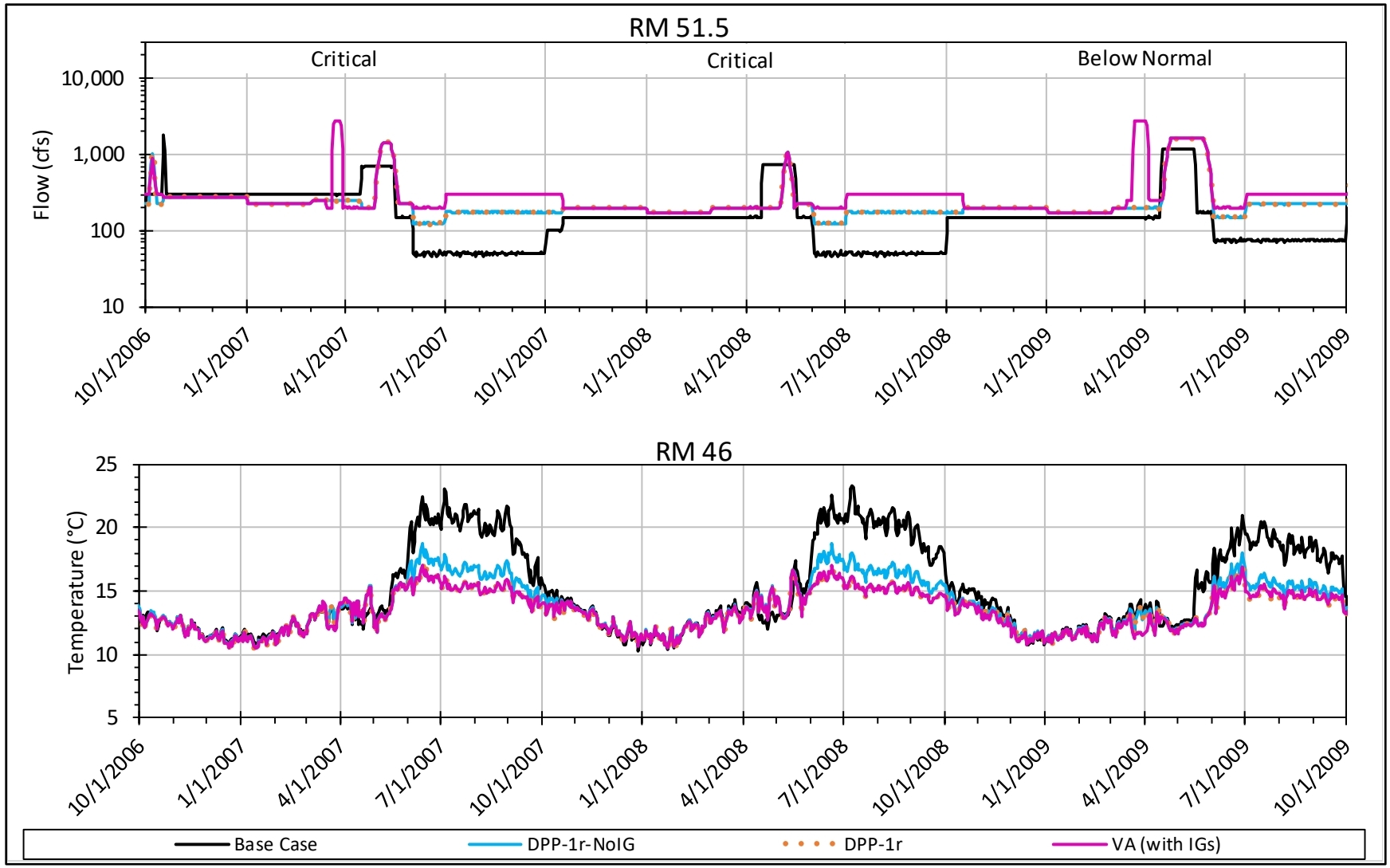

Figure G-1. Time-series of simulated daily average flow at RM 51.5 (top) and daily average temperature in the lower Tuolumne River at RM 46 (bottom), water years 2007–2009 (Source: Districts, 2018b,f; 2020a,b).

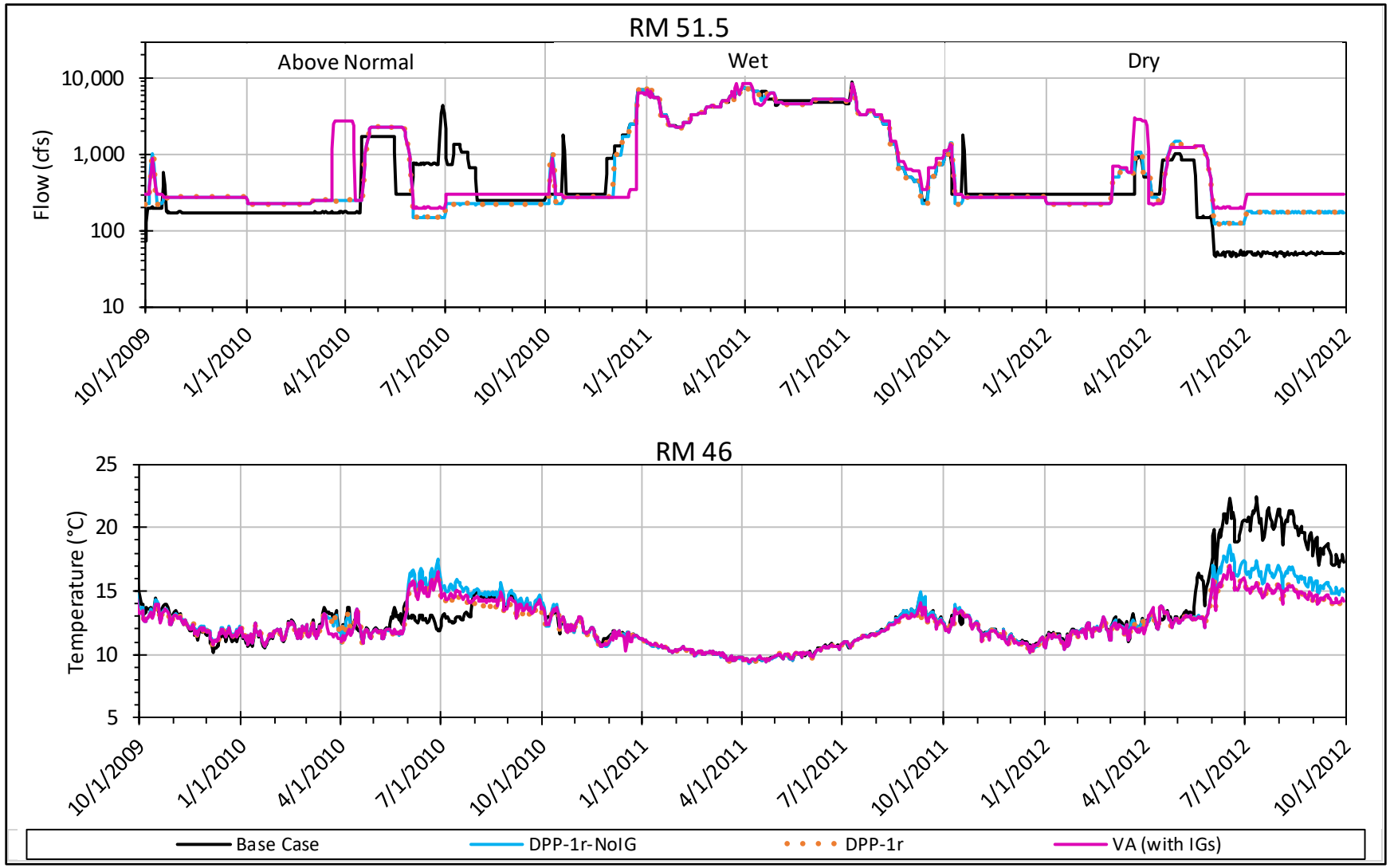

Figure G-2. Time-series of simulated daily average flow at RM 51.5 (top) and daily average temperature in the lower Tuolumne River at RM 46 (bottom), water years 2010–2012 (Source: Districts, 2018b,f; 2020a,b).

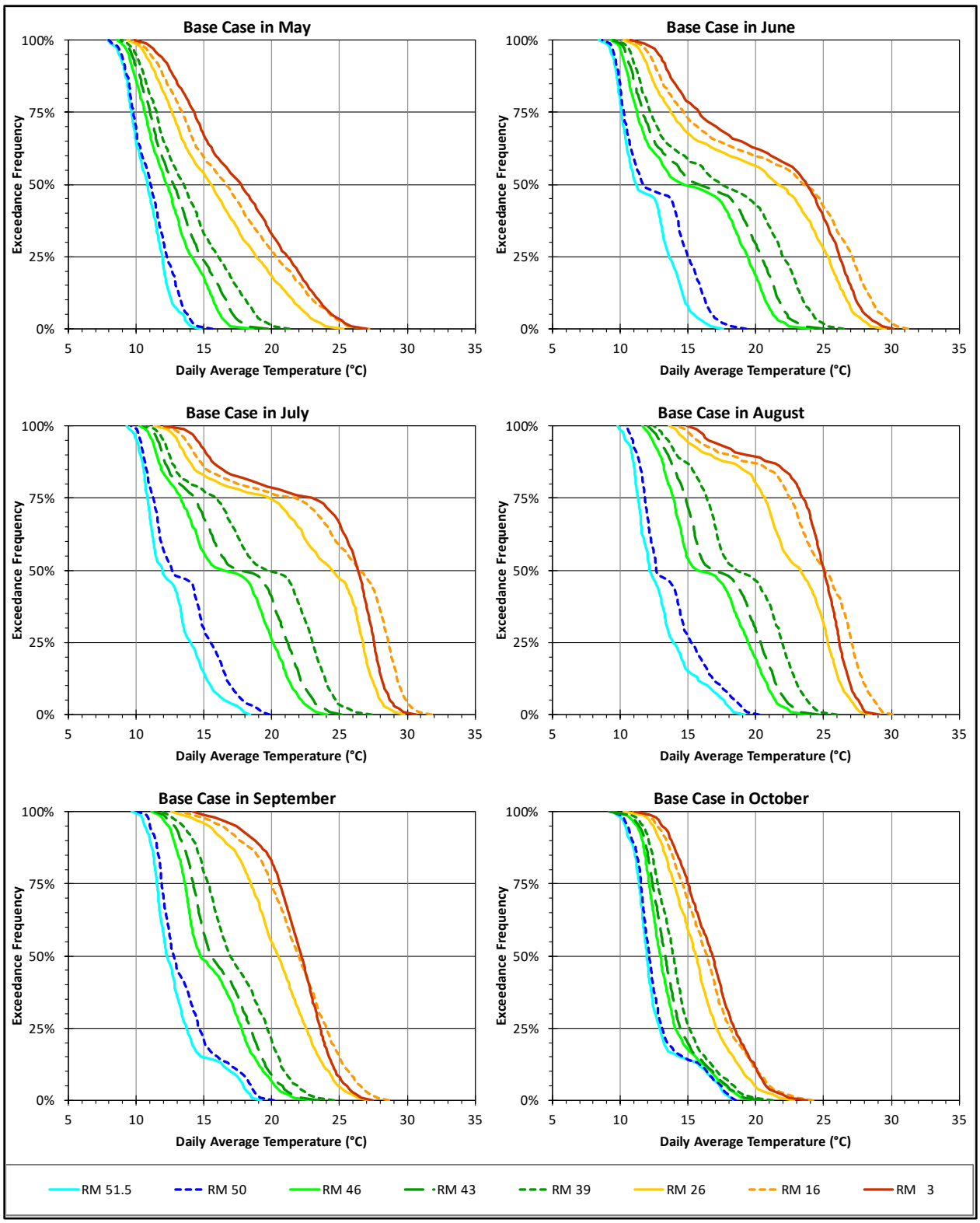

Figure G-3. Monthly exceedance frequencies for simulated lower Tuolumne River daily average temperature under the base case scenario, May through October (Source: Districts, 2018f).

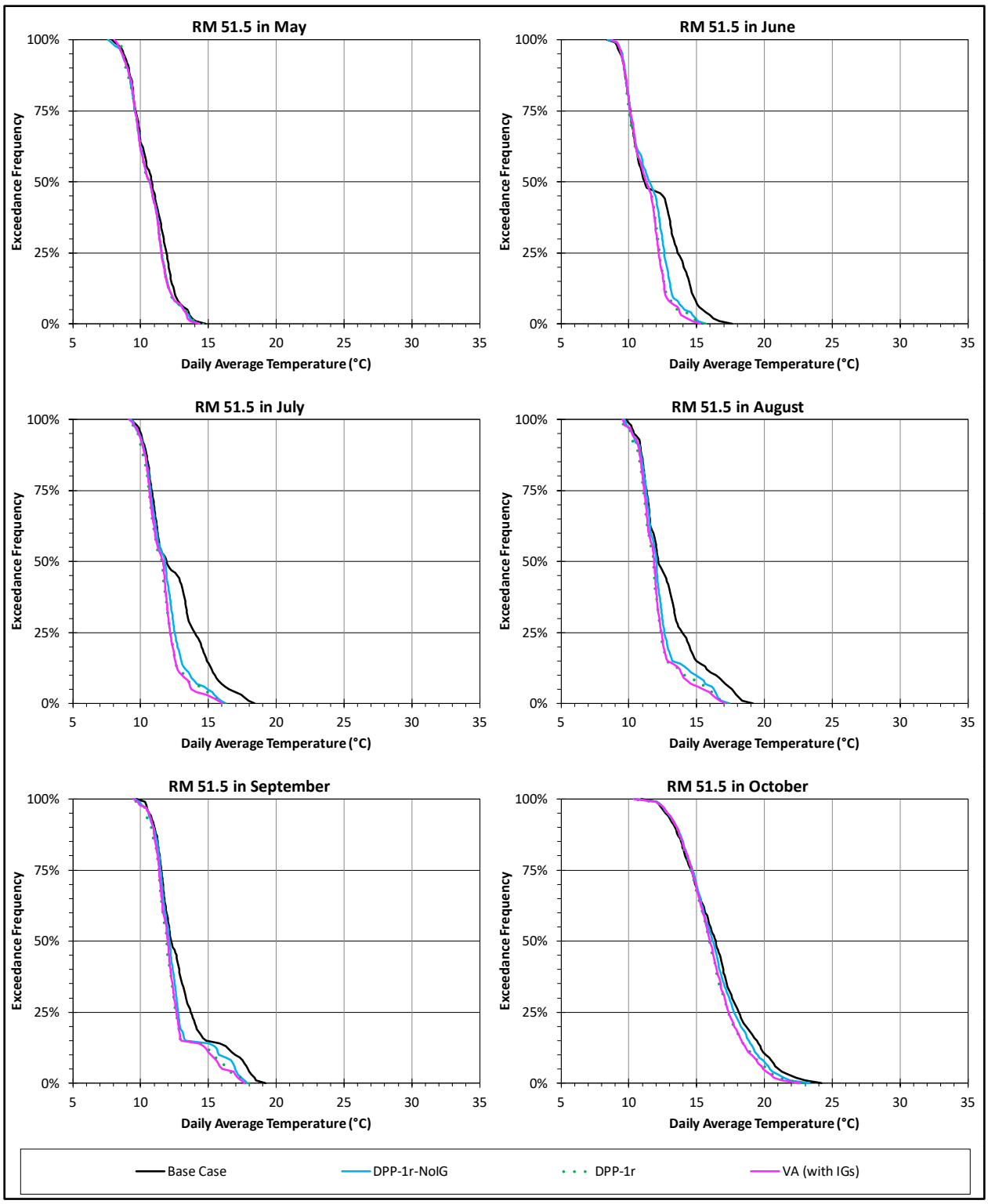

Figure G-4. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 51.5 under the base case and Districts' scenarios, May through October (Source: Districts, 2018b,f; 2020a,b).

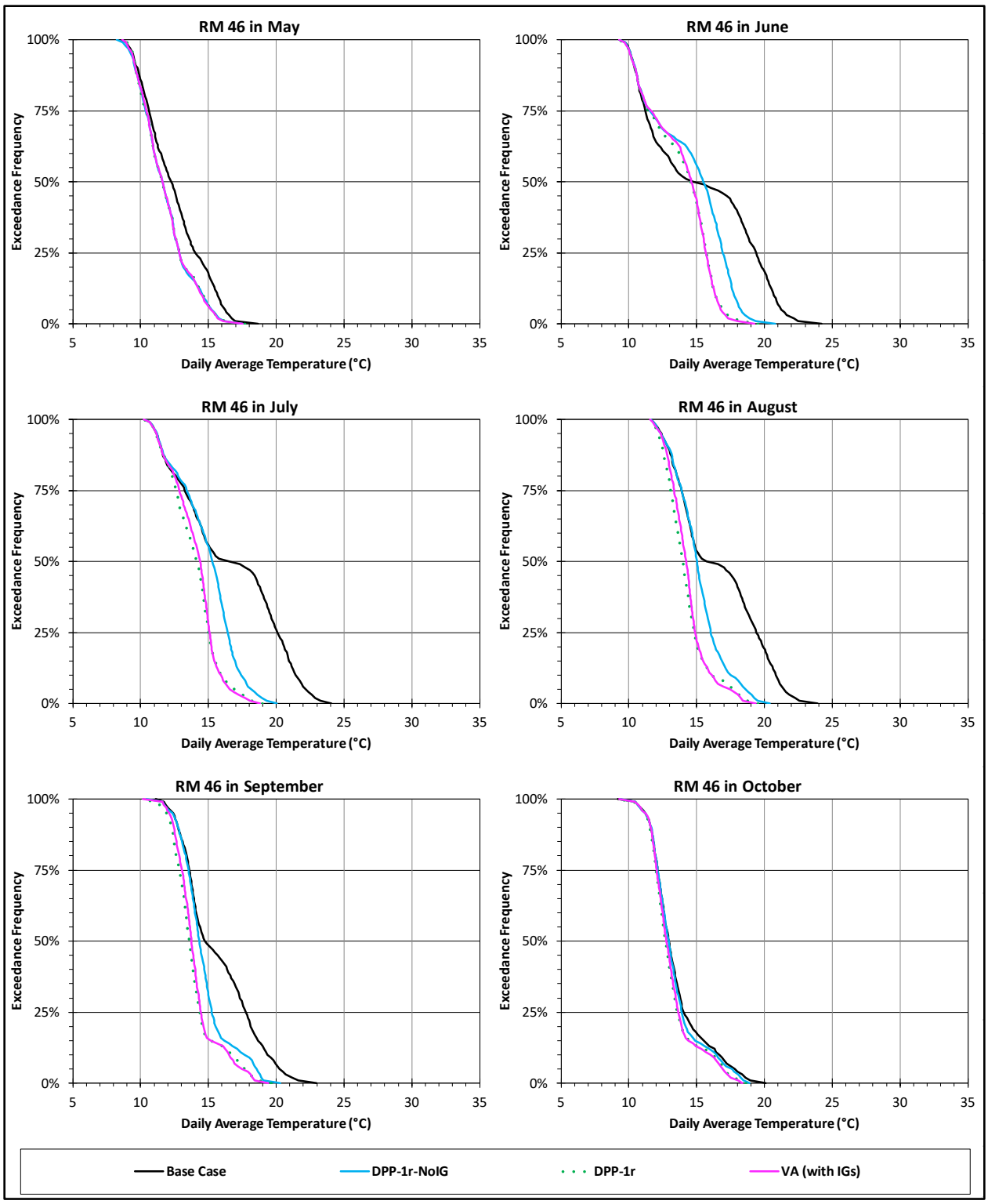

Figure G-5. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 46 under the base case and Districts' scenarios, May through October (Source: Districts, 2018b,f; 2020a,b).

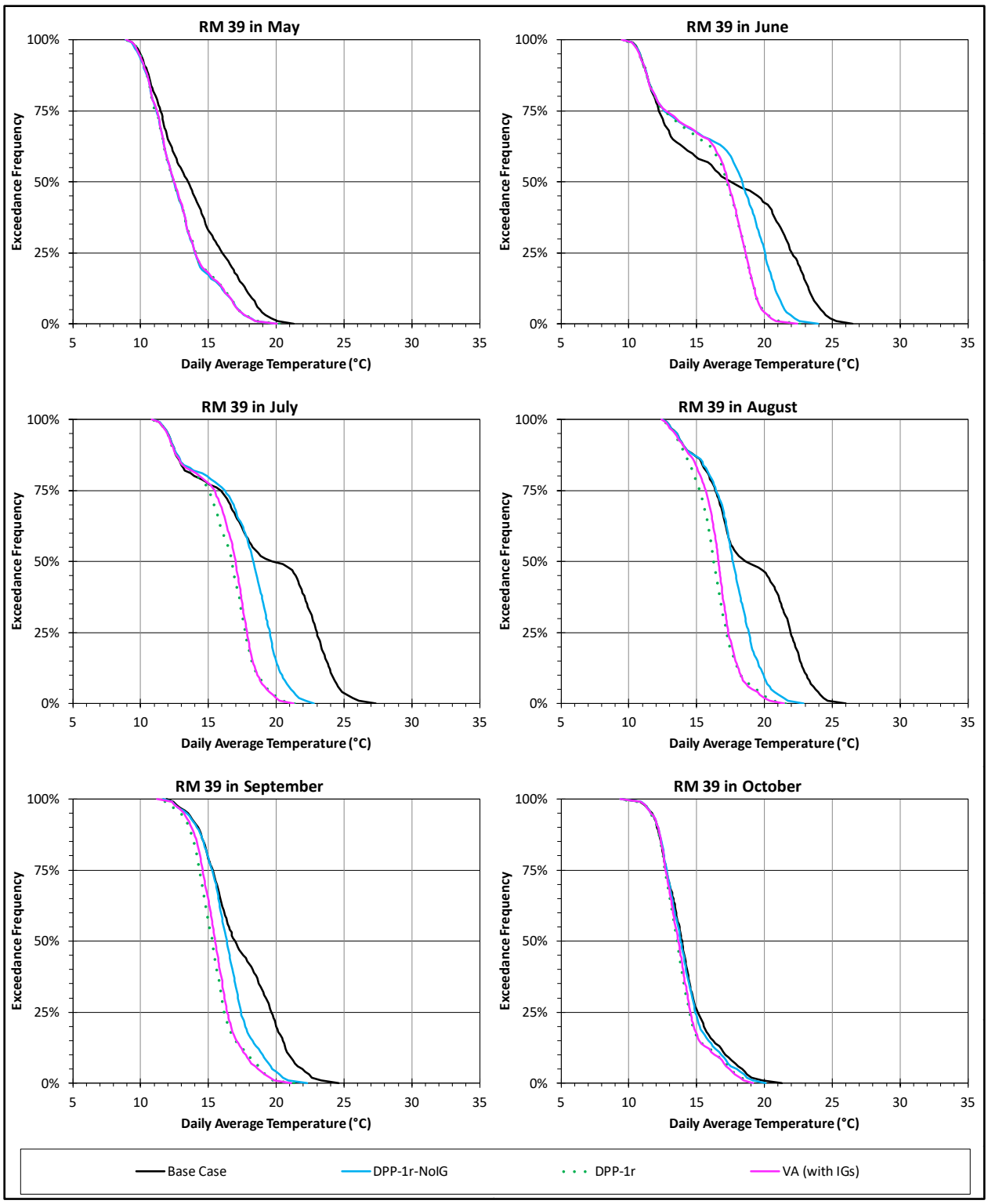

Figure G-6. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 39 under the base case and Districts' scenarios, May through October (Source: Districts, 2018b,f; 2020a,b).

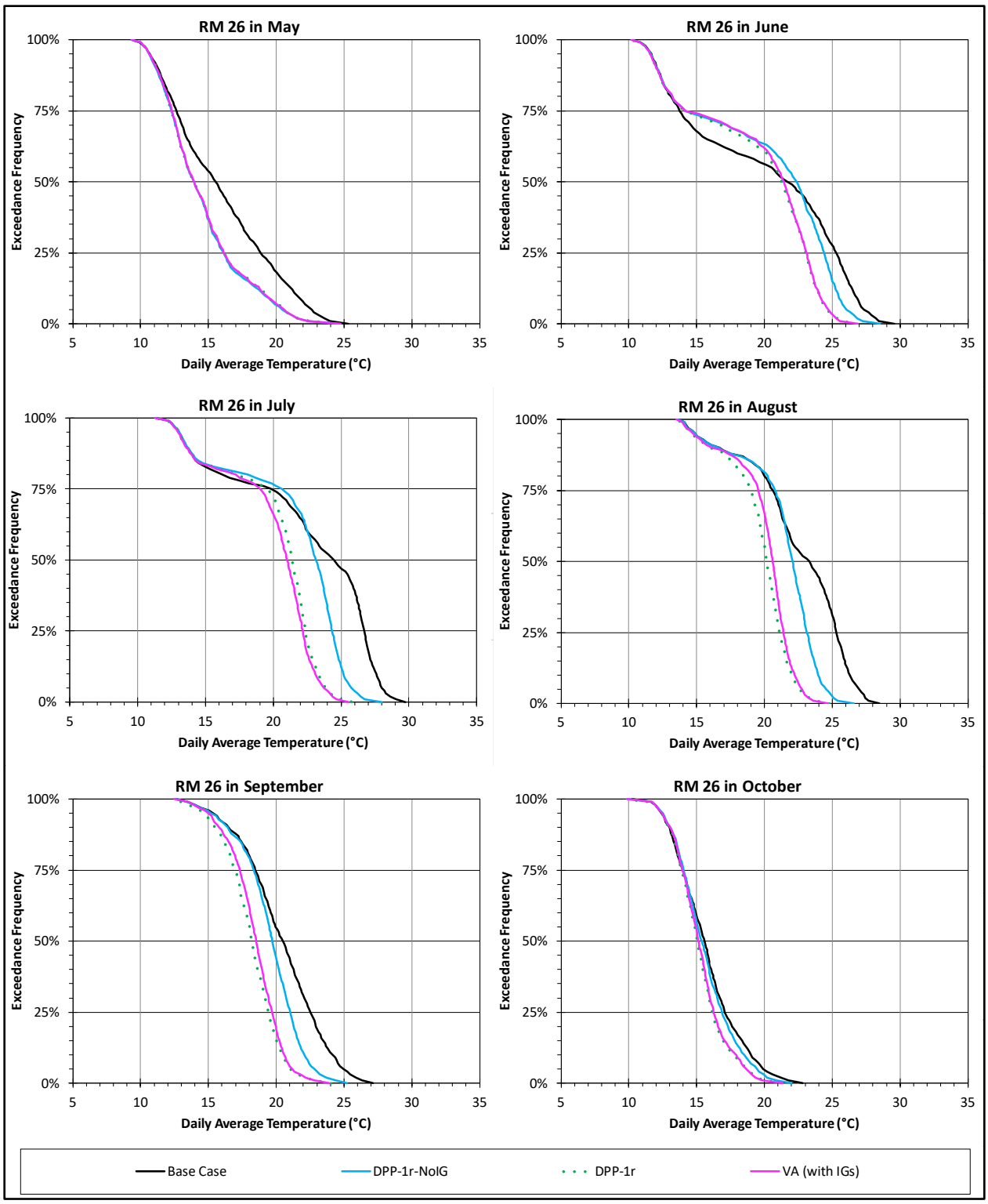

Figure G-7. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 26 under the base case and Districts' scenarios, May through October (Source: Districts, 2018b,f; 2020a,b).

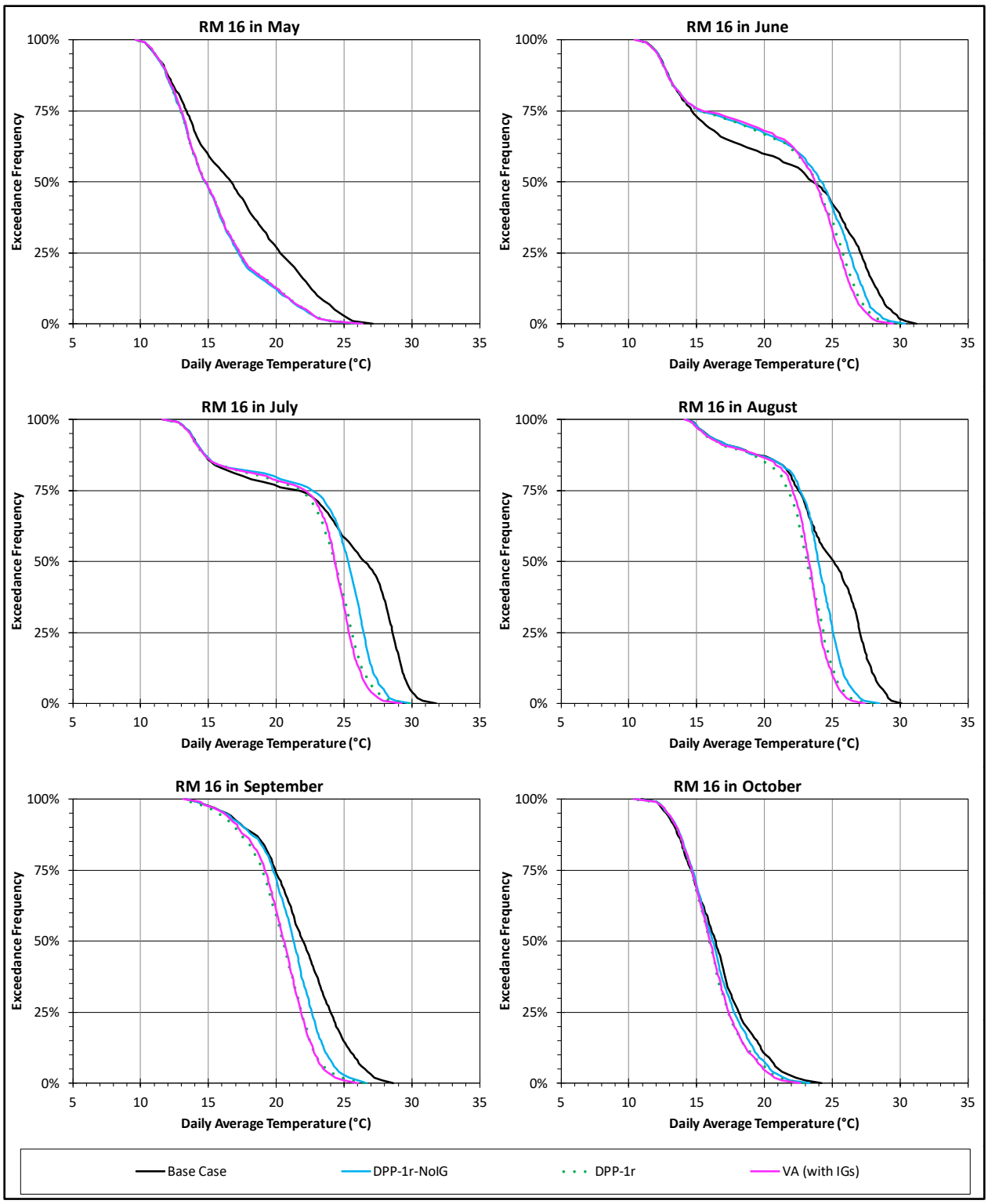

Figure G-8. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 16 under the base case and Districts' scenarios, May through October (Source: Districts, 2018b,f; 2020a,b).

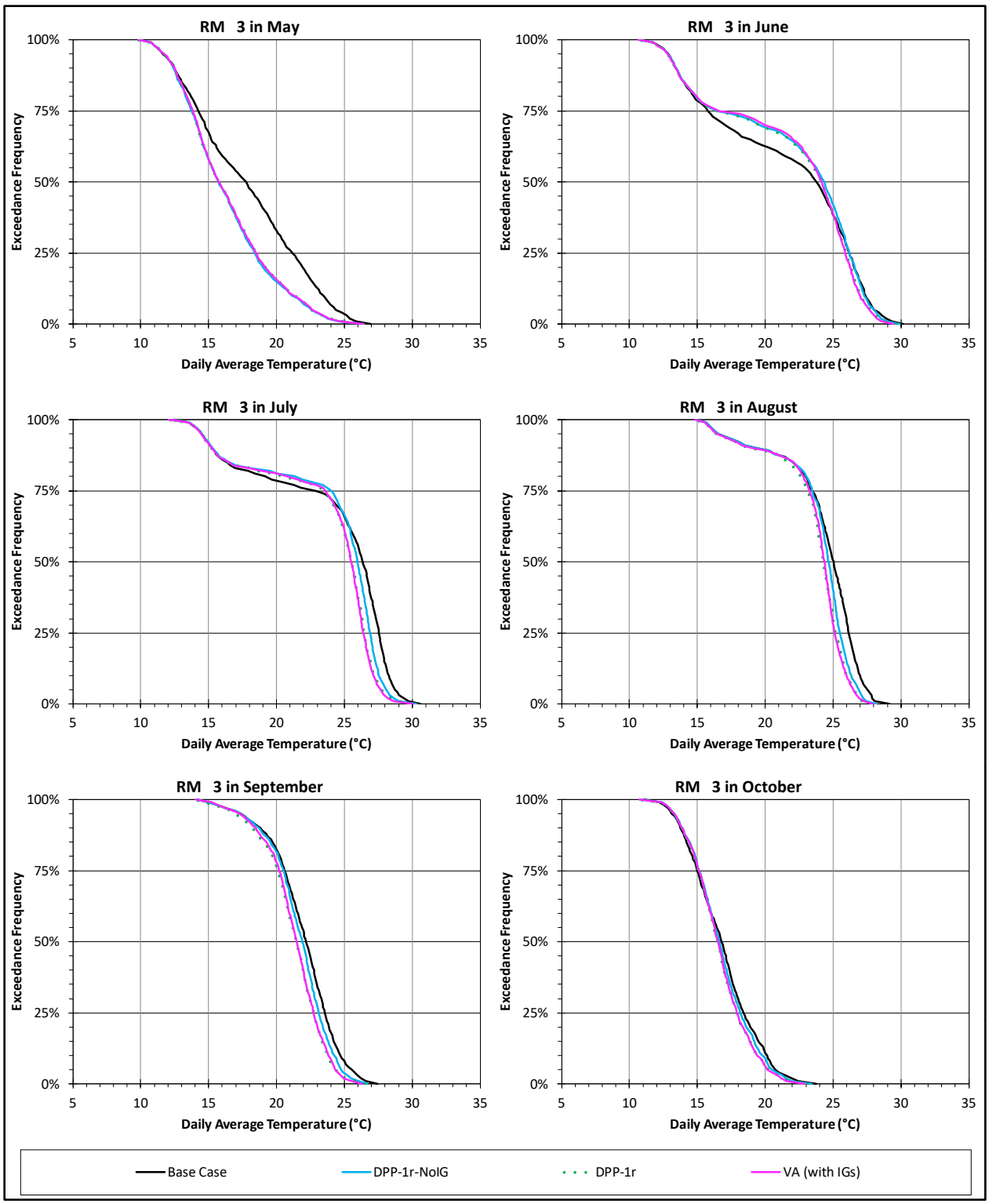

Figure G-9. Monthly exceedance frequency of simulated lower Tuolumne River daily average temperature at RM 3 under the base case and Districts' scenarios, May through October (Source: Districts, 2018b,f; 2020a,b).

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