FERC/EIS-0276

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR HYDROPOWER LICENSE

Lassen Lodge Hydroelectric Project—FERC Project No. 12496-002–California

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

July 2018

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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) on the application for the proposed Lassen Lodge Project (FERC Project No. 12496), to be located on the upper South Fork Battle Creek in Tehama County, about 1.5 miles west of the town of Mineral, California. The project would occupy no federal land or Indian reservations.

This final EIS documents the views of governmental agencies, non-governmental organizations, affected Indian tribes, the public, the license applicant, and Federal Energy Regulatory Commission (Commission) staff. It contains staff evaluations of the applicant's proposal and alternatives for licensing the Lassen Lodge 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 24, 2018.

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 www.ferc.gov/docs-filing/elibrary.asp. Please call (202) 502-8222 for assistance.

Attachment: Final EIS

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COVER SHEET

a.	Title:	Environmental Impact Statement for Hydropower License, Lassen Lodge Project—FERC Project No. 12496, California
b.	Subject:	Final Environmental Impact Statement
c.	Lead Agency:	Federal Energy Regulatory Commission
d.	Abstract:	The Lassen Lodge Project would be located on upper South Fork Battle Creek and non-federal land in Tehama County, about 1.5 miles west of the town of Mineral, California. Rugraw, LLC (Rugraw), proposes to construct a diversion dam, intake structure, fish screen, pipeline, penstock, powerhouse, substation, switchyard, four multipurpose areas, transmission line, and two project access roads from California State Route 36 to the diversion dam and to the powerhouse. The 8-foot-high, 2-foot-wide, and 63-foot-long diversion dam would be located at river mile 23, approximately 0.5-mile upstream of the Old State Highway Route 36 Bridge, creating a 0.4-acre impoundment. The 50- by 51-foot powerhouse would contain a single, multi-jet, vertical Pelton-type turbine and would be closed-coupled to a synchronous generator with a capacity of 5.0 megawatts, with proposed average annual generation of 24,936 megawatt-hours. The staff's recommendation is to license the project as proposed by Rugraw with some modifications and additional measures.
e.	Contact:	Kenneth Hogan Federal Energy Regulatory Commission Office of Energy Projects 888 First Street, N.E. Washington, D.C. 20426 (202) 502-8434
f.	Transmittal:	This final environmental impact statement on an application to construct and operate the Lassen Lodge Hydroelectric Project is being made available for public comment on or about July 24, 2018, as required by the National Environmental Policy Act of 1969[1] and the Commission's Regulations Implementing the National Environmental Policy Act (18 C.F.R., 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).

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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 development 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 consistent with the FPA and 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]

[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] Pub. L. 95-91, 91 Stat. 556 (1977).

[4] 16 U.S.C. § 803(a).

[5] 16 U.S.C. § 803(g).

[6] 18 C.F.R. § 385.206 (2017).

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TABLE OF CONTENTS

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LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
7DADM	7-day average of the daily maximum
ABS	Above Old Highway 36 Bridge Station
Advisory Council	Advisory Council on Historic Preservation
APE	area of potential effects
APLIC	Avian Power Line Interaction Committee
Basin Plan	*Central Valley Regional Water Quality Control Board Basin Plan*
BCSSRP	Battle Creek Salmon and Steelhead Restoration Project
BLM	U.S. Department of the Interior, Bureau of Land Management
BMI	benthic macroinvertebrates
BMP	best management practice
BP	before present
California DFW	California Department of Fish and Wildlife
CESA	California Endangered Species Act
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
CRLF	California red-legged frog
CVRWQCB	California Regional Water Quality Control Board, Central Valley Region
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
DPS	distinct population segment
DSMP	debris and sediment management plan
EFH	Essential Fish Habitat
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
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
FYLF	foothill yellow-legged frog
HPMP	Historic Properties Management Plan
HG	hydraulic geometry
Interior	U.S. Department of the Interior
kV	kilovolt

mg/L	milligrams per liter
MIF	minimum instream flow
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
NAHC	California Native American Heritage Commission
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NTU	nephelometric turbidity unit
PA	Programmatic Agreement
PBF	physical or biological feature
PCE	primary constituent element
PG&E	Pacific Gas and Electric Company
PHABSIM	physical habitat simulation
project	Lassen Lodge Hydroelectric Project, FERC Project No. 12496
RBDD	Red Bluff Diversion Dam
REA	ready for environmental analysis
Reclamation	U.S. Bureau of Reclamation
RM	river mile
ROW	right-of-way
Rugraw	Rugraw, LLC
SD1	scoping document
SD2	revised scoping document
SHPO	State Historic Preservation Office
SMP	salmonid monitoring plan
SPI	Sierra Pacific Industries
State Route 36	California State Route 36
SWPPP	stormwater pollution prevention plan
TCP	traditional cultural properties
µmhos/cm	micromhos per centimeter
U.S.C.	United States Code
USGS	United States Geological Survey
W3T	Water Temperature Transaction Tool
Water Board	California State Water Resources Control Board
WQC	water quality certification
WUA	weighted usable area

EXECUTIVE SUMMARY

Proposed Action

On April 21, 2014, Rugraw, LLC (Rugraw), filed an application for a license with the Federal Energy Regulatory Commission (Commission or FERC) for the construction, operation, and maintenance of the proposed 5.0-megawatt (MW) Lassen Lodge Hydroelectric Project No. 12496 (project). The project would be located on upper South Fork Battle Creek in Tehama County, California, about 1.5 miles west of the town of Mineral. The primary purpose of the project is hydroelectric power generation. The project would occupy no federal land or Indian reservations.

Project Description and Proposed Facilities

The proposed Lassen Lodge Project would include the following new facilities: (1) an 8-foot-high, 63-foot-long, diversion dam located at river mile 23 of South Fork Battle Creek, with three 8-by-8-foot pneumatic gates with a sill elevation of 4,302 feet mean sea level; (2) a 0.4-acre reservoir at a normal pool elevation of 4,310 feet mean sea level; (3) an enclosed 17-foot by 25-foot concrete intake structure with two 5-foot by 12-foot trash racks; (4) a 20-foot by 59-foot control/fish screen structure attached to the intake; (5) a 48-inch-diameter, 7,565-foot-long, low-pressure pipeline and a 36-inch-diameter, 5,230-foot-long, high-pressure penstock; (6) a 50-foot by 51-foot powerhouse containing a single Pelton-type turbine and generator with an installed capacity of 5.0 MW; (7) a buried concrete box culvert discharging back to South Fork Battle Creek; and (8) transmission facilities. The project would bypass approximately 2.4 miles of South Fork Battle Creek (bypassed reach).

To transmit power from the generator, an underground conduit would be built to a new substation located about 500 feet away. Rugraw would connect the project to the grid by constructing a 12-mile-long, 60-kilovolt transmission line and a new switchyard adjacent to Pacific Gas and Electric Company's existing 60-kilovolt Volta-South transmission line. No recreation facilities are proposed.

Project Operation

Rugraw proposes to operate the Lassen Lodge Project in a run-of-river mode, maintaining the water surface elevation within +/- 0.5 inch of the normal pool elevation. Rugraw proposes to release a minimum flow of 13 cubic feet per second (cfs) to the bypassed reach. Because the minimum hydraulic capacity of the project turbine would be 5 cfs, river inflows less than 18 cfs (minimum flow plus minimum hydraulic capacity of the turbine) would not be diverted to operate the project and instead would be released downstream into the bypassed reach. Rugraw would divert flows of 18 cfs and above for generation, up to the turbine's maximum hydraulic capacity of 105 cfs, while maintaining the 13 cfs minimum flow release into the bypassed reach. River inflows greater than 118 cfs (minimum flow plus maximum hydraulic capacity of the turbine) would be released downstream into the bypassed reach. The project would be shut down once river flows reached about 418 cfs.[7] The project would generate approximately 24,936 megawatt-hours (MWh) of electricity annually.

Proposed Environmental Measures

Rugraw proposes the following environmental measures to protect or enhance environmental resources at the project:

Project Construction

- Limit land disturbance and vegetation clearing to those areas needed for construction. Delineate the limits of construction, work areas, and multipurpose areas with flagging, fencing, and/or stakes to prevent land-disturbing activities outside of construction areas.
- Stockpile natural topsoils and replace, regrade, and revegetate disturbed areas, in accordance with California forestry regulations and best practices, with native vegetation. Restore disturbed stream and riparian habitat to preconstruction conditions and with riparian plantings and/or seeding, where applicable, with approved seed mixes.
- Develop a stormwater pollution prevention plan (SWPPP) with measures to prevent storm-induced erosion and sedimentation during ground-disturbing construction activities, including:
    - Store spoils from project construction in areas that limit erosion of spoil material and prevent runoff into aquatic habitats.
    - Install cofferdams, silt fences, or other structures to isolate in-water work areas.
- Use existing roads to the maximum possible extent, constructing new access roads only when necessary; limit access roads to a width of 12 feet whenever possible; and surface permanent roads with gravel to a depth and quantity sufficient to maintain a stable road surface and minimize erosion and dust.
- Conduct in-water work activities between July 1 and October 15 when streamflows are low to protect water quality and aquatic resources.

[7] In the final amended license application, Rugraw states that the project would be shut down at a flow of about 450 cfs, but in a letter filed on June 29, 2018, Rugraw clarifies that the project would begin its shutdown procedure at 418 cfs (letter from Charlie Kuffner, Rugraw, LLC, to Savannah Downey, California State Water Resources Control Board, dated June 28, 2018).

- Maintain upstream and downstream fish passage at the project during construction by constructing the diversion structure in phases or by providing a temporary diversion culvert to allow fish to pass the site.
- Conduct biological monitoring during construction to ensure that measures to protect biological resources are implemented appropriately.
- Provide environmental training to construction staff regarding laws, regulations, and best management practices (BMPs) to protect threatened and endangered species and special-status plant species and their habitats.
- Conduct preconstruction surveys in all areas of suitable habitat for threatened and endangered and special-status plant species where surveys have not previously been conducted, and implement specified protection measures as necessary.
- Avoid streams, wetlands, and pond habitats to the extent possible during construction, and use existing stream and wetland crossings where possible.
- Implement the Noxious Weed Management and Revegetation Plan (filed on November 30, 2015), which includes measures to ensure weeds and non-native invasive vegetation do not reestablish at onsite disposal areas during project construction, with a proposed plan revision to include provisions for riparian plantings along disturbed portions of South Fork Battle Creek to provide overhanging vegetation.
- Map, evaluate, and quantify, by vegetation type, the vegetation that would be removed as a result of project construction.
- Conduct preconstruction surveys for migratory bird nests within 100 feet of any areas that will be disturbed during the typical nesting season of April 15 to July 31 to identify nest locations and their status.
- Restrict construction activities within 100 feet of any active migratory bird nests found during the preconstruction surveys.
- Conduct preconstruction raptor nest surveys in suitable habitat within 1 mile of any areas that will be disturbed during the appropriate nesting periods (January through August) to identify nest locations and their status.
- Determine and apply an appropriate buffer for restricting construction activities around any active raptor nests found during preconstruction surveys.
- Design and construct the transmission line in compliance with the Avian Power Line Interaction Committee (APLIC) guidance to reduce impacts on avian species (APLIC, 2006; 2012).

- Avoid ground-disturbing activity on or near talus[8] slopes to protect Sierra Nevada red fox and American pika.
- Avoid construction activity within or near potential bat roosting habitat, including rock crevices, cliffs, and snags.
- Conduct surveys for juvenile and adult foothill yellow-legged frogs (FYLF) immediately prior to construction when in-water work would occur and relocate juvenile and adult FYLF found within the project reach and up to 500 feet downstream, outside the project construction area.[9]
- Avoid construction activities in riparian areas during the time that egg masses of FYLF are present (typically mid-April through mid-May); postpone construction around the immediate area where egg masses of FYLF are found until the eggs have hatched; avoid collection of rocks from in-water environments and minimize disturbance to pools and shallow runs between March 1 and August 31 to protect FYLF and their habitat.
- Develop a California red-legged frog (CRLF) protection plan to provide for and allow for CRLF in the project area to become reestablished and to be protected from manageable threats during construction.
- Reduce visual contrast where over-story vegetation is removed by thinning and removing trees from the edge of the right-of-way to give a natural appearance, where possible.
- Use wood poles to support the project transmission line to blend with surrounding vegetation.

<u>Project Operation</u>

- Operate the project in a run-of-river mode, maintaining the water surface elevation within +/- 0.5 inch of the normal pool elevation.
- Provide a ramping rate that will not exceed 0.1 foot of stage change per hour as measured by a stream gage proposed to be located within the

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[8] Talus slopes consist of loose rock eroded from cliff faces or rocky outcrops upslope. Vegetation is typically sparse or absent in these areas.

[9] Although Rugraw did not define the term “project reach,” we interpret this to be South Fork Battle Creek from the upper extent of the proposed reservoir to just downstream of the proposed tailrace discharge.

bypassed reach between the diversion structure and the Old State Highway Route 36 Bridge.[10]

- Monitor water temperature at the following locations: (1) the diversion/intake structure, (2) in the bypassed reach at Old Highway 36 Bridge, (3) within the bypassed reach just upstream of the tailrace, (4) in the powerhouse tailrace, (5) downstream of the powerhouse in mixed flows from the bypassed reach and powerhouse tailrace, and (6) approximately 2.1 miles downstream of the powerhouse below Ponderosa Way Bridge.[11]
- Discontinue project operation when the average daily stream temperature exceeds 20 degrees Celsius (°C), measured in the bypassed reach upstream of Angel Falls.
- Develop a debris and sediment management plan (DSMP) to include:
    - Annually sluicing sediments from the project's reservoir when natural flow at the diversion site exceeds 400 cfs.
    - An evaluation of sediment deposits in the reservoir in years where natural flows do not reach 400 cfs to determine if sluicing is needed and, if so, sluice at flows greater than 108 cfs (minimum instream flow [MIF] of 13 cfs plus turbine design flow of 95 cfs).[12]
- Maintain an MIF of 13 cfs or inflow, whichever is less, in the bypassed reach to protect aquatic resources.[13]

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[10] On August 31, 2016, Rugraw filed a letter in response to the Water Board's preliminary conditions and California DFW's preliminary section 10(j) recommendations, filed on June 24, 2016, and June 15, 2016, respectively, adopting the agencies' preliminary recommended ramping rate, thereby amending the proposed ramping rate provided in the final license application.

[11] In its February 2, 2018, comments on the draft EIS, Rugraw confirms its proposal to monitor water temperature for the first 5 years of project operation and to publish that data for review by all interested parties.

[12] Staff edited the text associated with this proposal for clarity, and it reflects our interpretation of Rugraw's proposal.

[13] In its February 2, 2018, comments on the draft EIS, Rugraw states that it is willing to consider seasonal minimum flows ranging from 8 to 13 cfs, depending on the number of anadromous fish in the reach, and suggests that Commission staff analyze an alternative minimum flow of 8 cfs. Although Rugraw does not specify that it is changing its 13-cfs minimum flow proposal, staff includes an analysis of the 8-cfs minimum flow in this final EIS as suggested.

- Monitor stream low at the following locations: (1) immediately downstream of the diversion dam, (2) in the bypassed reach just above the powerhouse tailrace, and (3) at the existing station below Ponderosa Way Bridge**.**
- Construct an upstream and downstream fish passageway and fish screen structure at the project diversion dam to ensure fish are able pass the diversion dam, and design the facilities in coordination with the California Department of Fish and Wildlife (California DFW) incorporating the National Marine Fisheries Service Southwest Region Fish Screening Criteria for Anadromous Salmonids and National Marine Fisheries Service Northwest Region Anadromous Salmonid Passage Facility Design.
- Develop an anadromous fish monitoring program that includes the notification of resource agencies if anadromous species are found within the bypassed reach.
- If steelhead are detected upstream of Panther Grade,[14] conduct genetic tissue sampling of steelhead/rainbow trout to identify barriers to upstream steelhead passage within the bypassed reach, and implement adaptive management strategies to address the potential barriers.
- Implement project operating rules for when anadromous salmonids are present in the bypassed reach and develop an associated monitoring program.[15]
- Monitor fish behavior at the project's tailrace and modify the tailrace if fish attraction is observed.
- Develop an operations model for flow and water temperature.
- Develop a CRLF protection plan to provide for and allow for CRLF at the project to become reestablished and to be protected from "manageable threats" during operation.

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[14] Panther Grade is a natural falls-boulder cascade at RM 18.9 that is a likely barrier to upstream fish migration at most flows in South Fork Battle Creek.

[15] In its February 2, 2018, comments on the draft EIS, Rugraw provides the following proposed operating rules based on the number of anadromous fishes (minimum length of 18 inches) successfully migrating to the tailrace or above within the project reach: (1) when 1 to 11 fish are found, relocate them to more suitable habitat below Panther Grade; and (2) when 12 or more fish are found, release a pulse flow of at least 30 cfs into the bypassed reach for a minimum of 48 hours (in each month they are found) and conduct additional studies of the habitat within the project reach to better inform an appropriate adaptive management plan based on current site conditions.

- Implement the Historic Properties Management Plan (HPMP) filed on November 30, 2015.

Public Involvement

Before filing its license application, Rugraw conducted pre-filing consultation under the Commission’s traditional 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, we distributed a scoping document (SD1) to stakeholders and other interested parties on October 3, 2014. Two scoping meetings were held on November 5, 2014: a day-time meeting in Sacramento, California; and an evening meeting in Red Bluff, California. Based on comments made during the scoping meetings and written comments filed with the Commission, we issued a revised scoping document (SD2) on March 26, 2015. On April 25, 2016, we issued a notice that Rugraw’s application for an original license for the Lassen Lodge Project was ready for environmental analysis and requesting comments, terms and conditions, recommendations, and prescriptions.

The draft environmental impact statement (EIS) was sent to the U.S. Environmental Protection Agency and made available to the public on December 4, 2017. Written comments on the draft EIS we due by February 4, 2018. In addition, the Commission accepted oral testimony on the draft EIS at two public meetings in Red Bluff, California, on January 3, 2018. The transcripts from these meetings were filed in the administrative record for the project on February 12, 2018. Appendix A lists the commenters that filed written comments, summarizes the substantive comments, and includes staff responses to those comments.

In addition, on May 22, 2018, Commission staff sent a letter to landowners that may be affected by an amendment to Rugraw’s proposed transmission line route and to Tehama County, California, seeking comments on the proposed route (as amended) and information on how it may affect the use of their property. No comments were filed in response to this letter.

Alternatives Considered

This final EIS analyzes the effects of the proposed project’s construction and operation and recommends conditions for any license that may be issued for the project. In addition to Rugraw’s proposal, we consider three alternatives: (1) no-action, whereby the project would not be licensed and constructed; (2) Rugraw’s proposal with staff modifications (staff alternative); and (3) the staff alternative with all mandatory conditions.

Staff Alternative

Under the staff alternative, the project would include most of Rugraw's proposed measures, with the following modifications and additions.

Project Construction

- Modify the proposal to restore disturbed areas with native vegetation using seed mixes recommended by California DFW.
- Modify the proposed SWPPP to include measures for controlling runoff from the construction sites, preventing material from contacting or entering surface waters, and use of washed riprap, rocks, and gravel adjacent to or in watercourses during construction.
- Develop a construction plan that incorporates the specific measures proposed for construction, and file the plan with the Commission for approval.
- Develop a plan for monitoring turbidity and pH, and documenting observations of oily sheens and turbidity plumes during project construction.
- Modify the proposed Noxious Weed Management and Revegetation Plan to include provisions for the preconstruction treatment of existing non-native invasive plant populations on project land, additional reseeding and monitoring if restoration success criteria are not met by the end of the 2-year monitoring period, and measures to protect rare plant species from control measures targeting noxious weeds.
- Modify the proposed measure for restricting construction activities around active raptor nests to include consultation with California DFW in determining the appropriate buffer distance.
- Conduct preconstruction inspections for slender Orcutt grass, elderberry, and vernal pool habitat in areas of proposed ground disturbance that were not previously surveyed in 2013, and adjust the transmission line to avoid any areas where these species or habitats are found.
- Develop a special-status amphibian protection plan that includes the following provisions to protect FYLF, Cascades frog, and CRLF: (1) conduct preconstruction surveys for all life stages during the breeding season; (2) avoid construction activities in riparian areas when egg masses are present; (3) develop a protocol for handling FYLF and Cascades frogs during relocation activities; (4) identify specific areas for relocation (notify California DFW if relocation of FYLF or Cascades frogs is necessary); (5) stop work and notify the U.S. Department of the Interior, Fish and Wildlife Service (FWS) within 24 hours if CRLF are observed during

preconstruction surveys or during construction; and (6) relocate larval, juvenile, and adult FYLF and Cascades frogs prior to construction activities to an area sufficiently upstream to prevent them from re-entering the construction area.

- Design and construct the transmission line with consideration given to the APLIC guidance to reduce impacts on avian species.[16]

Project Operation

- Modify the proposed DSMP to include: (1) consultation with the California State Water Resources Control Board (Water Board) and California DFW during low-flow years to determine if the sluicing of sediments should occur at inflows less than 400 cfs, (2) monitoring of turbidity to document any project-caused exceedance of the *Central Valley Regional Water Quality Control Board Basin Plan*'s turbidity objectives, and (3) periodic surveys of the project impoundment to document sediment and woody material deposition.
- Provide a ramping rate that does not exceed 1 inch of stage change per hour as measured at the staff recommended monitoring gage located just downstream of the diversion dam.
- Discontinue project operation when the average daily stream temperature measured upstream of Spring #4's influence exceeds 20ºC and is higher than the stream temperature measured at the dam.
- Develop a project operation compliance monitoring and reporting plan to support and document compliance with run-of-river project operation, MIF requirements, ramping rates, base flow recession rates, and water temperature protection measures and that specifies: (1) real-time water temperature monitoring at the project's dam and just upstream of Spring #4 influence; (2) real-time monitoring of water surface elevation just downstream of the diversion dam and streamflow just upstream of Spring #4 influence; (3) water surface elevation monitoring in the reservoir; (4) non-compliance event reporting; and (5) annual compliance reports.
- Develop an aquatic invasive species monitoring plan in consultation with the resource agencies that incorporates measures to help prevent the introduction and/or spread of aquatic nuisance species (flora and fauna) into the proposed project area, including construction BMPs to prevent the

[16] The Commission typically does not enforce regulations and/or guidelines issued by other entities.

spread of aquatic nuisance species (e.g., bullfrog) and protocols to decontaminate equipment that could spread chytrid fungus.[17]

- Develop an avian protection plan that incorporates Rugraw's proposed transmission line design and considers FWS's Avian Protection Plan Guidelines and APLIC Guidelines to reduce the risk of avian interactions with the proposed transmission line, and implement the plan throughout the term of the license.
- Develop a bald eagle and raptor management plan that considers FWS's National Bald Eagle Management Guidelines and includes the use of species-specific distance buffers, landscape buffers, seasonal restrictions, and additional recommendations to benefit raptors.
- Develop a plan to protect FYLF from spring base flow recession rates that could dewater egg masses.
- Finalize the HPMP filed on November 30, 2015, to include both California State Historic Preservation Office (SHPO) and staff comments and recommendations. Revisions to the HPMP would include: (1) modifying sections 1.2, 1.4, 1.7, 1.8, 4.1, 4.3, 4.5, 4.6, 4.7, 5.1, 5.2, 5.3, and appendix B of the document for a more clear and concise management approach for historic properties that may be affected by the proposed project; (2) copies of any post-2014 tribal correspondence and consultation related to the identification of cultural resources and development of the HPMP to document full compliance with section 106; (3) a cultural resources interpretive element, such as installation interpretive signage at key viewing areas; (4) a detailed monitoring plan for cultural resources within the area of potential effects (APE) that are eligible for listing in the National Register of Historic Places or have not yet been evaluated; (5) provisions for periodic review and revision of the HPMP; (6) editorial corrections as specified in section 5.1.2 of this EIS; and (7) inclusion of Volume II into the final HPMP.[18]

The staff alternative does not include the Rugraw proposals regarding: maintaining the reservoir water surface elevation within +/- 0.5 inch of the normal pool elevation, monitoring water temperature at some locations within the project area, providing upstream fish passage at the diversion dam during project operation, developing an anadromous fish monitoring program, genetic sampling for steelhead, and developing an operations model for flow and water temperature. The staff alternative

[17] Bullfrogs are known to spread chytrid fungus, which can result in disease and mass die-offs of amphibians.

[18] Volume II includes all of the individual site record forms of cultural resources located in the APE that were filed separately from the HPMP.

also does not include the following five Water Board preliminary water quality certificate conditions: (1) development of a drought plan (preliminary condition 4); (2) annual consultation on current special-status species (preliminary condition 5); (3) development of a fish population monitoring plan (preliminary condition 11); (4) development of a fish habitat assessment plan (preliminary condition 12); and (5) development of an amphibian monitoring plan (preliminary condition 13).

Environmental Effects of the Staff Alternative

The primary issues associated with constructing and operating the project are effects of project construction, operation, and maintenance on instream flows and water quality; loss of fish, botanical, and wildlife habitat; effects on aesthetics; and protection of cultural resources. The environmental effects of the staff alternative are described in the following section.

Geology and Soil Resources

Construction of the project would include land-disturbing activities associated with building the diversion dam and associated intake and fish screening structure, the pipeline and penstock, the powerhouse, and the transmission line and its substation. These activities would include instream excavation, vegetation removal, and other soil disturbance that would create the potential for erosion and could affect water quality. Rugraw's proposed measures to minimize the limits of disturbance; stockpile, replace, regrade, and revegetate topsoils; develop and implement an SWPPP; protect aquatic habitats from erosion; and use a gravel surface for permanent roads would limit the adverse effects of erosion on terrestrial and aquatic habitats. Staff's additional recommended measures for controlling runoff, provisions for preventing material from contacting or entering surface waters, and use of washed riprap, rocks, and gravel in areas adjacent to or in watercourses during construction would further protect aquatic habitats by preventing the discharge of fines to watercourses.

Aquatic Resources

Use of a cofferdam, silt fences, in-water construction window during low-flow periods, and similar BMPs would minimize the effect of increased turbidity on aquatic organisms during project construction because these measures would isolate construction areas from South Fork Battle Creek and would protect aquatic resources by limiting the spread of disturbed sediment in the creek. Implementing staff's recommended water quality monitoring during project construction would identify when construction activities adversely affect water quality and facilitate corrective action to be taken in a timely fashion to protect aquatic resources.

The proposed DSMP, which provides for the periodic sluicing of accumulated sediment from the project reservoir for the duration of a license term, would help to maintain downstream aquatic habitat diversity by maintaining sediment and gravel transport past the dam. Staff's recommended modification to the DSMP, which includes a consultation requirement with the Water Board and California DFW, to determine the need for sediment sluicing prior to sluicing at flows less than 400 cfs, monitoring turbidity associated with sediment sluicing events to assess any project-caused exceedance of the *Central Valley Regional Water Quality Control Board Basin Plan*'s turbidity objectives, and periodically surveying the project impoundment to document sediment and woody material deposition would ensure the protection of aquatic and riparian habitats.

Staff's minimizing of project-caused exceedances of 20ºC daily average in the bypassed reach as measured just upstream of Spring #4 influence, via project shut-downs, would protect resident salmonid habitat in the bypassed reach.

Staff's recommended streamflow monitoring would document compliance with the recommended run-of-river operation and the MIF and ramping rate in the bypassed reach.

Staff's recommended minimum instream bypassed reach flow of 13 cfs would protect aquatic resources in the bypassed reach. In addition, implementing our recommended ramping rate would reduce the potential for stranding mortality downstream of the diversion dam and powerhouse.

Staff's recommended project operation compliance monitoring and reporting plan would provide a process for documenting compliance with streamflow, ramping rate, and water temperature requirements. The plan would identify monitoring and reporting procedures, and provide a pathway for adaptively modifying the plan, as needed.

Although anadromous fish do not currently have access to the project reach, maintaining upstream and downstream fish passage during construction of the project's powerhouse, tailrace, and diversion dam would allow resident species to egress the site and not be impacted by project construction. If ongoing anadromous fish restoration efforts in South Fork Battle Creek result in anadromous fish being able to access the project area during project construction, then maintaining fish passage during the construction period also would benefit these species. Operation of a fish screen at the project intake and downstream fish passage facilities at the diversion dam would provide effective downstream fish passage at the project's diversion. Monitoring of anadromous fish presence and behavior in the tailrace would help to determine if additional measures are needed to address tailrace attraction, improve upstream passage at potential impediments in the bypassed reach, or modify project operation if restoration efforts provide anadromous species with access to the project reach in the future.

Staff's recommended aquatic invasive species monitoring during project operation would identify the presence of invasive species and help to limit the spread of aquatic invasive species.

Terrestrial Resources

Construction of the project facilities would disturb existing vegetation and remove some wildlife habitat. Birds could collide with the project's transmission line and increase risk of injury and electrocution.

Multiple measures would reduce these effects by using biological monitors, training construction staff, clearly delineating work areas, and conducting preconstruction inspections to identify and protect sensitive resources. Conducting preconstruction sensitive plant inspections in areas not previously surveyed and proposed for disturbance would minimize risk to sensitive plants.

The proposed Noxious Weed Management and Revegetation Plan, with staff's recommended modification to continue reseeding and monitoring until success criteria are met, treat existing non-native plant populations in the project boundary, and protect rare plant species from control measures, would help to promote and protect habitat quality and native vegetation structure.

Rugraw proposes to construct the transmission line in accordance with current standards to minimize risk of avian collision and electrocution and provide protection buffers around any bald eagle and other raptor nests observed during preconstruction surveys. However, specific line design and protection buffer distances are unknown. Developing an avian protection plan and a bald eagle and raptor management plan as recommended by staff would ensure that design and measures are appropriate for the project area, and appropriate nest buffers are implemented during project construction and during any vegetation maintenance activities along the transmission that may be necessary during the duration of the license.

Three special-status amphibian species could occur in the project area. Construction activities may cause injury or mortality and affect habitat for these species. Staff's recommended special-status amphibian protection plan would ensure that all life stages of the FYLF, Cascades frog, and CRLF are protected during project construction and operation. The plan would include measures to avoid disturbance to riparian habitats during the breeding season, and conduct preconstruction surveys to relocate juvenile and adult FYLF and Cascades frogs outside of construction areas.

Threatened and Endangered Species

No threatened or endangered anadromous fish currently occur in the project area, although critical habitat for the threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*) has been designated in the project area. Construction and operation of the proposed project may cause short-term increases in turbidity and alter the water temperature and flow regime in the project's bypassed reach. However, with the implementation of the staff-recommended measures to protect aquatic resources and habitats discussed above, the project may affect, but is not likely to adversely affect, designated critical habitat for the threatened Central Valley spring-run Chinook salmon and Central Valley steelhead.

We conclude that licensing the project, as proposed with staff-recommended measures, would have no effect on slender Orcutt grass (*Orcuttia tenuis*), vernal pool fairy shrimp (*Branchinecta lynchi*), and valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)* because Rugraw's surveys did not identify these species or suitable habitat for these species on proposed project lands. The project would also have no effect on CRLF (*Rana draytonii*) because it has not been documented on proposed project lands, and the only potentially suitable habitat on proposed project lands is in ponds that would not be affected by the proposed project. In addition, staff's recommended special-status amphibian protection plan would ensure that all CRLF life stages are protected during project construction and operation and support its re-establishment in the project area. Staff's recommendation to implement bullfrog control measures as part of the aquatic invasive species monitoring plan would reduce potential predation on CRLF in the project area. The threatened Northern spotted owl (*Strix occidentalis caurina*) could occur in the project area. However, proposed project lands do not contain high-quality habitat or critical habitat for this species because of historical logging and other disturbances and lack of mature forest stands, but mixed conifer patches along Battle Creek may provide marginally suitable nesting habitat on the proposed project bypassed reach. FWS responded to the draft EIS by letter filed December 21, 2017, and stated that the Northern spotted owl is not expected to occur in the project area, and that "no further action pursuant to the Act is necessary." We conclude that licensing the Lassen Lodge Project, as proposed with staff-recommended measures, would have no effect on the Northern spotted owl.

Recreational Resources

The potential for the project to affect public recreation is minimal because the project would be located entirely on private land with limited access. As such, there are no proposed or recommended recreation measures.

Land Use and Aesthetics

Construction activities would be visible to the public, and construction equipment would be present along South Powerhouse Road and Hazen Roads in the town of Manton and would affect aesthetics in the area. Measures to restrict construction to designated areas, restore existing conditions where possible, use wood poles for the transmission lines and minimize road development would minimize the effects of the project on aesthetics and on forestry, rural development, and open space.

After construction, the transmission line on the western part of the project site in the town of Manton would be visible adjacent to the roadway for a distance of about 1.5 miles on South Powerhouse Road and Hazen Road. However, because this portion of the proposed transmission line route would be primarily along Hazen Road and South Powerhouse Road and only require about 500 feet of new right-of-way to reach the switchyard, impacts on aesthetics would be minor. Permanent vegetation clearing could be associated with construction of the transmission line not directly adjacent to roadways to maintain a clear and safe distance of trees from the transmission line. However, Rugraw's proposals to limit ground disturbances and vegetation removal and to clearly delineate work area boundaries, would minimize effects. Because the distance from South Powerhouse Road to the proposed switchyard is only 500 feet, impacts on aesthetics from vegetation clearing not along roadways are expected to be minor.

Some motorists along California State Route 36 may be able to view other portions of the transmission line, particularly along its southeastern route; however, views are expected to be of short duration, with less foreground emphasis.

Cultural Resources

Project-related effects on cultural resources within the APE could occur from project construction, operation, and maintenance; use and maintenance of project roads; and mitigation measures associated with other environmental resources. Rugraw's HPMP includes measures that are consistent with most of the Advisory Council on Historic Preservation and Commission's 2002 guidelines. However, revising the HPMP to include additional California SHPO and staff-recommended measures would ensure that historic properties are protected over the license term. To meet section 106 of the National Historic Preservation Act (NHPA) requirements, the Commission intends to execute a Programmatic Agreement (PA) with the California SHPO for the proposed project for the protection of historic properties that would be affected by project construction and operation. The PA terms would require Rugraw to address all historic properties identified within the project's APE through implementation of a final HPMP. The PA would stipulate that Rugraw would file a final HPMP for Commission approval within 6 months after license issuance.

No-action Alternative

Under the no-action alternative the project would not be constructed.

Conclusions

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

In section 4.2, *Comparison of Alternatives*, of the EIS, we estimate the likely cost of alternative power for each of the two alternatives identified above. Our analysis shows that, during the first year of operation under the proposed action alternative, project power would cost $1,442,540, or $57.85/MWh, more than the likely alternative cost of power. Under the staff alternative, project power would cost $1,413,080, or $56.67/MWh, more than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $1,430,970, or $57.39/MWh, more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (24,936 MWh annually); (2) the 5.0 MW of electric capacity would come from a renewable resource that would not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by Rugraw, and additional modifications and measures recommended by staff, would adequately protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

ENVIRONMENTAL IMPACT STATEMENT

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

Lassen Lodge Hydroelectric Project
FERC Project No. 12496—California

1.0 INTRODUCTION

1.1 APPLICATION

On April 21, 2014, Rugraw, LLC (Rugraw), filed an application for an original license for the Lassen Lodge Project (project) with the Federal Energy Regulatory Commission (Commission or FERC).[19] The 5.0-megawatt (MW) hydropower project would be constructed on the upper South Fork Battle Creek in Tehama County, California, about 1.5 miles west of the town of Mineral (figure 1-1). The project would occupy no federal land.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed Lassen Lodge Project is to provide a source of hydroelectric power. Therefore, under provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to Rugraw for the project and what conditions should be placed on any license 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 recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing an original license for the Lassen Lodge Project would allow Rugraw to generate electricity at the project for the term of a license, making electrical power from a renewable resource.

[19] Rugraw amended its final license application on December 2, 2015.

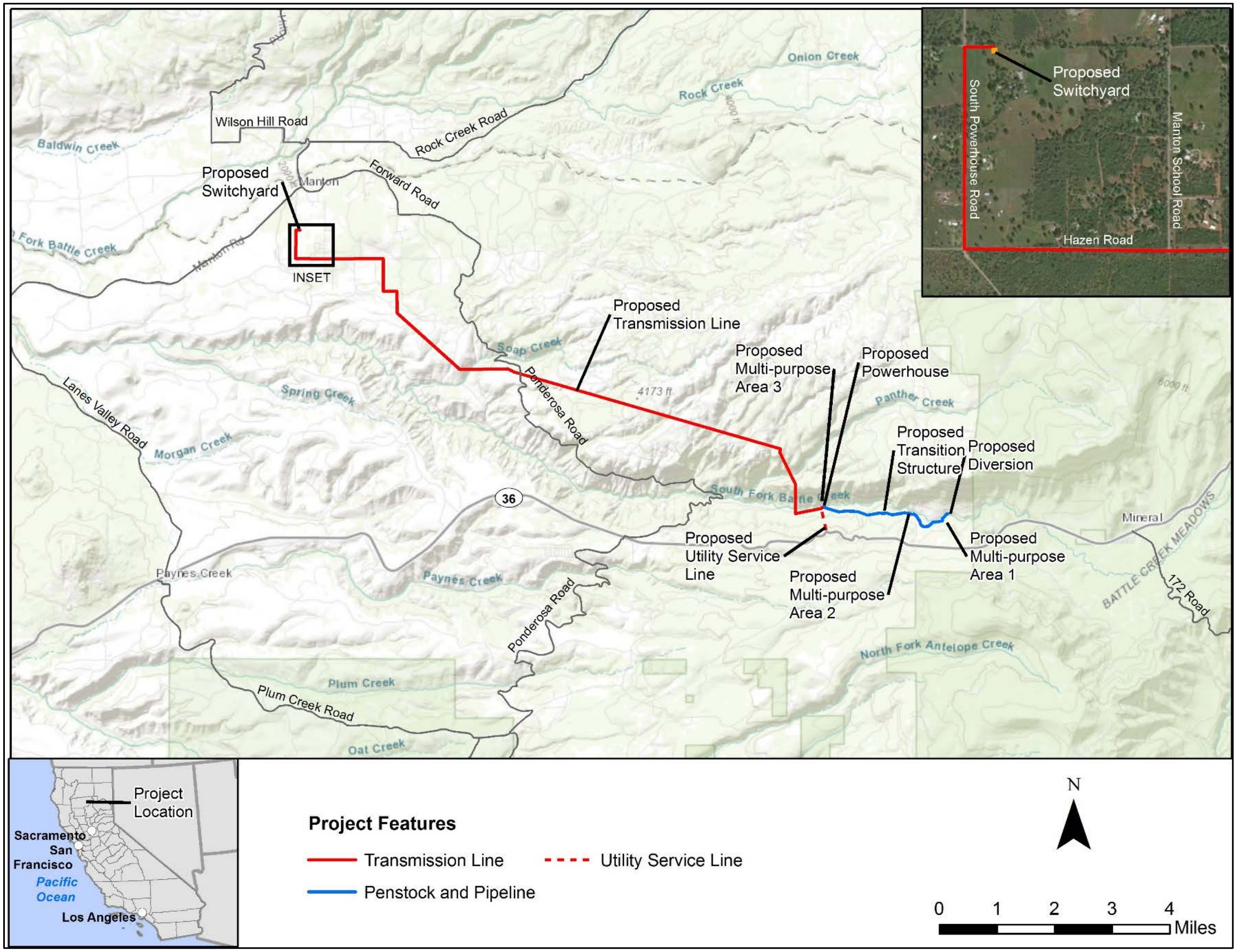

Figure 1-1. Lassen Lodge Project location and facilities layout (Source: Rugraw, 2015, as modified by staff).

This final environmental impact statement (EIS) assesses the effects associated with construction and operation of the project and alternatives to the proposed project. It also includes recommendations to the Commission on whether to issue an original license, and if so, includes the recommended terms and conditions to become a part of any license issued.

In this EIS, we assess the environmental and economic effects of constructing and operating the project: (1) as proposed by Rugraw, (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, in which the project would not be licensed or constructed. Important issues addressed include effects of construction and operation on water quality; aquatic resources, including winter-, spring-, and fall-run Chinook salmon and steelhead; vegetation and wildlife; land use and aesthetics; and cultural resources.

1.2.2 Need for Power

The Lassen Lodge Hydroelectric Project would provide hydroelectric generation to meet part of California's power requirements, resource diversity, and capacity needs. The project would have an installed capacity of 5.0 MW and generate approximately 24,936 megawatt-hours (MWh) per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. To assess the need for power, staff looked at the needs in the operating region in which the project is located. The Lassen Lodge Project is located in the California-Mexico subregion of the Western Electricity Coordinating Council. According to NERC's 2016 Long-Term Reliability Assessment, generating capacity is expected to drop from 49,628 to 47,210 MW from 2017 to 2026, and net internal demand is expected to drop slightly from 38,665 MW to 38,154 MW (NERC, 2016).

We conclude that power from the Lassen Lodge Project would help meet a need for power in the California-Mexico subregion in both the short and long term. Being a renewable resource, the project provides power that may displace generation from non-renewable sources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any license for the Lassen Lodge Project would be 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 states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce or the U.S. Department of the Interior (Interior). The U.S. Department of Commerce and Interior, by letters filed June 21, 2016, and June 24, 2016, respectively, request that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

1.3.1.2 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.

The California Department of Fish and Wildlife (California DFW), National Marine Fisheries Service (NMFS), and Interior timely filed, on June 16, 2016, June 21, 2016, and June 24, 2016, respectively, recommendations under section 10(j), as summarized in table 5-2 in section 5.3, *Recommendations of Fish and Wildlife Agencies*. In letters dated February 2, 2018, and February 13, 2018, Interior and NMFS requested a meeting to resolve the inconsistencies. Commission staff conducted a meeting with Interior and NMFS on March 15, 2018, in Sacramento, California.[20] In section 5.3, *Recommendations of Fish and Wildlife Agencies*, 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, a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the Clean Water Act. Rugraw initially applied to the California State Water Resources Control Board (Water Board) for section 401 water quality certification (WQC) for the Lassen Lodge Project on May 20, 2014, and subsequently each year since, has withdrawn and refiled its application. The Water Board received Rugraw's latest request on March 21, 2018.[21] The new deadline for certification action is March 21,

[20] A transcript of the meeting was filed to the record on March 15, 2018.

[21] Filed on May 15, 2018.

2019. In the interim, by letter filed June 24, 2016, the Water Board provided preliminary terms and conditions in response to the notice of Ready for Environmental Analysis issued by Commission staff on April 26, 2016.

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. Four federally listed species may occur in the Lassen Lodge Project vicinity: the California red-legged frog (*Rana draytonii*) (CRLF), vernal pool fairy shrimp (*Branchinecta lynchi*), slender Orcutt grass (*Orcuttia tenuis*), and valley elderberry longhorn beetle (*Desmocerus californicus dimorphus)* (letter from Patricia Sanderson Port, Regional Environmental Officer, Interior, San Francisco, California, to K.D. Bose, Secretary, FERC, Washington, D.C., June 24, 2016). Although currently not found in the project area, there is the potential for the future occurrence of the listed Sacramento River winter-run Chinook salmon (*Oncorhynchus tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), and California Central Valley steelhead (*O. mykiss*) if the Battle Creek Salmon and Steelhead Restoration Project (BCSSRP) is successful in removing downstream fish passage barriers to in South Fork Battle Creek by approximately 2020 (letter from S. Edmondson, Chief, FERC Branch, NMFS West Coast Region, Sacramento, California, to K.D. Bose, Secretary, FERC, Washington, D.C., June 21, 2016).[22] Although not yet started, the Battle Creek Winter-Run Chinook Salmon Reintroduction Project plan and its associated multi-agency Battle Creek Jumpstart Project is releasing juvenile winter-run Chinook into Battle Creek beginning spring 2018. With these releases, adult fish could return to Battle Creek within the next 2 to 3 years, and could also stray into South Fork Battle Creek. Our analyses of project impacts on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

We conclude that licensing the Lassen Lodge Project, as proposed with staff-recommended measures, would have no effect on slender Orcutt grass, vernal pool fairy

[22] The BCSSRP is a collaborative effort among Interior, the U.S. Bureau of Reclamation (Reclamation), PG&E, various resource agencies, and the public focused on restoring prime salmon and steelhead habitat downstream of the proposed project on Battle Creek, an area considered one of the most important anadromous fish spawning streams in the Sacramento River Valley (Jones & Stokes, 2005). We note that the proposed completion date for removing fish passage barriers has varied among agencies. In more recent letters of comment on the draft EIS, NMFS states that the completion date would be "approximately 2021" (letter filed January 31, 2018), and Interior states that the restoration project "will extend anadromy to Angel Falls by 2023" (letter filed February 2, 2018).

shrimp, and valley elderberry longhorn beetle because Rugraw's surveys did not identify these species or suitable habitat for these species on proposed project lands. Prior to construction, Rugraw also would conduct additional inspections in all areas of proposed disturbance. If habitat for these species is detected, Rugraw would consult with the U.S. Department of the Interior, Fish and Wildlife Service (FWS) prior to construction. The project would also have no effect on the CRLF because it has not been documented on proposed project lands, and the only potentially suitable habitat on proposed project lands is located in ponds that would not be affected by the proposed project.

The draft EIS included a discussion of the possible presence of the threatened Northern spotted owl (*Strix occidentalis caurina*) in the project area. Staff concluded that licensing the Lassen Lodge Project, as proposed with staff-recommended measures, is not likely to adversely affect the Northern spotted owl because any potential effects on suitable habitat during construction would be discountable, and proposed and recommended measures would limit potential effects of construction on this species. Similarly, proposed measures to follow industry standards for design of the transmission line would minimize risk of collision and electrocution of Northern spotted owl. By letter dated December 5, 2017, Commission staff requested concurrence from FWS on its determinations of effects under the ESA. FWS responded by letter filed December 21, 2017, that the Northern spotted owl is not expected to occur in the project area, and that "no further action pursuant to the Act is necessary."

Construction and operation of the proposed project may cause short-term increases in turbidity and alter the water temperature and flow regime in the project's bypassed reach, but proposed erosion control measures during construction and implementing an instream flow during operation would protect designated critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead. Therefore, the project may affect, but is not likely to adversely affect, designated critical habitat. By letter dated December 5, 2017, Commission staff requested concurrence from NMFS on its determinations of effects under the ESA. NMFS responded by letter filed April 5, 2018, that it does not concur with the staff finding of not likely to adversely affect because the draft EIS lacked sufficient detail to determine the extent to which the proposed project may affect federally listed species and their designated critical habitat and is insufficient to initiate consultation as outlined in the regulations governing interagency consultation (50 Code of Federal Regulations [C.F.R.] §402.12). We include additional analysis of effects on listed fish species and designated critical habitat physical or biological features in section 3.3.4, *Threatened and Endangered Species*, and appendix B, *Effects of Proposed Project Operations on Designated Central Valley Spring-Run Chinook Salmon and California Central Valley Steelhead Critical Habitat Physical or Biological Features*, of this final EIS.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code (U.S.C.) § 1456(3)(A), the Commission cannot issue a license for a project within or affecting a state’s coastal zone unless the state CZMA agency concurs with the license applicant’s certification of consistency with the state’s CZMA 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 project is not located within the state-designated Coastal Management Zone or the San Francisco Bay Conservation and Development Commission’s jurisdiction. By letter dated February 15, 2017, and filed by Commission staff on February 16, 2017, the California Coastal Commission declined to assert federal consistency jurisdiction over the proposed Lassen Lodge Project. Therefore, no consistency certification is needed for the proposed action.

1.3.5 National Historic Preservation Act

Section 106 of the NHPA requires that every federal agency “take into account” how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties (TCPs), and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the construction and operation of the Lassen Lodge Project. The terms of the PA would ensure that the Rugraw addresses and treats all historic properties identified within the project’s area of potential effects (APE) through implementation of a Historic Properties Management Plan (HPMP).

1.3.6 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NMFS on all actions that may adversely affect Essential Fish Habitat (EFH). In the case of the Lassen Lodge Project, EFH consultation is required for Chinook salmon, because South Fork Battle Creek up to Angel Falls is considered EFH. Because Angel Falls is located 1.7 miles upstream of the powerhouse site, 1.7 miles of the 2.4-mile-long bypassed reach would be considered EFH.

In this final EIS, we conclude that the proposed project would have only minor, short-term impacts on Chinook salmon EFH. Via this EIS, we are providing NMFS with our EFH assessment and request that NMFS provide any EFH conservation recommendations.

1.4 PUBLIC REVIEW AND COMMENT

Commission regulations (18 C.F.R., section 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing a license application. This consultation is the first step in complying with the Fish and Wildlife

Coordination Act, ESA, NHPA, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing the draft EIS, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on October 3, 2014. It was noticed in the *Federal Register* (FR) on October 3, 2014.[23] Two scoping meetings, both advertised in the local Red Bluff Daily News newspaper,[24] were held on November 5, 2014, where oral comments on the project were sought. The daytime meeting was held in Sacramento, California, while the evening meeting was held in Red Bluff, 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. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
National Marine Fisheries Service	December 4, 2014
Pacific Gas and Electric Company	December 15, 2014
Tehama County, California	December 17, 2014

A revised scoping document (SD2) addressing these comments was issued on March 26, 2015.

1.4.2 Interventions

On August 28, 2014, the Commission issued a notice that Rugraw had filed an application for an original license for the Lassen Lodge Project. This notice set October 27, 2014, as the deadline for filing protests and motions to intervene. In response to the notice, the following entities filed motions to intervene:

Intervenor	Date Filed
California State Water Resources Control Board[25]	September 9, 2014
National Oceanic and Atmospheric Administration, National Marine Fisheries Service, West Coast Region	September 12, 2014
California Department of Fish and Wildlife	October 16, 2014
U.S. Department of the Interior, Office of the Solicitor[24]	October 23, 2014

[23] *Federal Register* Vol. 79, No. 198.

[24] Proof of publication filed December 3, 2014.

[25] Submitted notice of intervention.

Intervenor	Date Filed
American Whitewater	October 27, 2014
California Sportfishing Protection Alliance	October 27, 2014

1.4.3 Comments on the Application

A notice requesting comments, preliminary terms and conditions, and recommendations was issued on April 25, 2016. The following entities commented:

Commenting Agency and Other Entity	Date Filed
California Department of Fish and Wildlife	June 16, 2016
National Oceanic and Atmospheric Administration, National Marine Fisheries Service, West Coast Region	June 21, 2016
California State Water Resources Control Board	June 24, 2016
U.S. Department of the Interior	June 24, 2016

Rugraw filed reply comments on August 31, 2016.

1.4.4 Comments on the Draft Environmental Impact Statement

The draft EIS was sent to the U.S. Environmental Protection Agency (EPA) and made available to the public on December 4, 2017. Written comments on the draft EIS were due February 4, 2018. In addition, oral testimony on the draft EIS was received during two public meetings held in Red Bluff, California, on January 3, 2018.[26] Appendix A lists the commenters that filed written comments, summarizes the substantive comments that were filed, and includes staff responses to those comments, and indicates where we made modifications to this final EIS, as appropriate.

1.4.5 Landowner Comments on the Proposed Transmission Line (as amended)

As specified in its amended final license application filed on December 2, 2015, Rugraw proposes a transmission line route that aligns with South Powerhouse Road and Hazen Road in the vicinity of the town of Manton to address landowner concerns regarding visual effects and direct effects on property. Section 2.2.1, *Project Facilities*, of this final EIS contains the full description of the route (we did not analyze this proposed route in the draft EIS). To ensure that any landowner concerns with the route are considered, Commission staff issued a letter to potentially affected landowners and Tehama County on May 22, 2018, soliciting comments on this proposed route. No comments were filed in response to this letter.

[26] The transcripts from the meetings were filed in the administrative record for the project on February 12, 2018.

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2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the proposed project would not be built, and the environmental resources in the proposed project area would not be affected.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Facilities

Rugraw proposes to construct the project 1.5 miles west of Mineral, California, on South Fork Battle Creek in Tehama County. The project would consist of a diversion dam, intake structure, fish screen, pipeline, penstock, powerhouse, substation, switchyard, four multipurpose areas, transmission line, and project access roads from Route 36 to the diversion dam and from Route 36 to the powerhouse. The 8-foot-high, 2-foot-wide, and 63-foot-long diversion dam would be located at river mile (RM) 23, approximately 0.5-mile upstream of the Old State Highway Route 36 Bridge, creating a 0.4-acre impoundment at a normal operating elevation of 4,310 feet mean sea level (msl) (figure 2-1). The diversion dam would include three 8-by-8-foot pneumatic gates with a sill elevation of 4,302 feet msl. When fully deflated, the gates would lay flat on the sill and virtually dewater the impoundment.

The proposed intake structure would be a 17-by-25-foot enclosed concrete structure located outside the normal stream wetted area, constructed partially in the south bank above the stream, and equipped with two 5-by-12-foot trash racks. Water would then pass into a 20-foot-wide, 8-foot-high, 50-foot-long control/fish screen structure that would include 27 4-by-8-foot perforated flat panel fish screens equipped with automatic travelling screen-cleaning brushes. An 18-inch-diameter juvenile fish return pipe incorporated into the downstream end of the fish screen structure would convey diverted fish downstream of the diversion dam, and flow from that pipe would be part of the minimum flow from the diversion dam. Upstream passage at the diversion dam would be provided by a conventional pool-and-weir fishway to be designed in accordance with California DFW specifications.

Water diverted for power generation would travel through a 48-inch-diameter, 7,565-foot-long, low-pressure high-density polyethylene pipeline and then into a 36-inch-diameter, 5,230-foot-long, welded steel high-pressure penstock. The 2.4-mile total length of the pipeline/penstock would be buried within a 40-foot-wide penstock right-of-way (ROW). An engineered cast-in-place concrete block transition structure would provide the transition from the 48-inch low-pressure high-density polyethylene pipeline to the 36-inch high-pressure steel penstock. Water would then enter a 50-by-51-foot powerhouse with a single multi-jet vertical Pelton-type turbine that would be closed-coupled to a synchronous generator with a capacity of 5.0 MW (figure 2-2).

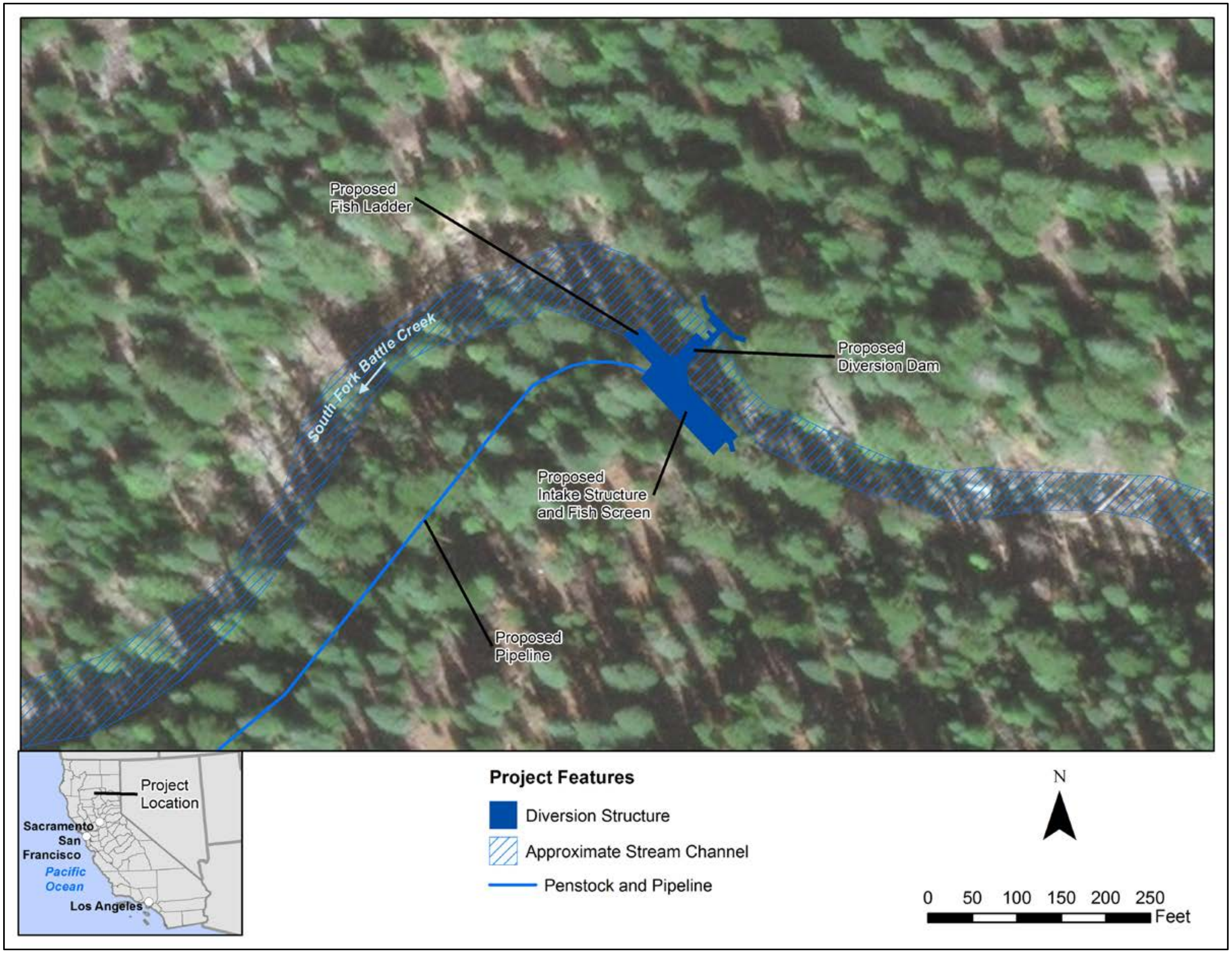

Figure 2-1. Lassen Lodge Project proposed diversion (Source: staff).

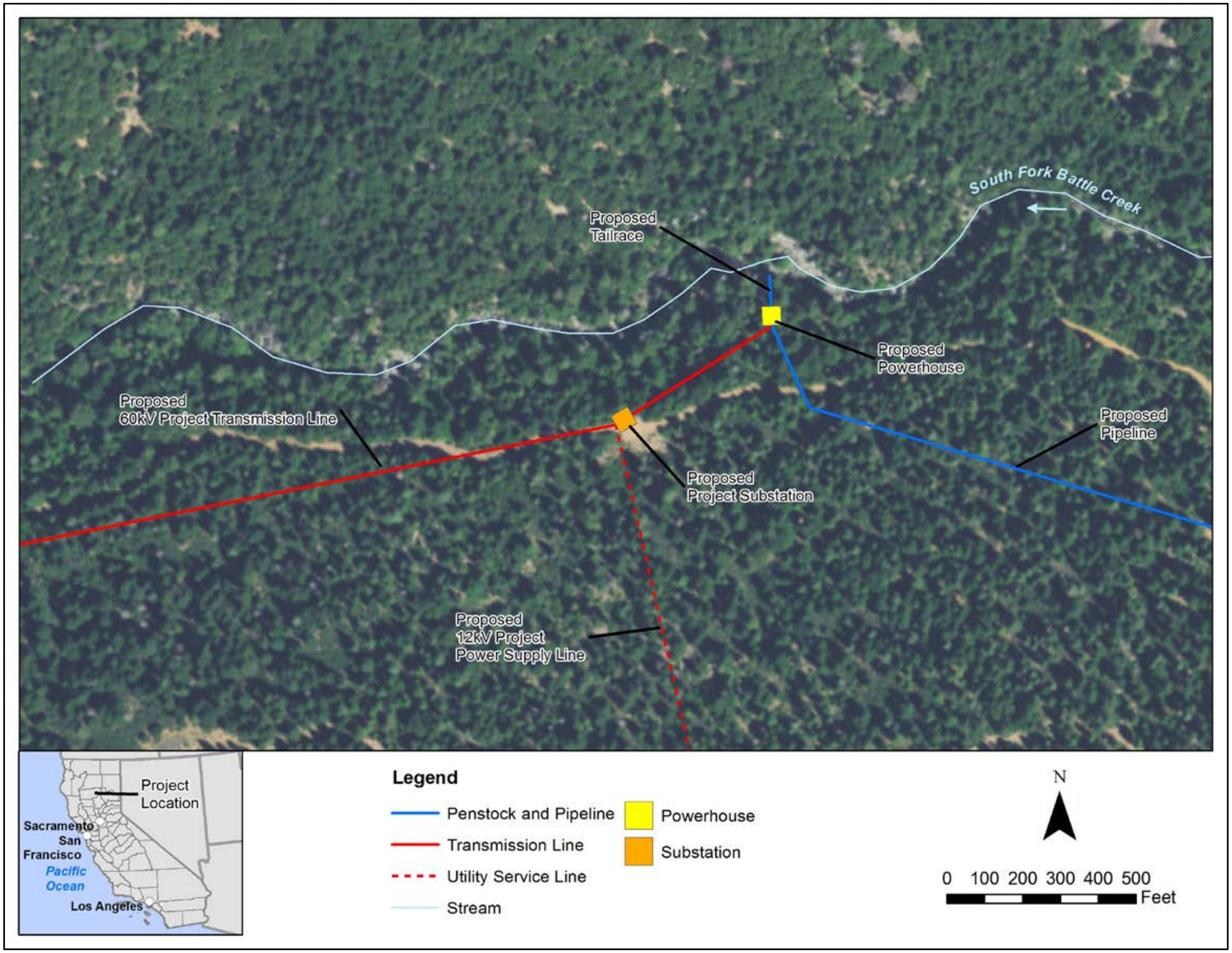

Figure 2-2. Lassen Lodge Project proposed powerhouse (Source: staff).

Water would exit the powerhouse at atmospheric pressure into a tailrace structure that starts under the powerhouse floor, and then enters an 8-by-6-by-70-foot buried concrete box culvert that returns water to the stream by cascading down 9 feet to the rock-strewn streambed over existing large boulders.

A new 12-mile-long, 60-kilovolt (kV) transmission line, within a 40-foot-wide ROW, would connect the powerhouse substation to a switchyard adjacent to the Pacific Gas and Electric Company (PG&E) 60-kV Volta-South transmission line in the town of Manton, California. The proposed transmission line route would align with South Powerhouse Road in the vicinity of the town of Manton. The South Powerhouse Road route follows the south side of Hazen Road to the intersection with South Powerhouse Road and turns north and follows the east side of South Powerhouse Road to the proposed switchyard, located just to the east of South Powerhouse Road.

A security-fenced switchyard would be located approximately 300 feet east of the point of interconnection. The switchyard, which would include a 10-by-10-foot concrete block building, would disturb an area of approximately 40-by-35-feet. An approximately 0.1-mile-long, aerial, 12-kV line would connect to the existing PG&E line.

A new, enclosed, and security-fenced substation would be located about 500 feet west-southwest of the powerhouse. Underground conduits from the powerhouse to the substation would convey generated power at 4,160 volts to the transformer located in the fenced substation where the power will be stepped up to 60 kV. The substation would disturb an approximate area of 50 by 50 feet. An approximately 0.5-mile-long 12-kV aerial station service line would be constructed along a 40-foot-wide ROW from the substation location southeast to the PG&E's 12-kV distribution line adjacent to Highway 36 to provide electricity and phone service to the powerhouse facility.

Rugraw also proposes four temporary[27] multipurpose areas that would be used to support project construction: (1) a construction yard near the diversion dam; (2) a construction yard near the powerhouse; (3) a multipurpose area near the Old State Highway Route 36 Bridge that would also serve as a helicopter landing site; and (4) a multipurpose area toward the west end of the proposed project boundary to support transmission line construction. These areas would vary in size from about 0.25 acre to 1 acre and be located within previously disturbed areas (e.g., log landings) on private lands.

2.2.2 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after

[27] Rugraw only stated that the multipurpose areas would be used during construction and did not identify any future use during project operation; therefore, we conclude that these areas would be used for construction and restored upon completion of construction.

construction. Inspection during construction would concentrate on adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. 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 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.3 Project Operation

Rugraw proposes to operate the Lassen Lodge Project run-of-river, maintaining the water surface elevation (4,310 feet msl) of the proposed 0.4-acre-reservoir at +/-0.5 inch throughout the normal operating range. Rugraw proposes to release a minimum flow of 13 cubic feet per second (cfs) to the bypassed reach via a weir gate at the diversion dam. Because the powerhouse needs a minimum of 5 cfs to operate, when river inflows are less than 18 cfs (13 cfs for the minimum flow plus 5 cfs required for turbine operation) the project would not operate. Instead, when inflow is less than 18 cfs all flow would spill over the diversion dam and remain in-channel. When inflow is greater than 18 cfs, Rugraw would divert flows greater than 13 cfs for generation, up to the turbine's maximum hydraulic capacity of 105 cfs. Streamflows greater than the combined hydraulic capacity of the turbine and the proposed minimum flow of 13 cfs would proceed unimpeded over the project diversion dam and into the bypassed reach.[28] Table 2-1 depicts how the diversion dam pneumatic gates and powerhouse would operate under the range of expected flows.

[28] In the final amended license application, Rugraw states that the project would be shut down at a flow of about 450 cfs, but in a letter filed on June 29, 2018, Rugraw clarifies that the project would begin its shutdown procedure at 418 cfs (letter from Charlie Kuffner, Rugraw, LLC, to Savannah Downey, California State Water Resources Control Board, dated June 28, 2018).

Table 2-1. Proposed bypass flows and associated ramping rates under various operational scenarios. Rows with bold font indicate conditions that would result in changing flow releases into the bypassed reach (Source: staff).

Hydro Limb	Inflow to Project	Project Operation	Bypass Flow	Change in Flow in Bypass	Typical Season of Occurrence
Climbing	0–17 cfs	Not operating	0–17 cfs	Natural increase	August–November
	18 cfs	**Start operation**	**13 cfs**	**1-inch/hour decline**	**August–November**
	19–118 cfs	Increase operation from 5 cfs to 105 cfs in powerhouse	13 cfs	0	August–June
	119–417 cfs	Maxed out at 105 cfs	13–312 cfs	Natural increase	November–June
	418 cfs	**Not operating, 105 cfs powerhouse flows transferred to bypass**	**418 cfs**	**1-inch/hour increase**	**December–Early May**
	>418 cfs	Not operating	>418 cfs	Natural increase	December–Early May
Falling	>418–418 cfs	Not operating	>418–418 cfs	Natural decrease	December–Early May
	418 cfs	**Start operating, 105 cfs transferred from bypass to powerhouse**	**313 cfs**	**1-inch/hour decrease**	**December–Early May**
	417–118 cfs	Maxed out at 105 cfs	312–13 cfs	Natural decrease	November–June
	117–19 cfs	Operating at decreasing capacity 104–5 cfs	13 cfs	0	August–June
	18 cfs	**Stop operation, 5 cfs transferred from powerhouse to bypass**	**13–18 cfs**	**1-inch/hour increase**	**August–November**
	17–0 cfs	Not operating	17–0 cfs	Natural decrease	August–November

2.2.4 Environmental Measures

Rugraw proposes several measures, including the following:

Project Construction

- Limit land disturbance and vegetation clearing to those areas needed for construction. Delineate the limits of construction, work areas, and multipurpose areas with flagging, fencing, and/or stakes to prevent land-disturbing activities outside of construction areas.
- Stockpile natural topsoils and replace, regrade, and revegetate disturbed areas, in accordance with California forestry regulations and best practices, with native vegetation. Restore disturbed stream and riparian habitat to preconstruction conditions and with riparian plantings and/or seeding, where applicable, with approved seed mixes.
- Develop a stormwater pollution prevention plan (SWPPP) with measures to prevent storm-induced erosion and sedimentation during ground-disturbing construction activities, including:
    - Store spoils from project construction in areas that limit erosion of spoil material and prevent runoff into aquatic habitats.
    - Install cofferdams, silt fences, or other structures to isolate in-water work areas.
- Use existing roads to the maximum possible extent, constructing new access roads only when necessary; limit access roads to a width of 12 feet whenever possible; and surface permanent roads with gravel to a depth and quantity sufficient to maintain a stable road surface and minimize erosion and dust.
- Conduct in-water work activities between July 1 and October 15 when streamflows are low to protect water quality and aquatic resources.
- Maintain upstream and downstream fish passage at the project during construction by constructing the diversion structure in phases or by providing a temporary diversion culvert to allow fish to pass the site.
- Conduct biological monitoring during construction to ensure that measures to protect biological resources are implemented appropriately.
- Provide environmental training to construction staff regarding laws, regulations, and best management practices (BMPs) to protect threatened and endangered species and special-status plant species and their habitats.
- Conduct preconstruction surveys in all areas of suitable habitat for threatened and endangered and special-status plant species where surveys

have not previously been conducted, and implement specified protection measures as necessary.

- Avoid streams, wetlands, and pond habitats to the extent possible during construction, and use existing stream and wetland crossings where possible.
- Implement the Noxious Weed Management and Revegetation Plan (filed on November 30, 2015), which includes measures to ensure weeds and non-native invasive vegetation do not reestablish at onsite disposal areas during project construction, with a proposed plan revision to include provisions for riparian plantings along disturbed portions of South Fork Battle Creek to provide overhanging vegetation.
- Map, evaluate, and quantify, by vegetation type, the vegetation that would be removed as a result of project construction.
- Conduct preconstruction surveys for migratory bird nests within 100 feet of any areas that will be disturbed during the typical nesting season of April 15 to July 31 to identify nest locations and their status.
- Restrict construction activities within 100 feet of any active migratory bird nests found during the preconstruction surveys.
- Conduct preconstruction raptor nest surveys in suitable habitat within 1 mile of any areas that will be disturbed during the appropriate nesting periods (January through August) to identify nest locations and their status.
- Determine and apply an appropriate buffer for restricting construction activities around any active raptor nests found during preconstruction surveys.
- Design and construct the transmission line in compliance with the Avian Power Line Interaction Committee (APLIC) guidance to reduce impacts on avian species (APLIC, 2006; 2012).
- Avoid ground-disturbing activity on or near talus[29] slopes to protect Sierra Nevada red fox and American pika.
- Avoid construction activity within or near potential bat roosting habitat, including rock crevices, cliffs, and snags.
- Conduct surveys for juvenile and adult foothill yellow-legged frogs (FYLF) immediately prior to construction when in-water work would occur and

[29] Talus slopes consist of loose rock eroded from cliff faces or rocky outcrops upslope. Vegetation is typically sparse or absent in these areas.

relocate juvenile and adult FYLF found within the project reach and up to 500 feet downstream, outside the project construction area.[30]

- Avoid construction activities in riparian areas during the time that egg masses of FYLF are present (typically mid-April through mid-May); postpone construction around the immediate area where egg masses of FYLF are found until the eggs have hatched; avoid collection of rocks from in-water environments and minimize disturbance to pools and shallow runs between March 1 and August 31 to protect FYLF and their habitat.
- Develop a CRLF protection plan to provide for and allow for CRLF in the project area to become reestablished and to be protected from manageable threats during construction.
- Reduce visual contrast where over-story vegetation is removed by thinning and removing trees from the edge of the ROW to give a natural appearance, where possible.
- Use wood poles to support the project transmission line to blend with surrounding vegetation.

Project Operation

- Operate the project in a run-of-river mode, maintaining the water surface elevation within +/- 0.5 inch of the normal pool elevation.
- Provide a ramping rate that will not exceed 0.1 foot of stage change per hour as measured by a stream gage proposed to be located within the bypassed reach between the diversion structure and the Old State Highway Route 36 Bridge.[31]
- Monitor water temperature at the following locations: (1) the diversion/intake structure, (2) in the bypassed reach at Old Highway 36 Bridge, (3) within the bypassed reach just upstream of the tailrace, (4) the powerhouse tailrace, (5) downstream of the powerhouse in mixed flows

[30] Although Rugraw did not define the term “project reach,” we interpret this to be South Fork Battle Creek from the upper extent of the proposed reservoir to just downstream of the proposed tailrace discharge.

[31] On August 31, 2016, Rugraw filed a letter in response to the Water Board’s preliminary conditions and California DFW’s preliminary section 10(j) recommendations, filed on June 24, 2016, and June 15, 2016, respectively, adopting the agencies’ preliminary recommended ramping rate, thereby amending the proposed ramping rate provided in the final license application.

from the bypassed reach and powerhouse tailrace, and (6) approximately 2.1 miles downstream of the powerhouse below Ponderosa Way Bridge.[32]

- Discontinue project operation when the average daily stream temperature exceeds 20 degrees Celsius (°C), measured in the bypassed reach upstream of Angel Falls.
- Develop a debris and sediment management plan (DSMP) to include:
    - Annually sluicing sediments from the project's reservoir when natural flow at the diversion site exceeds 400 cfs.
    - An evaluation of sediment deposits in the reservoir in years where natural flows do not reach 400 cfs to determine if sluicing is needed and, if so, sluice at flows greater than 108 cfs (minimum instream flow [MIF] of 13 cfs plus turbine design flow of 95 cfs).[33]
- Maintain an MIF of 13 cfs or inflow, whichever is less, in the bypassed reach to protect aquatic resources.[34]
- Monitor streamflow at the following locations: (1) immediately downstream of the diversion dam, (2) in the bypassed reach just above the powerhouse tailrace, and (3) at the existing station below Ponderosa Way Bridge.
- Construct an upstream and downstream fish passageway and fish screen structure at the project diversion dam to ensure fish are able pass the diversion dam, and design the facilities in coordination with the California DFW incorporating the NMFS Southwest Region Fish Screening Criteria for Anadromous Salmonids and NMFS Northwest Region Anadromous Salmonid Passage Facility Design.

[32] In its February 2, 2018, comments on the draft EIS, Rugraw confirms its proposal to monitor water temperature for the first 5 years of project operation and to publish that data for review by all interested parties.

[33] Staff edited the text associated with this proposal for clarity, and it reflects our interpretation of Rugraw's proposal.

[34] In its February 2, 2018, comments on the draft EIS, Rugraw states that it is willing to consider seasonal minimum flows ranging from 8 to 13 cfs, depending on the number of anadromous fish in the reach, and suggests that Commission staff analyze an alternative minimum flow of 8 cfs. Although Rugraw does not specify that it is changing its 13-cfs minimum flow proposal, we include an analysis of the 8-cfs minimum flow in this final EIS as suggested.

- Develop an anadromous fish monitoring program that includes the notification of resource agencies if anadromous species are found within the bypassed reach.
- If steelhead are detected upstream of Panther Grade,[35] conduct genetic tissue sampling of steelhead/rainbow trout to identify barriers to upstream steelhead passage within the bypassed reach, and implement adaptive management strategies to address the potential barriers.
- Implement project operating rules for when anadromous salmonids are present in the bypassed reach and develop an associated monitoring program.[36]
- Monitor fish behavior at the project's tailrace and modify the tailrace if fish attraction is observed.
- Develop an operations model for flow and water temperature.
- Develop a CRLF protection plan to provide for and allow for CRLF at the project to become reestablished and to be protected from "manageable threats" during operation.
- Implement the HPMP filed on November 30, 2015.

2.2.5 Modifications to Applicant's Proposal—Mandatory Conditions

The following mandatory conditions have been provided and are evaluated as part of the applicant's proposal.

Water Quality Certification Conditions

The Water Board has not yet issued the WQC. Water Board received Rugraw's latest request on March 21, 2018.[37] The new deadline for certification action is March

[35] Panther Grade is a falls-boulder cascade at RM 18.9 that is likely a barrier to upstream fish migration at most flows in South Fork Battle Creek.

[36] In its February 2, 2018, comments on the draft EIS, Rugraw provides the following proposed operating rules based on the number of anadromous fishes (minimum length of 18 inches) successfully migrating to the tailrace or above within the project reach: (1) when 1 to 11 fish are found, relocate them to more suitable habitat below Panther Grade; and (2) when 12 or more fish are found, release a pulse flow of at least 30 cfs into the bypassed reach for a minimum of 48 hours (in each month they are found) and conduct additional studies of the habitat within the project reach to better inform an appropriate adaptive management plan based on current site conditions.

[37] Filed on May 15, 2018.

21, 2019. However, by letter filed June 24, 2016, the Water Board provided preliminary terms and conditions in response to the notice of Ready for Environmental Analysis issued by Commission staff on April 26, 2016.[38]

The following, project-specific, preliminary WQC conditions provided by the Water Board are administrative in nature or insufficiently detailed, and, therefore, we do not analyze them in this EIS: (1) reservation of authority to condition the project with MIFs (preliminary condition 1); (2) recognition that project operation will likely be subject to ramping rates to be specified at a later date (preliminary condition 2); (3) obtain all of the necessary state and federal permits and any other regulatory approvals prior to construction (preliminary condition 3); (4) Water Board review and approval of proposed plans (preliminary condition 7); (5) agency consultations for all required plans (preliminary condition 15); (6) Water Board review of activities that may affect water quality (preliminary condition 16); and (7) notification of ground-disturbing activities (preliminary condition 17). In addition, the Water Board provided 16 standard, non-project-specific, conditions (preliminary conditions 24–40) that we also consider administrative in nature; therefore, we do not analyze them in this EIS.

The following preliminary WQC conditions provided by the Water Board are analyzed in this EIS: (1) development of a drought plan (preliminary condition 4); (2) annual consultation on current special-status species (preliminary condition 5); (3) construction-related water quality monitoring (preliminary condition 6); (4) development of an aquatic invasive species monitoring plan (preliminary condition 8); (5) development of a pesticide use plan (preliminary condition 9); (6) development of a water quality monitoring plan (preliminary condition 10); (7) development of a fish population monitoring plan (preliminary condition 11); (8) development of a fish habitat assessment plan (preliminary condition 12); (9) development of an amphibian monitoring plan (preliminary condition 13); (10) development of a vegetation and invasive weed management plan (preliminary condition 14); (11) control of erosion, sedimentation, and turbidity (preliminary condition 18); and (12) pre-washing of imported rock, riprap, and other imported gravels (preliminary condition 19). The following preliminary WQC conditions are not sufficiently detailed environmental conditions, and, therefore, we do not analyze them in this EIS: (1) disposition of construction-related materials and spoils (preliminary condition 20); (2) handling of cement, concrete products, wash water, etc. (preliminary condition 21); (3) equipment washing (preliminary condition 22); and (4) onsite containment and storage of chemicals (preliminary condition 23).

2.3 STAFF ALTERNATIVE

Under the staff alternative the project would include most of Rugraw's proposed measures as outlined above, with modifications to some of the measures. However, we

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[38] These conditions are not mandatory until issued as final certification conditions by the Water Board.

do not recommend: maintaining the reservoir water surface elevation within +/- 0.5 inch of the normal pool elevation, monitoring water temperature at some locations within the project area, providing upstream fish passage at the diversion dam during project operation, developing an anadromous fish monitoring program, genetic sampling for steelhead, amending Rugraw's proposed operating plan based on the number of anadromous fishes successfully migrating into the project reach, and developing an operations model for flow and water temperature.[39] The staff alternative would include the following additional measures and/or modifications to Rugraw's proposed measures.

Project Construction

- Restore disturbed areas with native vegetation using seed mixes recommended by California DFW.
- Modify the proposed SWPPP to include measures for controlling runoff from the construction sites, preventing material from contacting or entering surface waters, and use of washed riprap, rocks, and gravel adjacent to or in watercourses during construction.
- Develop a construction plan that incorporates the specific measures proposed for construction, and file the plan with the Commission for approval.
- Develop a plan for monitoring turbidity and pH and documenting observations of oily sheens and turbidity plumes during project construction.
- Modify the proposed Noxious Weed Management and Revegetation Plan to include provisions for preconstruction treatment of existing non-native invasive plant populations on project lands, additional reseeding and

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[39] Although we recommend Rugraw operate the project in a run-of-river mode, we do not recommend incorporating Rugraw's proposal to maintain the reservoir water surface elevation within +/- 0.5 inch of the normal pool elevation because this level of precision is likely beyond the capabilities of currently available monitoring and flow regulation equipment and is unnecessary for the protection of environmental resources. For reasons discussed in section 5.0, *Conclusions and Recommendations*, we find that Rugraw's proposed upstream fish passage facilities at the diversion dam, anadromous fish monitoring program, its proposed genetic sampling for steelhead, and amended operating plan are inconsistent with the comprehensive planning standard of section 10(a) of the FPA, including the equal consideration provision of section 4(e) of the FPA, because, based on staff's determination, the costs of the measures outweigh the expected benefits. Because Rugraw provided limited information on what the operations model may entail, we have not analyzed the model and are not recommending it as a requirement of any license issued.

monitoring if restoration success criteria are not met by the end of the 2-year monitoring period, and measures to protect rare plant species from control measures targeting noxious weed species.

- Modify the proposed measure for restricting construction activities around active raptor nests to include consultation with California DFW in determining the appropriate buffer distance.
- Conduct preconstruction inspections for slender Orcutt grass, elderberry, and vernal pool habitat in areas of proposed disturbance not previously surveyed in 2013, and adjust the transmission line design to avoid any areas where these species or habitats are found.
- Develop a special-status amphibian protection plan that includes the following provisions to protect FYLF, Cascades frog, and CRLF: (1) conduct preconstruction surveys for all life stages during the breeding season; (2) avoid construction activities in riparian areas when egg masses are present; (3) develop protocols for handling FYLF and Cascades frog during relocation activities; (4) identify specific areas for relocation; (5) notify California DFW if relocation of FYLF or Cascades frogs is necessary; (6) stop work and notify FWS within 24 hours if CRLF are observed during preconstruction surveys or during construction; and (7) relocate larval, juvenile, and adult FYLF and Cascades frogs prior to construction activities to an area sufficiently upstream to prevent them from re-entering the construction area.
- Design and construct the transmission line with consideration given to the APLIC guidance to reduce impacts on avian species.

Project Operation

- Modify the proposed DSMP to include consultation with the Water Board and California DFW during low-flow years to determine if the sluicing of sediments should occur at inflows less than 400 cfs, monitor turbidity associated with sediment sluicing events to document any project-caused exceedance of the *Central Valley Regional Water Quality Control Board Basin Plan's* (Basin Plan's) turbidity objectives, and periodically survey the project impoundment to document sediment and woody material deposition and inform modifications to the DSMP as needed.

- Provide a ramping rate that does not exceed 1 inch of stage change per hour as measured at the staff recommended monitoring gage located just downstream of the diversion dam.[40]
- Discontinue project operation when the average daily stream temperature measured upstream of Spring #4 influence exceeds 20ºC and is higher than the stream temperature measured at the dam.
- Develop a project operation compliance monitoring and reporting plan to support and document compliance with run-of-river project operation, MIF requirements, ramping rates, base flow recession rates, and water temperature protection measures and that specifies: (1) real-time water temperature monitoring at the project's dam and just upstream of Spring #4 influence; (2) real-time monitoring of water surface elevation just downstream of the diversion dam and streamflow just upstream of Spring #4 influence; (3) water surface elevation monitoring in the reservoir; (4) non-compliance event reporting; and (5) annual compliance reports.
- Develop an aquatic invasive species monitoring plan in consultation with the resource agencies that incorporates measures to help prevent the introduction and/or spread of aquatic nuisance species (flora and fauna) into the proposed project area, including construction BMPs, to prevent the spread of aquatic nuisance species (e.g., bullfrog), and protocols to decontaminate equipment that could spread chytrid fungus.[41]
- Develop an avian protection plan that incorporates Rugraw's proposed transmission line design and considers FWS's Avian Protection Plan Guidelines to reduce the risk of avian interactions with the proposed transmission line, and implement the plan throughout the term of the license.
- Develop a bald eagle and raptor management plan that considers FWS's National Bald Eagle Management Guidelines and includes the use of species-specific distance buffers, landscape buffers, seasonal restrictions, and additional recommendations to benefit raptors.
- Develop a plan to protect FYLF from spring base flow recession rates that could dewater egg masses.
- Finalize the HPMP filed on November 30, 2015, to include both California State Historic Preservation Office (SHPO) and staff comments and

[40] Staff agreed with the resource agencies at the March 15, 2018, section 10(j) meeting that the ramping rate should be 1-inch/hour.

[41] Bullfrogs are known to spread chytrid fungus, which can result in disease and mass die-offs of other amphibians.

recommendations. Revisions to the HPMP would include: (1) modifying sections 1.2, 1.4, 1.7, 1.8, 4.1, 4.3, 4.5, 4.6, 4.7, 5.1, 5.2, 5.3 and Appendix B of the document for a more clear and concise management approach for historic properties that may be affected by the proposed project; (2) copies of any post-2014 tribal correspondence and consultation related to the identification of cultural resources and development of the HPMP to document full compliance with section 106; (3) a cultural resources interpretive element, such as installation interpretive signage at key viewing areas; (4) a detailed monitoring plan for cultural resources within the APE that are eligible for listing in the National Register or have not yet been evaluated; (5) provisions for periodic review and revision of the HPMP; (6) editorial corrections as specified in section 5.1.2 of this EIS; and (7) inclusion of Volume II into the final HPMP.[42]

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include valid WQC conditions in any license issued for the project. Although the Water Board has not yet issued certification and mandatory conditions for the project, by letter filed June 24, 2016, the Water Board provided preliminary terms and conditions in response to the Commission staff notice of Ready for Environmental Analysis issued on April 26, 2016. These preliminary terms and conditions may become mandatory conditions when the Water Board completes its action on Rugraw's application for certification, and we have analyzed these preliminary terms and conditions as if they are mandatory. Thus, 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) development of a drought plan (preliminary condition 4); (2) annual consultation on current special-status species (preliminary condition 5); (3) development of a pesticide use plan (preliminary condition 9); (4) development of a fish population monitoring plan (preliminary condition 11); (5) development of a fish habitat assessment plan (preliminary condition 12); and (6) development of an amphibian monitoring plan and providing annual reports that present monitoring data, evaluate frog populations, and recommend actions based on population changes (preliminary condition 13).

Incorporation of these mandatory conditions into a new license would not cause us to modify or eliminate any of the environmental measures that we include in the staff alternative.

[42] Volume II of the HPMP consist of individual cultural resource site record forms within the APE, which were filed separately from the HPMP.

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, with historic and current conditions described first. 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*.[43]

3.1 DESCRIPTION OF THE RIVER BASIN

The project would be located on the upper South Fork Battle Creek, on the western slopes of the Cascade Range about 1.5 miles west of the town of Mineral, an unincorporated community in Tehama County, California. The upper South Fork Battle Creek at the project site has a drainage area of about 33 square miles, located south and west of Lassen Volcanic National Park. The basin in the vicinity of the project is mountainous with elevations in excess of 6,000 feet, and South Fork Battle Creek flows through a deeply incised canyon. Much of the area has been logged heavily, and private land traversed by the penstock alignment has been clear-cut within the past 10 years. The area can be characterized as heavily disturbed by previous logging and road construction. South Fork Battle Creek joins North Fork Battle Creek downstream of the project site, and Battle Creek then flows 16 miles to join the Sacramento River (figure 3-1). Figure 3-2 identifies the key stream features in the area of the proposed project reach, including Ponderosa Bridge, Panther Creek, Panther Grade, and Angel Falls. Panther Creek enters South Fork Battle Creek just downstream of Panther Grade, which is a falls-boulder cascade at RM 18.9 that is a commonly accepted barrier to upstream fish migration (Jones & Stokes, 2005). Although Panther Grade may be passable to fish at some flow levels, Angel Falls (RM 22.3) is a complete barrier to upstream fish migration at all flow levels. Angel Falls is also the upper extent of the BCSSRP.

[43] Unless otherwise indicated, our information is taken from the original and amended applications for license for this project (Rugraw, 2014; 2015).

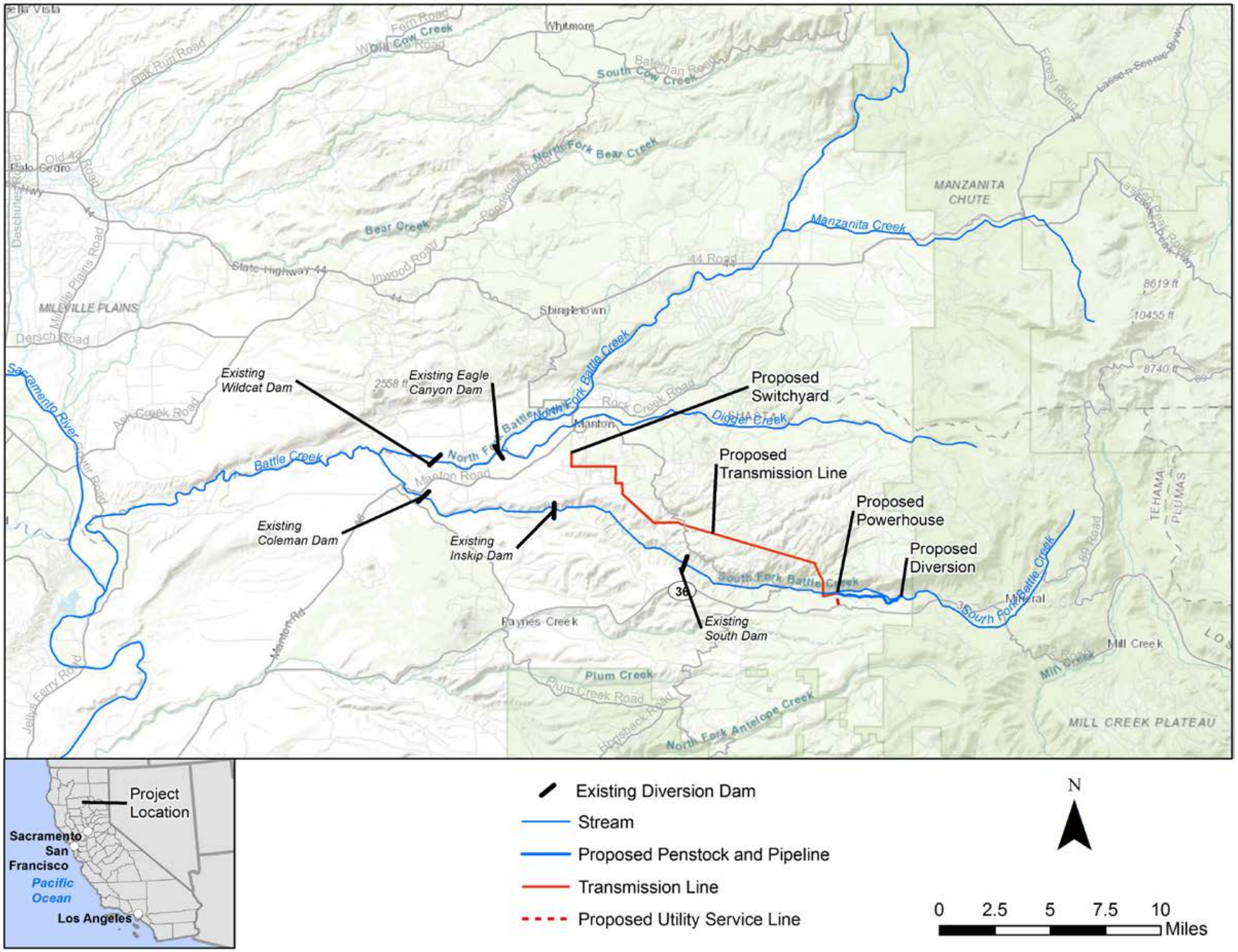


Figure 3-1. Battle Creek Basin map showing location of proposed project (Source: staff).

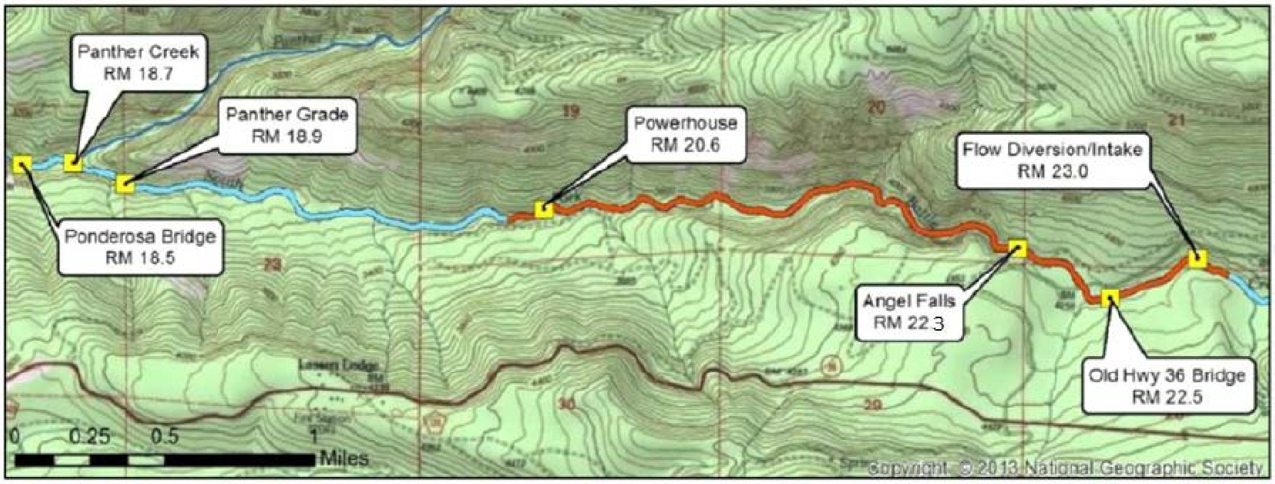


Figure 3-2. South Fork Battle Creek topographic map showing notable stream features and proposed project reach (Source: Cramer et al., 2015).

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 C.F.R. §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 preliminary staff analysis, we have identified water resources (water quality and temperature) and fisheries resources (resident and anadromous fish and related habitat) as having the potential to be cumulatively affected by the proposed project in combination with other activities in the Battle Creek Basin.

The following existing actions or activities in the Battle Creek Basin may contribute to cumulative effects:

- Sierra Pacific Industries (SPI) owns the land surrounding the proposed project area and manages it for timber harvest.
- PG&E operates the Battle Creek Hydroelectric Project No. 1121 on the mainstem Battle Creek and the North and South Forks of Battle Creek, including three diversion dams on South Fork Battle Creek downstream of the proposed Lassen Lodge Project (see figure 3-1).

- The interagency BCSSRP will restore approximately 48 miles of salmonid habitat in the Battle Creek Basin and includes plans to remove or install fish passage at the three diversion dams located downstream of the proposed project on South Fork Battle Creek.

3.2.1 Geographic Scope

The geographic scope of the analysis defines the physical limits or boundaries of the proposed action's effect 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 Battle Creek Basin, specifically the removal (Coleman Diversion Dam and South Diversion Dam) and modification (Inskip Diversion Dam) of dams on the South Fork Battle Creek. Because the proposed action can affect resources differently, the geographic scope for each resource may vary.

The geographic scope for aquatic resources would be the South Fork Battle Creek from the upstream extent of the project impoundment downstream to its confluence with the North Fork Battle Creek. We chose this geographic scope because: (1) the project would affect water quality and sediment movement within the project area and areas downstream to the confluence with the North Fork Battle Creek; and (2) project operation, including flow regulation and potential effects on water temperature, could influence the ability of salmon and steelhead to use historical habitat within the project bypassed reach if salmon and steelhead are restored to South Fork Battle Creek as a result of the BCSSRP.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis in this final EIS includes a discussion of past, present, and future actions and their effects on each resource that could be cumulatively affected. Based on the potential term of a new license, the temporal scope looks 30 to 50 years into the future, concentrating on the effect on the resources from reasonably foreseeable future actions. The historical discussion, by necessity, is limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effects of the proposed action and 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 site-specific and cumulative environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EIS. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative.*

3.3.1 Geology and Soil Resources

3.3.1.1 Affected Environment

Geologic Setting

The project area is located at the southern end of the Cascade Range, which includes a chain of volcanoes that extends from British Columbia into northern California. The basement rocks of the southern end of the Cascade Range are sedimentary deposits of late Cretaceous age. These basement rocks are overlain by volcanic deposits of late Pliocene and Quaternary age. The predominant deposit in the project area is Late Pliocene ashflow tuff breccia of the Tuscan Formation.

The project area is located on the southwestern flank of the Lassen Peak volcanic system, approximately 12 miles from Lassen Peak. The most recent activity in the Mount Lassen area occurred between 1914 and 1917, which included an explosive eruption sequence that produced a 19-mile mudflow down the northeastern slope. Lassen Peak is only one of a cluster of volcanic domes that had flows of andesite, dacite, and rhyolite during the Quaternary age. The flows were followed by lahars, or hot volcanic debris avalanches, that formed into tuff breccia.

Faulting and Seismicity

The project area contains no major faults (Clynne and Muffler, 2010; California Geological Survey, 2006). Regionally, the project is located between two zones of tectonic activity. To the west is a zone of right lateral shear within the northern Coast Ranges that runs parallel to the San Andreas fault; this zone represents a wide mobile belt of continuing deformation along the boundary between the North American and the Pacific crustal plates. To the east is a zone of generally east-west crustal extension corresponding to the Basin and Range province. The most recent faulting in the region occurred in 1975 with minor movement along the Cleveland Hill Fault south of Oroville, approximately 50 miles south of the project area, accompanied by an earthquake sequence.

Several clusters of earthquake epicenters up to approximately magnitude 4.5 on the Richter scale define the seismicity of the southern Cascade Range. Most of the earthquakes in this region probably originate through Basin and Range-style tectonic faulting, but some are associated with young volcanic centers. Earthquakes occurred in the vicinity of Mount Lassen during the eruptions of 1917. Two earthquakes of magnitude 5.0 and 5.5 on the Richter scale occurred in 1946 and one event in 1991. The Cascade Range seismicity involves generally shallow events, occurring at depths to about 7.5 miles.

Soils

Soil in the project area consists of weathering products of Tertiary and Quaternary volcanic flows and mudflow deposits. These soils contain varying concentrations of stones and gravel. The soil profile tends to be the thickest over the tuff breccia of the Tuscan Formation, reaching several feet. More recent basaltic andesite deposits weathered into reddish colored soils. Soils are more easily eroded on slopes.

Spalling and abundant rockfall slope instability are present on the steep canyon walls, especially the north wall. However, there is no evidence of deep-seated rotational or translational landsliding. Rockfalls appear to be controlled by the jointing in the flows and undercutting by weathering of rocks.

The soils at the diversion site consist of primarily alluvial river sediments with large boulders and gravels with very little fine materials such as clay or organic matter. Sediment accumulation in the streambed of the affected reach of South Fork Battle Creek is limited by high-velocity water flows.

3.3.1.2 Environmental Effects

As discussed in section 2.2.1, *Project Facilities*, construction of the project would include the diversion dam and associated intake and fish screening structure, the pipeline and penstock, the powerhouse, and the transmission line and its substation. Ancillary construction may involve preparing multi-use equipment and materials storage areas and upgrading existing roads.

Excavation of the stream bed and stream banks to construct the diversion dam and intake structure, trenching to bury the pipeline, vegetation clearing and trenching to construct the penstock and any disturbance to upland areas for access roads, transmission lines, laydown areas, and the powerhouse could cause localized erosion, sedimentation, and streambed material transport. Sediment eroded during construction of the diversion dam, intake, penstock, and powerhouse would be transported to South Fork Battle Creek via runoff. Construction of the transmission line would mostly affect tributaries draining to South Fork Battle Creek from the north. Soil eroded from upland construction sites and disturbance of the stream bed could adversely affect water quality, as well as resident aquatic species and their respective instream habitats.

Rugraw proposes to construct the project during the typical dry season in northern California. General outdoor construction would occur from April 15 through October 15, although start and end dates may be modified because of unusual weather conditions. In-water work would occur between July 1 and October 15. To further minimize soil erosion and sedimentation, and to protect the water quality of South Fork Battle Creek, Rugraw proposes to prepare and implement an SWPPP that would minimize the erosion of soils in the construction areas and limit sediment transport. The SWPPP would include, at a minimum, provisions to:

- limit surface disturbance to only those areas necessary for construction, thereby preserving existing vegetation;
- salvage and stockpile topsoil and following construction, replace, regrade and seed topsoil with native vegetation;
- use temporary fencing and protective barriers to protect vegetation not required to be removed;
- initiate construction immediately following vegetation clearing to minimize the exposure of disturbed areas to wind and water erosion;
- slope roadways and excavations away from washes and clear loose soils and sediments in areas where haul roads would cross surface washes;
- install riprap at the washes;
- build small earthen embankments within washes to slow or divert surface water;
- install silt fences in work areas near a wash to prevent sediment from entering the wash during rain storms; and
- apply water to disturbed soil areas to ensure excessive runoff does not occur and to control wind erosion and dust.

Rugraw also proposes cofferdams and other structures to isolate in-water work areas and allow for construction "in the dry." Other proposed BMPs include installation of sedimentation basins for capturing solids in stormwater runoff; placement of construction materials to avoid erosion from flowing water, and construction of permanent roads with gravel depth and quantity to maintain a stable road surface.

The Water Board provided preliminary terms and conditions for the project. Those conditions, designed to minimize erosion and sedimentation, included water quality monitoring (including turbidity) when performing in-water work (preliminary condition 6); pre-washing riprap, rocks, and gravel prior to near or in-water placement (preliminary condition 19); and erosion control measures to be put in place prior to and during construction or ground-clearing activities (preliminary conditions 18 and 20).

In its letter filed June 21, 2016, NMFS recommends (10(j) recommendation 6) that, through consultation with NMFS, Interior, California DFW, and the Water Board, Rugraw develop and implement a DSMP that describes the operation and actions that would ensure the periodic downstream transport of small and large woody material and sediment passed the project's dam. Rugraw proposes to sluice sediment accumulated in the project's reservoir during high flows during off-operation periods. Rugraw also agrees to re-introduce small and large woody material downstream of the diversion structure, and proposes to prepare a DSMP. However, Rugraw does not propose to monitor sediment and riparian response, which was recommended by NMFS as part of the DSMP. The NMFS-recommended DSMP and the proposed sediment sluicing are discussed in more detail in section 3.3.2.2, *Aquatic Resources, Environmental Effects*.

Our Analysis

Construction of the proposed project would temporarily disturb areas at the diversion dam site, at the powerhouse, along the route of the penstock, and along the transmission line.

Developing an SWPPP with the erosion and sedimentation control measures proposed by Rugraw and measures recommended by the Water Board (preliminary conditions 6, 18, 19 and 20) would minimize the amount of erosion and sediment transport to South Fork Battle Creek resulting from project construction. Preliminary conditions 6, 18, and 20 are standard erosion control measures, while preliminary condition 19 would require pre-washing any rock or gravel prior to near- or in-water placement. Pre-washing of imported rock or gravel would remove fines from crusher operations and prevent those fines from entering South Fork Battle Creek and contributing to additional sedimentation.

In addition to the erosion and sedimentation control measures developed as part of the SWPPP, Rugraw proposes several construction measures for protection of environmental resources, including the timing of construction; delineation of construction areas using fencing and/or flagging; using existing roads to the maximum extent possible, and constructing any new access roads to a width of no more than 12 feet; maintaining upstream and downstream fish passage at the project during construction; avoiding streams, wetlands, and pond habitats to the extent possible during construction and using existing stream and wetland crossings where possible; and providing environmental training to construction staff regarding laws, regulations, and BMPs to protect threatened and endangered species and special-status plant species and their habitats. These are reasonable measures to implement during construction, and to ensure that these measures are implemented and coordinated, could be included in a construction plan to be filed for Commission approval prior to the start of ground-disturbing activities. This construction plan would also be closely coordinated with the SWPPP.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Use and Quantity

South Fork Battle Creek is a 28-mile-long waterway with its headwaters beginning on the western slopes of the Cascade Range near Lassen Volcanic National Park, 1.5 miles west of the town of Mineral, CA. Along with the North Fork of Battle Creek, South Fork Battle Creek is a major tributary to Battle Creek, a 17-mile-long tributary to the Sacramento River. At its confluence with Battle Creek, South Fork Battle Creek drains an area of 124 square miles. South Fork Battle Creek at the proposed project site drains an area of about 33 square miles. Average annual precipitation is 36 inches, most of which falls from October through May.

Because of the project's high elevation, much of the precipitation that falls occurs as snow. As such, the hydrology of South Fork Battle Creek is snowmelt driven, with the highest flows occurring from March through June. Because of a lack of springs upstream of the project reach, extreme low flows naturally occur in the late summer and fall. A 7-day average low flow of zero occurs with a frequency of once every 10 years, and a 7-day average low flow of 4.4 cfs occurs with a frequency of once every 2 years. In the critically warm July through October timeframe, streamflow exceeds 18 cfs, the trigger at which flow diversions would start, only 25 percent of the time. One location on South Fork Battle Creek (Spring #4 located at RM 20.84) measured 0.3 cfs in October 2014 and was the only detectable source of year-round surface inflow between Angel Falls (located 1.7 miles upstream of the proposed powerhouse site) and the proposed powerhouse location (Cramer et al., 2015).

The lower portion of South Fork Battle Creek and Battle Creek exhibits high base flow throughout the summer and fall with a large portion of the water entering South Fork Battle Creek from cold springs emanating from the surrounding volcanic rock. The majority of these springs enter South Fork Battle Creek downstream of Panther Grade at RM 18.9.

The United States Geological Survey (USGS) conducted stream gaging on South Fork Battle Creek from 1959 to 1967 at the South Fork Battle Creek near Mineral gage, upstream of the Old Highway 36 Bridge at RM 22.5. Supplemented by long-term streamflow data from the USGS Deer Creek near Vina and Mill Creek near Los Molinos gages, the 8-year USGS continuous record was used as the basis for the development of an extended synthetic flow record specific to the project site. Table 3-1 shows a summary of USGS gage information used to develop the synthetic streamflow record for the project area. Table 3-2 provides monthly flow data for South Fork Battle Creek.

Table 3-1. Streamflow gage information for gages used in developing the synthetic flow record for South Fork Battle Creek (Source: USGS, 2017a,b).

Gage Name	South Fork Battle Creek near Mineral	Mill Creek near Los Molinos	Deer Creek near Vina
Gage number	11376400	11381500	11383500
Mean basin elevation (feet-msl)	5,702	3,961	4,199
Drainage area (square miles)	33.2	131.4	208.7

Gage Name	South Fork Battle Creek near Mineral	Mill Creek near Los Molinos	Deer Creek near Vina
Dates of operation	1960–1967	October 1, 1928 to June 20, 2017	October 1, 1911, to September 29, 1915; April 1, 1920 to June 20, 2017
Mean flow (cfs)	60	304	322
Maximum flow (cfs)	608	14,400	20,100
Minimum flow (cfs)	4	52	52

Table 3-2. Minimum, maximum, and mean monthly flow values for South Fork Battle Creek at the project site (Source: Rugraw, 2014, as modified by staff).

Month	Minimum Flow[a] (cfs)	Mean Flow[b] (cfs)	Maximum Flow[a] (cfs)
Jan	8	69	561
Feb	15	80	986
Mar	14	86	435
Apr	42	117	577
May	41	122	534
Jun	14	81	387
Jul	7	28	214
Aug	4	12	62
Sep	4	9	29
Oct	3	13	983
Nov	6	27	290
Dec	6	57	1,210

[a] Observed streamflow values from USGS South Fork Battle Creek near Mineral gage (1959–1967).

[b] Mean flow values were derived from a synthetic flow record using Mill Creek near Los Molinos flow values (1928–2017).

South Fork Battle Creek has an average annual flow of about 60 cfs at the project site. Average monthly flows range from a low of about 9 cfs in September to a high of

122 cfs in May. Based on the available flow record, recorded maximum flow in South Fork Battle Creek at the USGS South Fork Battle Creek near Mineral gage was 1,210 cfs. Recorded minimum flow at the same gage was 3 cfs.

Water in South Fork Battle Creek is not used by other water users. Domestic water supply facilities along the upper reaches of the stream, near Mineral, CA, primarily consist of groundwater wells.

Water Quality

Water Quality Standards

The South Fork Battle Creek Basin is part of the Sacramento River Basin, and the Fourth Edition of the Basin Plan for the Sacramento and San Joaquin River Basins (CVRWQCB, 2016) applies to waters in the project area. The Basin Plan designates existing beneficial uses for water bodies in the basin as irrigation, stock watering, power, water contact recreation and canoeing and rafting, other non-contact water recreation, warm freshwater habitat, cold freshwater habitat, coldwater aquatic organism migration, coldwater fish spawning, warmwater fish spawning, and wildlife habitat.

Water quality standards applicable to surface waters in the project area are defined in two primary documents: the Basin Plan (CVRWQCB, 2016) and the California Toxics Rule (40 C.F.R. Part 131). Table 3-3 summarizes applicable criteria for South Fork Battle Creek. The Water Board did not include any water bodies in the project area on the 303(d) list of water-quality-limited water bodies for 2012 (Water Board, 2015), which is the most recent EPA-approved list.

Table 3-3. Water quality criteria for South Fork Battle Creek in the project area (Source: CVRWQCB, 2016).

Constituent	Water Quality Objectives
Temperature	Natural water temperatures shall not be altered unless it can be demonstrated to the satisfaction of the Regional Board that such alteration does not adversely affect beneficial uses. At no time or place shall the temperature be increased more than 5°F above the natural receiving water.
Dissolved oxygen (DO)	Monthly median of 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. DO concentrations shall not be reduced below 7.0 milligrams per liter (mg/L).
pH	The pH shall not be depressed below 6.5 nor raised above 8.5.

Constituent	Water Quality Objectives
Turbidity	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 increases of 1 nephelometric turbidity unit (NTU) where natural turbidity is 0–5 NTU, increases of 20 percent where natural turbidity is 5–50 NTU, increases of 10 NTU where natural turbidity is 50–100 NTU, and increases of 10 percent where natural turbidity is >100 NTU.
Fecal coliform	Based on a minimum of not less than five samples for any 30-day period, shall not exceed a geometric mean of 200/100 milliliters, nor shall more than 10 percent of the total number of samples taken during any 30-day period exceed 400/100 milliliters.
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.

Water Quality

A literature review of available data and information shows that South Fork Battle Creek generally has excellent water quality and relatively stable inflows from springs about 0.2 mile upstream of the proposed powerhouse site and downstream, near Panther Grade that discharge cold, clear water into the creek (Tetra Tech, 2015a). Samples taken upstream and near the Tehama County Sanitation District No. 1 ponds at Mineral suggest that overflow from these ponds may have historically caused elevated fecal coliform concentrations in the creek. No other point sources for pollutants upstream of the proposed project are known. Potential nonpoint sources include surface runoff from roads; exposed dirt surfaces; and cattle grazing pastures, which are most active during spring and summer. Based on aerial photos, it appears the riparian habitat in the large meadow located approximately 2 miles upstream of the proposed dam site was fenced in the mid- to late-1990s (Watercourse Engineering, 2015).

The Water Board sampled the creek about 14 miles downstream of the proposed project, near Manton, and found low levels of chlorides, nitrates, magnesium, potassium, dissolved solids, and hardness (Tetra Tech, 2015a).

Water quality was sampled at the proposed diversion and powerhouse sites to describe conditions in the project area during the critical low-flow late summer period. This sampling on September 4, 2013, at a streamflow of 4 to 5 cfs at the proposed diversion site, showed the creek had low alkalinity, neutral pH, and low electrical conductivity at both stations (table 3-4). Analyses for heavy metals at both sites revealed none of the 18 regulated drinking water metals (Tetra Tech, 2015a). At a flow of 13 cfs on July 3 and 4, 2013, DO measurements conducted while habitat mapping between Angel Falls and the proposed powerhouse location were 7.6 to 8.9 mg/L, or 86 to 89 percent of saturation (Sellheim and Cramer, 2013).

Table 3-4. South Fork Battle Creek surface water quality, September 4, 2013 (Source: Tetra Tech, 2015a).[a]

Parameter	Proposed Diversion Site (RM 23.0)	Proposed Powerhouse Site (RM 20.6)
Field temperature (°C)	16.73	11.61
Field DO (mg/L)	7.66	6.27
Conductivity, field/lab (µmhos/cm)	69/79	63/82
pH, field/lab (standard units)	7.42/7.51	7.95/7.57
Turbidity[b]	0	0
Hardness as $CaCO_3$[b]	26	26
Total alkalinity (mg/L)	32	39
Bicarbonate as $CaCO_3$ (mg/L)	32	39
Carbonate as $CaCO_3$ (mg/L)	<5	<5
Total dissolved solids (mg/L)	62	64
Hydroxide (mg/L)	<5	<5
Chloride (mg/L)	0.56	0.89
Fluoride (mg/L)	<0.10	<0.10
Nitrate as NO_3[b]	<2.0	<2.0
Sulfate as SO_4[b]	5.1	2.3
Calcium (mg/L)	6.4	5.8
Magnesium (mg/L)	2.5	2.8
Potassium (mg/L)	1.3	1.3
Sodium (mg/L)	3.2	2.4

Notes: mg/L = milligrams per liter; µmhos/cm = micromhos per centimeter

[a] Sampled at a flow of 4 to 5 cfs at the proposed dam location.

[b] Units not reported by Tetra Tech (2015a).

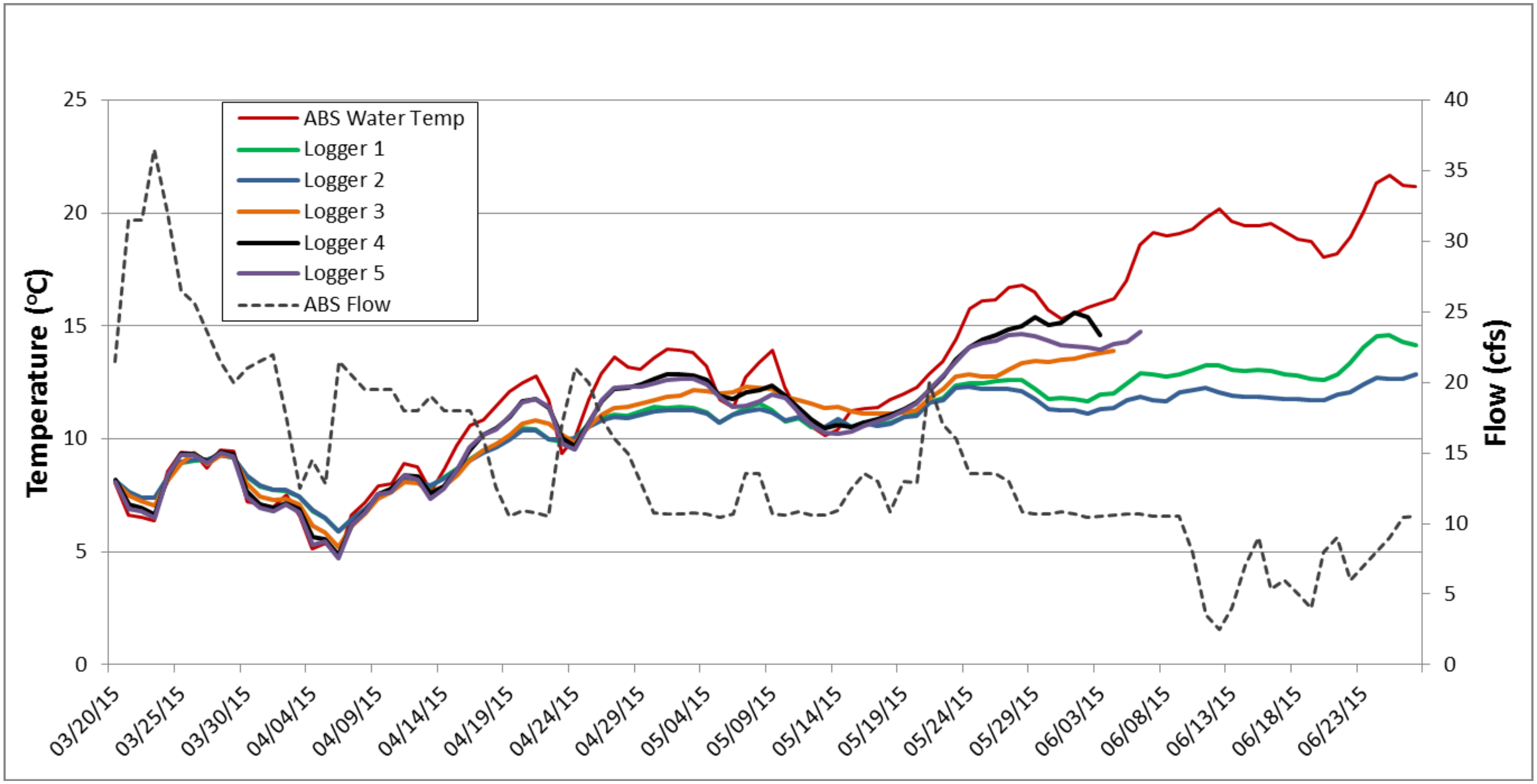
Water Temperature

Rugraw collected water temperature data in several years for planning purposes. Data collected in South Fork Battle Creek near the proposed diversion during November 2003 through December 2006 showed daily mean temperatures that ranged from near freezing in the winter to about 18ºC in mid- to late July (Tetra Tech, 2015a).

In early spring 2015, temperatures were nearly the same at all six sites monitored from the Above Old Highway 36 Bridge Station (ABS) (about 0.5-mile downstream of the diversion dam site and 1.9 miles upstream of the powerhouse site) to the powerhouse site, as indicated by differences being less than 1ºC. As spring and summer progressed, daily mean temperature at sites near the powerhouse site remained stable at 10 to 15ºC, and the warmest conditions, some of which exceeded 20ºC, occurred at ABS, upstream of Angel Falls (figure 3-3). Daily fluctuations were as large as approximately 5ºC above ABS, 3ºC at the proposed powerhouse site, and 1ºC downstream of Panther Grade in summer of 2013 (Tetra Tech, 2015a). In late summer through early fall, temperatures at ABS cooled substantially, while temperatures remained relatively stable at the other sites monitored. Figure 3-4 documents a slight cooling trend between the proposed dam site and Angel Falls using thermal imagery collected on August 23, 2011.

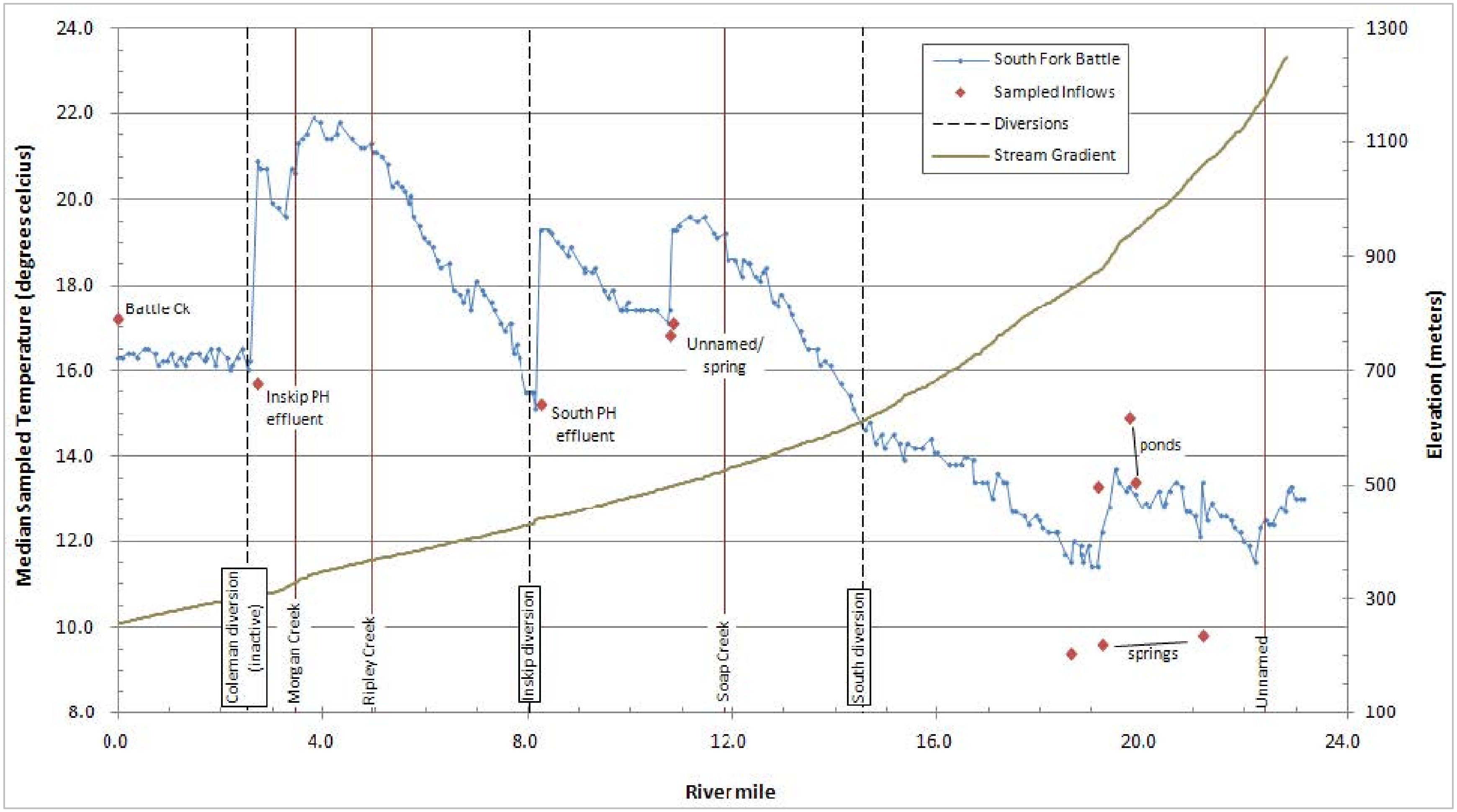
After issuance of the draft EIS, Rugraw filed measured water temperature data collected at ABS and near the powerhouse location in 2015 through 2017 (Rugraw, 2018).[44] These data show the annual minimum temperature was near freezing at both ABS and near the powerhouse location. Maximum daily mean temperatures varied by year and location with warmer conditions at ABS than near the powerhouse site in all three years. Seasonal temperature extremes were larger at ABS than near the powerhouse site, especially in the years with lower flows (i.e., 2015 and 2016). The warmest conditions occurred in 2015, a critical water year, with a maximum daily mean temperature of 23.1ºC at ABS and 16.1ºC near the powerhouse site. In 2016, a below normal water year, maximum daily mean temperature was 19.6ºC at ABS and 16.6ºC near the powerhouse site. In the wet water year of 2017, maximum daily mean temperature was 18.6ºC at ABS and 17.8ºC near the powerhouse site.

[44] Rugraw provided data for ABS and two stations near the proposed powerhouse location (i.e., 8-foot falls and Cramer Station 2). Cramer Station 2 data are limited to March 20 to June 30, 2015, and there is a data gap from July 11 to October 12, 2015, for the other two stations.



Note: Data loggers from upstream to downstream are: ABS at RM 22.5, #5 at RM 21.7, #4 at RM 21.4, and #3 at RM 21.1, all of which were located upstream of Spring #4; and #2 at RM 20.6 and #1 at RM 20.4, both of which were located downstream of Spring #4.

Figure 3-3. Daily mean temperature and streamflow in South Fork Battle Creek, March–June 2015 (Source: Cramer et al., 2015, as modified by staff).



Note: Vertical lines indicate locations of detected surface inflows and diversions.

Figure 3-4. Median channel temperatures and stream gradient plotted versus RM for South Fork Battle Creek during a flow of about 25 cfs at the proposed dam site on August 23, 2011 (Source: Watershed Sciences, Inc., 2011).

These seasonal and daily trends in stream temperatures show the importance of two primary factors: (1) warming in an upstream meadow, and (2) the stabilizing effect of springs and water exchange with flows beneath the streambed (hyporheic flows). About 2 miles upstream of the proposed diversion site, South Fork Battle Creek flows through a large, open meadow with minimal riparian shading. The open nature of the meadow subjects the stream to substantial warming from solar radiation and little insulation from the local air temperature both in the summer and winter. These conditions are likely the primary reason for warm summer temperatures with large daily fluctuations and the larger seasonal range of temperature at the inflow to the proposed project. Hyporheic flows and inflow from cool-water springs stabilize temperatures downstream of Angel Falls, particularly near the powerhouse site and farther downstream near Panther Grade.

Fishery Resources

Aquatic Habitat

In July 2013, Rugraw completed a detailed aquatic habitat survey in the proposed bypassed reach from RM 20.6 to 22.3 (Sellheim and Cramer, 2013). At that time, the flow was 13 cfs, and the maximum water temperature was 22°C. All 51 channel habitat units in the reach were classified by unit type (pools, riffles, rapids and cascades) and measured for gradient, wetted and active channel dimensions, substrate composition, depth, and velocity, and rated for wood complexity, potential barriers, and channel constraint types (table 3-5).

As Sellheim and Cramer (2013) describe, the proposed bypassed reach channel is confined by either bedrock or hill slopes throughout the majority of the study area. The measured stream gradient averages about 5 percent in most of the reach, but increases to about 15 percent just downstream of Angel Falls. The mean active channel width is 85 feet, and the mean wetted channel width is 23 feet. Fast-water channel units compose more than 80 percent of the surface area (figure 3-5). Large boulders are the dominant substrate type in all channel units in the study reach, often creating “pocket water” habitat. Sixteen of the 20 pools in the reach were ≥1-meter deep at 13 cfs and likely capable of supporting resident trout through the low flow season. Flows in the range of 30 to 60 cfs likely would provide adequate passage opportunities (connectivity) for trout to move about within the reach. Gravel and cobble are more common in pools than in other habitat unit types; however, these substrate size classes are relatively rare. The channel contains almost no woody debris, and 16 of the 20 pools in the reach were more than 3 feet deep and appear to be capable of supporting resident trout through the low-flow season.

Although the proposed bypassed reach contains suitable salmonid spawning and rearing habitat, low natural flows during the summer limit the availability of rearing habitat, especially during dry years when flows decrease to less than 5 cfs and water temperatures climb to 24°C.

Table 3-5. Habitat feature measurements within South Fork Battle Creek from proposed powerhouse location to Angel Falls, taken July 3 and 4, 2013, at a flow of 13 cfs (Source: Sellheim and Cramer, 2013).

	Unit Area			Average Channel Width (feet)			Substrate				
Unit Type	**Sq. Feet**	**% Total Area**	**# of Units**	**Wetted**	**Active**	**% Gradient**	**% Fines**	**% Gravel**	**% Cobble**	**% Boulder**	**% Bedrock**
Cascade	5,885.7	2.4	3	13.8	67.9	20.9	0	0.6	4.4	95	0
Pool	34,194.7	14.8	20	29.5	75.4	0	2.4	20.3	20.9	43.1	11.9
Rapid	64,251.9	26.3	11	24.9	61.7	14.2	0.5	2.2	3.2	91.4	2.7
Riffle	138,031.0	56.5	17	21.6	92.5	5.3	2	5.7	7.8	74.4	10.8

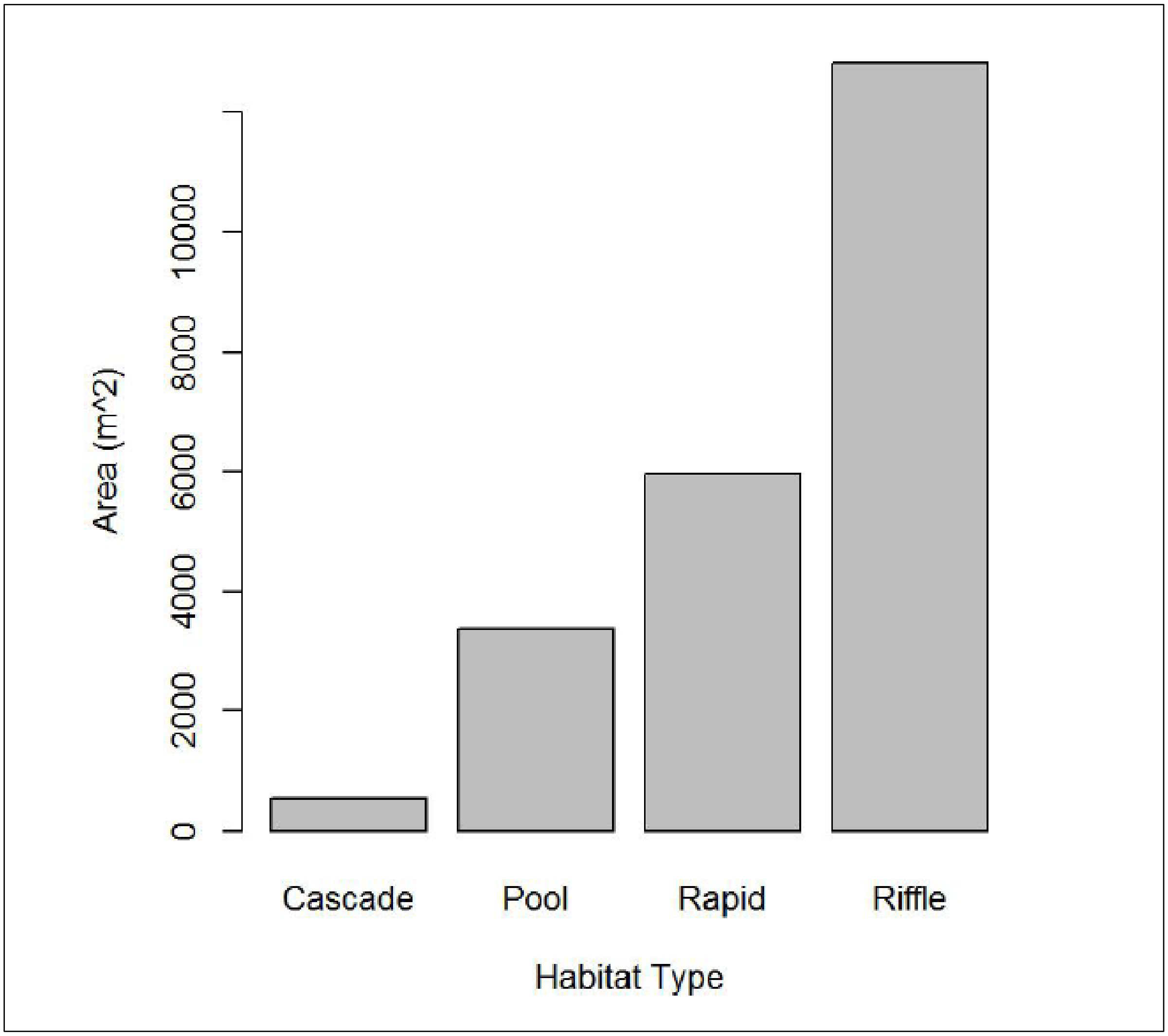


Figure 3-5. Area of each channel unit type within the survey reach of South Fork Battle Creek (Source: Sellheim and Cramer, 2013).[45]

In addition to the July 2013 habitat survey, Rugraw completed a supplemental survey in a subset of the channel units in the bypassed reach at a higher flow (31 cfs) during mid-March 2015 (Cramer et al., 2015). The survey was designed to quantify key attributes of habitat for juvenile rearing and adult spawning; evaluate potential migration barriers; estimate rearing and spawning capacity for spring- and fall-run Chinook, steelhead, and resident rainbow trout; and assess habitat change in response to flow. Rugraw also completed reconnaissance surveys downstream of the project reach (below RM 20.6) to identify changes in flow and temperature downstream of the proposed powerhouse location.

[45] One square meter (m^2) equals 10.76 square feet (ft^2).

This assessment documented a sharp contrast between stream reaches upstream and downstream of Panther Grade in the suitability of the habitat for supporting anadromous salmonid populations. The contrast was driven by differences in flow and water temperature originating in that vicinity and by the presence of several barriers and/or obstacles to upstream migration at and upstream of Panther Grade.[46] Upstream of Panther Grade, flow is supplied by snowmelt and rainfall, which produce peak flows in the spring, but extremely low flows in late summer to early fall (corresponding to the spawning time for spring and fall Chinook). The 2-year return flow for the 7-day low flow is only 4.4 cfs, and the majority of the project reach went completely dry in the summers of both 2014 and 2015. In contrast, a series of cold spring inflows between Panther Grade and Panther Creek (RM 18.9 to RM 18.7) were found to produce a flow of 28 cfs measured just downstream of the Ponderosa Way Bridge (RM 18.4) at the same time that flow was zero and the streambed was dry in most of the project reach. The cool and substantial spring inflows, sustained even through drought, provide favorable and reliable habitat for anadromous fish in South Fork Battle Creek downstream of Panther Grade.

Rugraw's measurements of the Panther Grade Falls (Parkinson, 2012) determined that for upstream migrating anadromous fish, it is impassible at flows of 180 cfs and less.[47] Additional measurements of jump heights and jump-pool depths were also completed in 2015 at seven potential barriers within the project reach. Each of the seven barriers was impassable to upstream migrating anadromous fish at the 31-cfs survey flow, because of inadequate jump-pool depth. The largest barrier was Powerhouse Falls, immediately downstream of the proposed powerhouse location. Fish ascending this barrier would require a 7.5-foot vertical jump, and the pool at its base is only about 1.6 feet deep, which is insufficient for a fish to make a 7.5-foot vertical jump. This falls was

[46] Anadromous fish would only enter the project's bypassed reach if they successfully pass the downstream Coleman, Inskip, and South Diversion dams on South Fork Battle Creek, navigate through Panther Grade, and travel an additional 1.7 river miles up to and past the powerhouse tailrace. Although unoccupied, the proposed bypassed reach includes designated critical habitat for ESA-listed steelhead up to Angel Falls (RM 22.3), which is a complete barrier to upstream fish migration, and for ESA-listed spring-run Chinook salmon up to RM 21.4. Historical presence of either of these species in the proposed bypassed reach below Angel Falls is not known, because the designation was made after downstream barriers to anadromous fish passage had been in place for many years.

[47] Average monthly flows in South Fork Battle Creek range from a low of about 9 cfs in September to a high of 122 cfs in May. Flows more than 180 cfs are extremely rare during the Chinook migration period and would occur approximately once every 2 years during the steelhead migration period.

measured previously at 180 cfs[48] in December 2002, and also found to be impassible at that flow (Parkinson, 2012). Based on this information, Cramer et al. (2015) concluded it was highly probable that these passage barriers would prevent anadromous fish from entering the project reach.

Fish Populations

As a component of its July 2013 aquatic habitat assessment, Rugraw's biologists snorkeled about half of the pool channel units (9 out of 20 units), spread evenly throughout the study reach (figure 3-6). Rainbow trout (*Oncorhynchus mykiss*), which were common throughout the reach, were the only species observed during the survey. Juveniles 80 to 150 millimeters in fork length were the dominant size class, but larger yearlings (>150 millimeters) were also represented. A few fish >300 millimeters were observed in the deeper pools near the upper extent of the project area (i.e., Angel Falls).

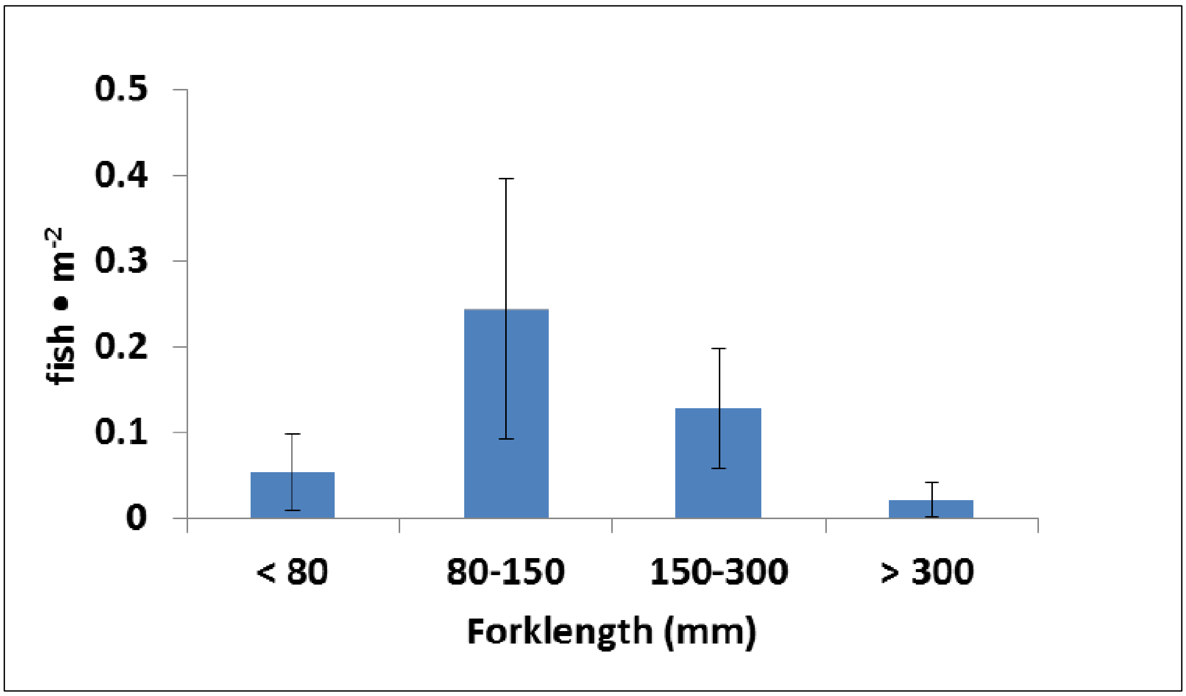


Figure 3-6. Snorkel observations of rainbow trout (*O. mykiss*) in representative pools within the study reach. Error bars indicate 2 standard errors (Source: Sellheim and Cramer, 2013).

All rainbow trout observed in the study reach in 2013 either died or moved downstream when the reach went dry in summer 2014, and only small juveniles were observed in shallow pools in the lower 0.24 mile of the reach where about 0.4 cfs of

[48] 180 cfs is the highest flow that can safely be surveyed in the reach.

spring water entered the channel. This drying event, and evidence of previous such events in drought years, considered in combination with the finding of impassable upstream barriers within the reach over a wide range of flows, indicate that reseeding of trout in the reach most likely occurs by fish moving downstream from above Angel Falls. Thus, reseeding of the stream with trout occurs naturally from upstream and does not depend on the ability of trout downstream to migrate upstream over passage barriers.

The limited fish assemblage in the study reach compared to other portions of the Battle Creek watershed is another indicator of the challenges of accessing and surviving within the study reach. Quarterly electrofishing surveys by FWS just upstream of Panther Grade show that rainbow trout and riffle sculpin are the only fish species present above Panther Grade (Whitton et al., 2010). Similarly, only rainbow trout were observed within the study reach during Rugraw's 2013 snorkel surveys. These data contrast those collected from other areas in the Battle Creek watershed, where generally 8 to 10 species were captured during each sampling event in the main stem, and 4 to 8 species were captured in the lower reaches of the North and South Forks, located downstream of the proposed project area. During the FWS survey, 12 native and 4 nonnative species were captured in the basin, but only two native species that are also present above Angel Falls were present in Rugraw's July 2013 survey.

Rainbow trout, like those captured in the proposed project's bypassed reach, are the most abundant and widespread native salmonid in western North America and likely the most widely distributed fish in California. The species can be either freshwater resident (rainbow trout) or anadromous (steelhead), and, where the two forms co-occur, the progeny of resident rainbow trout have the potential to become anadromous and the progeny of steelhead have the potential to become resident. They are also capable of spawning more than once before they die. However, most steelhead spawn only once in their life. Central Valley steelhead typically enter freshwater from August through April (Busby et al., 1996) and spawn from January through February. Spawning occurs over coarse gravel in the tail of a pool or in a riffle (Moyle, 2002). Following emergence from the gravel, young steelhead then reside in freshwater for 1 to 3 years before migrating to saltwater. Resident rainbow trout complete their entire life cycle in freshwater.

In the Sacramento-San Joaquin river system, acute and chronic episodes of elevated water temperatures are of major concern to fishery resource managers. Whereas most juvenile Central Valley Chinook salmon spend less than a year in freshwater, and rarely over-summer, juvenile rainbow trout and steelhead spend at least one full summer in freshwater; therefore, juvenile rainbow trout and steelhead have a greater likelihood of being exposed to chronically elevated water temperatures. According to the University of California, Division of Agriculture and Natural Resources (2017), optimal rainbow trout growth occurs at temperature ranging from 15 to 18ºC, and mortality typically results at 24 to 27ºC.

Although anadromous fish do not occur and are not expected to enter the project reach because of the substantial natural barriers to upstream migration, Cramer et al.

(2015) estimated the carrying capacities for various Chinook and steelhead life stages in the project reach at 13 and 31 cfs. For Chinook salmon, the estimated spawning capacity of 4 redds at 13 cfs, and 9 redds at 31 cfs would produce an estimated 872 parr and 1,962 parr, respectively. However, 13 cfs is higher than the median flow of 8 to 9 cfs during the September-October Chinook spawning season, indicating that a flow of 13 or 31 cfs would be an enhancement over baseline conditions. The estimated spawning capacity for steelhead trout was 50 redds at 13 cfs and 116 redds at 31 cfs. These redds would produce 8,150 steelhead parr at 13 cfs and 18,908 parr at 31 cfs; however, these parr estimates far exceed the steelhead rearing capacity of the reach, which is 1,407 parr at 13 cfs and 3,190 parr at 31 cfs.

3.3.2.2 Environmental Effects

Construction Effects

Erosion Control and Effects on Water Quality

Constructing the project would disturb areas near proposed project facilities and require the use and storage of potentially hazardous materials, all of which could degrade water quality. These risks are commonly mitigated through implementation of BMPs for erosion control, management of stormwater, and containment of hazardous materials. Because BMPs manage, but do not necessarily eliminate, risks of degrading water quality, monitoring water quality along with erosion control enables evaluating the effectiveness of measures taken, and provides insight into adaptive measures that could further limit water quality degradation.

As discussed in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects*, Rugraw proposes measures to control erosion and storm runoff. Rugraw additionally proposes to isolate in-water work areas with cofferdams, silt fences, or other structures and conduct all in-water work activities between July 1 and October 15.

The Water Board recommends that Rugraw monitor water quality, with emphasis on turbidity, when performing any in-water work, if project activities could have a discharge to surface waters, and when project-related activities result in the creation of a visible plume in surface waters (preliminary condition 6). Under preliminary condition 10, the Water Board also recommends that Rugraw develop a water quality monitoring plan, install and operate equipment at multiple water quality monitoring locations as determined by Rugraw and relevant resource agencies, and make data publicly available. The Water Board identifies potential parameters to be monitored, including, but not limited to: benthic macroinvertebrates (BMI), turbidity, flow, water surface level, pH, temperature, alkalinity, minerals, and/or conductivity. In the draft EIS, we interpreted this Water Board recommendation to be intended for construction of the project.

In its comments on the draft EIS, the Water Board clarified that its recommended water quality monitoring plan would apply to project construction, operation, and maintenance activities, and it requested extending analysis of this plan to include periods of operation and maintenance.[49]

Our Analysis

As described in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects*, implementation of an erosion and sediment control plan would minimize the amount of erosion and sedimentation resulting from project construction, and implementation of an SWPPP would minimize sediment releases and elevation of turbidity that could result from construction disturbance. Isolating in-water work areas, and limiting in-water work to the low-flow period, would minimize elevated turbidity and pH. In addition, monitoring for pH and turbidity and taking corrective actions if adverse effects are discovered, would help protect the water quality of South Fork Battle Creek from impacts from project construction activities.

Development of a water quality monitoring plan would provide a means of determining the effectiveness of mitigation measures aimed at maintaining water quality during the proposed construction period. Monitoring water quality daily before construction begins for the day, near the middle of the work day, and at the end of the work day would provide data sufficient to determine construction effects. *In situ* monitoring of turbidity and pH[50] upstream of construction sites and at the downstream end of mixing zones below construction site(s) would provide sufficient background data for detecting any construction-related turbidity and pH effects, evaluating the effectiveness of erosion and sediment control measures and the SWPPP, and identifying any adverse effects of concrete pouring near surface water. Reporting observations of oily sheens and turbidity plumes on surface waters would also document potential fuel and oil spills and major erosion events. These observations combined with monitoring data could be used to determine what caused these effects and facilitate initiation of appropriate responses, including clean-up actions. The water quality monitoring plan would specify the methods, quality assurance measures, and reporting schedules.

Effects on Aquatic Biota (Fish and BMI), Including Fish Passage

Construction activities could adversely affect resident fish and macroinvertebrate populations through temporary displacement and mortality associated with cofferdam construction and dewatering, excavation and dredging in the river channel, and erosion

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[49] We have added this requested analysis into section 3.3.2.2, *Aquatic Resources, Operational Effects on Aquatic Habitat and Biota, Sediment and Woody Debris Management.*

[50] The licensee would monitor pH only to evaluate effects of fresh concrete placement within or along the stream channel or other surface waters. Because construction is not expected to affect the creek's mineral content, conductivity, or alkalinity, there is no project nexus to warrant monitoring them.

and runoff from adjacent disturbed areas. Increases in suspended sediment could reduce aquatic habitat suitability downstream of the construction area, bury fish eggs, and clog the gills of macroinvertebrates.

Rugraw proposes to develop an SWPPP that outlines measures to prevent erosion and sedimentation during construction, as discussed in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects*. The SWPPP would include provisions for using cofferdams, silt fences, and other structures to isolate in-water work areas. Rugraw would also confine in-water work activities between July 1 and October 15, which is the low-flow period that would minimize adverse effects on water quality and aquatic biota. Finally, Rugraw proposes to maintain upstream and downstream fish passage during construction, either by constructing fish passage facilities first before constructing the remainder of the diversion/intake structure, or constructing a temporary diversion culvert if the entire diversion/intake structure is constructed as one unit in the dry.

Our Analysis

Some fishes may be displaced by cofferdam construction, increased turbidity associated with cofferdam installation, dewatering of the construction area, and excavation of the riverbed. However, Rugraw plans to complete project construction within 5.5 months. As such, any displacement would be temporary and unlikely to have long-term effects on aquatic organisms. Furthermore, limiting in-water construction to July1 through October 15 would minimize construction-related effects on aquatic organisms, because flows in South Fork Battle Creek are typically at their lowest during this period (less than 25 cfs), and most of the fish in the reach would have likely moved downstream to seek coldwater refugia. The in-water construction footprint would also be the smallest during this period, limiting potential adverse effects on immobile aquatic organisms.

Rugraw's proposed use of a cofferdam, silt fences, and similar BMPs would minimize the effect of increased turbidity on aquatic organisms because these measures would isolate construction areas from South Fork Battle Creek and limit the spread of disturbed sediment in the creek. Some minimal amount of fish stranding and mortality within the cofferdam construction areas is possible, although most fish would likely avoid the affected areas during cofferdam installation because of noise and vibrations associated with construction activities. Maintaining fish passage at the dam site would allow fish to egress the site and avoid exposure to construction activities. Some macroinvertebrate habitat would be permanently lost within the construction footprint, but, given the small amount of area and availability of similar substrate elsewhere, it is unlikely that this small loss of macroinvertebrate habitat would adversely affect this community.

Overall, Rugraw's proposed construction activities would only affect a few individual fish and macroinvertebrates and would not adversely affect local populations.

Rugraw would use cofferdams and other erosion control measures to minimize sediment suspension and redistribution during construction, thereby protecting aquatic habitat.

Operational Effects on Water Quantity and Water Quality

Project operation would reduce streamflow in the 2.4-mile-long bypassed reach between the diversion dam and the powerhouse and route water diverted at the dam through a buried pipeline-penstock system to the powerhouse. The project would operate in a run-of-river mode whereby the sum of all outflows from the project would approximate the sum of all inflows to the project at any given time. By operating run-of-river, the project would not store water or divert water for any purpose other than hydropower. The project would cause changes in flow in the bypassed reach upon project start-up and shut-down. However, the project's turbine would continue releasing flows from the powerhouse under a load rejection, thereby minimizing changes in flow downstream of the project. During project operation, the project would not affect streamflow downstream of the powerhouse, with the exception of the start-up of flow diversions. During initial project start-up, or after extended periods of shut-down when the pipeline/penstock has been drained, flow downstream of the powerhouse would be reduced while refilling the pipeline and penstock with water, although this would likely be relatively brief.[51] Reduced streamflow in the bypassed reach could alter the temperature regime by reducing the mass of water that is acted upon by solar warming (or cooling due to shading) in the reach, while water diverted through the 2.4-mile-long pipeline and penstock would not experience solar warming, but could be influenced by the temperature of the pipeline/penstock.

Flow Gaging and Monitoring

Rugraw proposes to operate the project as a run-of-river facility and maintain the impoundment's water surface elevation at +/- 0.5 inch throughout the normal operating range, with continuous monitoring of the impoundment's water elevation. Rugraw proposes, and California DFW recommends (10(j) recommendation 1), implementation of a continuous minimum flow release into the bypassed reach of 13 cfs, or inflow, whichever is less, and limiting project operation to periods with inflows of 18 cfs or more. Rugraw anticipates that project operation would typically cease in early July and resume in mid to late November because of low river flows. In addition, Rugraw proposes to discontinue project operation when the average daily stream temperature exceeds 20ºC, as measured within the bypassed reach. In comments on the draft EIS, Rugraw suggests consideration of an 8-cfs MIF for the bypassed reach, and states it is

[51] Completely refilling the pipeline-penstock system would take less than 1 hour with a diversion rate of more than 38 cfs, but as long as 37 hours at a diversion rate of 1 cfs.

open to providing MIFs that would vary depending on water year type and the presence/absence of anadromous fish.[52]

Rugraw proposes to establish and maintain three flow monitoring stations: (1) on the downstream side of the diversion structure, (2) in the bypassed reach just upstream of the powerhouse tailrace, and (3) downstream of the Ponderosa Way Bridge at approximately RM 18.5. The stations would continuously record streamflow and water temperature.

Interior and NMFS (10(j) recommendation 1) each recommend a continuous MIF of 35 cfs, or the natural inflow, if less, to provide habitat connectivity and fish passage within the bypassed reach. However, in a letter filed on April 5, 2018 (letter from B.A. Thom, Regional Administrator, NMFS, to K.D. Bose, Secretary, FERC), NMFS recommends that staff analyze alternative minimum flows of 35 cfs (November 1 to March 1), 30 cfs (March 2 to May 31), and 25 cfs (June 1 to October 31). We are designating this alternative recommendation as NMFS Alternative 1.

Interior and NMFS (10(j) recommendation 3) also recommend implementation of a flow gage monitoring plan, to designate existing flow gages (or new gages if needed) that would be used to monitor streamflows from upstream of the diversion dam to downstream of Panther Grade. The agencies' recommended locations of the flow gages are as follows: (1) upstream of the diversion dam; (2) at the intake's header box; (3) upstream of Angel Falls; (4) upstream of powerhouse Spring #4; (5) at the powerhouse discharge; (6) downstream of the powerhouse; and (7) downstream of Panther Grade. Interior and NMFS state the recommended flow gage monitoring plan is necessary to monitor compliance with license conditions.[53]

Rugraw, in its August 31, 2016, response to resource agency comments, agreed to develop a flow gage monitoring plan in consultation with appropriate resource agencies and did not dispute the number of recommended monitoring gages. However, Rugraw

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[52] Rugraw compares an 8-cfs MIF for the project's bypassed reach to a 5-cfs MIF that was approved by Reclamation and the Water Board for Baldwin Creek, which flows directly into the mainstem Battle Creek at a much lower elevation than the project reach, is easier for anadromous salmonids to access, and has the same ESA designation as the proposed project's bypassed reach. Rugraw argues that an 8-cfs MIF is comparable to (actually higher than) the approved 5-cfs MIF for Baldwin Creek, which has better salmonid habitat than the project reach (http://www.battle-creek.net/docs/gbcwwg/BattleCreekOverview_and_Statu%20Update_Jan%202017.pdf).

[53] During the section 10(j) meeting, FWS and NMFS indicates that monitoring flow and water temperature at four or five sites may be acceptable (a transcript of the meeting was filed to the record on March 15, 2018); however, they did not identify specific sites for monitoring.

commented that a site downstream of Angel Falls would not be accessible for maintaining a gage in the bypassed reach, and instead proposed a gage location in the bypassed reach just upstream of the powerhouse.[54]

Our Analysis

We provide our analysis of the proposed and recommended minimum flows and ramping rates for the bypassed reach below under *Effects of Flow Regulation on Aquatic Habitat* and *Ramping Rates*, respectively. 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.

Some of the agency-recommended gage locations would be unnecessary to monitor compliance with potential license requirements. For example, because the project is only expected to alter streamflow downstream of the powerhouse for short periods, there would be little value in monitoring flow at the two agency-recommended locations between the powerhouse and downstream of Panther Grade. Similarly, Rugraw's proposal to monitor the impoundment's water surface level would support compliance monitoring for the proposed run-of-river operation, and monitoring the water surface elevation upstream of the diversion dam and within the intake's header box would not be necessary.[55]

While gage accessibility is an important consideration, documenting compliance with any flow requirements of any license issued would be the overriding objective when identifying monitoring location(s). As such, Rugraw's proposal to locate a gage in the bypassed reach just upstream of the powerhouse, instead of the agency recommended location of just upstream of Spring #4, is not appropriate as flows monitored downstream of Spring #4 would be influenced by inflow from the spring. In contrast, monitoring streamflow just upstream of Spring #4 as recommended by the agencies would allow evaluation of the minimum flow within the bypassed reach.[56] While we note that monitoring bypassed reach flows upstream of Angel Falls (RM 22.3) would provide information similar to just upstream of Spring #4 and provide better access, the bypassed reach sometimes loses flow between the dam and the influence of Spring #4. Therefore, monitoring compliance with MIF just upstream of Spring #4 would allow determination

[54] Angel Falls and the powerhouse are located at RM 22.3 and RM 20.6, respectively.

[55] We note that, maintaining the water surface elevation of the reservoir to within +/-0.5 inch, as proposed, may be beyond the capabilities of currently available monitoring and flow regulation equipment, and maintaining such a level of precision would be difficult, especially where wind and waves may cause natural fluctuations in the water surface elevation that are more than 0.5 inch.

[56] Spring #4 is located at RM 20.8, 0.2-mile upstream of the proposed tailrace discharge.

of the extent that flow is lost in the reach and ensure that the MIF is available to resources it is intended to protect.

To monitor compliance with run-of-river operations and ramping rates, stage/flow monitoring would need to be capable of continuously documenting stage/flow changes. Run-of-river operation could be verified by monitoring the impoundment's water surface elevation, which would remain constant under run-of-river operation, with the understanding that the elevation may change during natural variations in inflow, such as high-flow events. For ramping rates, monitoring stage/flow changes at a location with high potential for stranding fish in the bypassed reach, immediately downstream of the diversion dam, would provide a means to monitor "worst-case" ramping rates because changes in stage tend to naturally attenuate moving downstream. The bypassed reach immediately downstream of the proposed diversion is also relatively wide and low gradient compared to the remainder of the reach, posing the greatest stranding risk for juvenile salmonids.

Development of an operation compliance monitoring and reporting plan that consolidates all project operation requirements, discusses compliance monitoring, and provides the reporting procedures would efficiently document compliance of project operation with flow requirements, which could change during the term of any license issued for the project.

Effects of Streamflow on Project Operation

The project would divert between 5 and 105 cfs for power generation, primarily during the winter and spring months when peak streamflows in the watershed occur. Rugraw proposes to design the powerhouse's Pelton turbine to continue water flow in the tailrace under a load rejection. As proposed, Rugraw would release an MIF or natural inflow, whichever is less, to the bypassed reach at all times. Rugraw is proposing a 13-cfs minimum flow but states that its proposal was somewhat arbitrary and based on inaccurate flow estimates during an agency site tour.[57] At natural flows up to 18 cfs, the powerhouse would be off-line under a 13-cfs MIF, and the entire streamflow would pass over the diversion into the bypassed reach. With these operational constraints, Rugraw notes that hydropower operations would typically cease in early July and resume in mid- to late-November, based on median available daily flow. In addition to its 13 cfs proposal, Rugraw comments on the draft EIS suggests that FERC staff consider an alternative 8-cfs MIF in the final EIS. At an 8-cfs minimum flow, operation could occur at natural flows as low as 13 cfs. The following section contains additional discussion of the identified MIFs, including effects on water temperature and aquatic habitat.

[57] This site tour occurred on November 6, 2014, when flow was estimated to be 13 cfs, which agency representatives indicated appeared adequate to support a vibrant fish population. However, flow on that day was later determined to be 10 cfs (Rugraw comments on draft EIS, filed on February 2, 2018).

Our Analysis

To assess the effects of streamflow on project operation, and in turn on water quality, we used synthesized flow data to estimate when inflow would be sufficient for the project to operate while also releasing a minimum flow into the bypassed reach. We estimated the percent of time the project could operate at Rugraw's proposed 13-cfs minimum flow and the agency-recommended 35-cfs minimum flow and presented it in the draft EIS. For the final EIS, we added an evaluation of Rugraw's recently suggested 8-cfs minimum flow and the NMFS Alternative 1 flow recommendation (table 3-6). Our analysis shows there would be sufficient inflow for the project to operate 71 percent of the time under an 8-cfs MIF, 61 percent of time under a 13-cfs MIF, 42 percent of the time under a 35-cfs MIF, and 45 percent of the time under the NMFS Alternative 1 flow.[58] Under an 8-cfs MIF, the project could operate the majority of time from mid-November through July and infrequently during the remainder of the year (table 3-6).[59] Under a 13-cfs MIF, inflow would be sufficient for the project to operate the majority of time in December through mid-July, rarely in September through mid-October, and infrequently the remainder of the year. Under a 35-cfs and NMFS Alternative 1 instream flow, there would be sufficient inflow for the project to operate the majority of time from mid-January through June, rarely in August through mid-November, and infrequently the remainder of the year. Project shut-down would have no effect on streamflows or water quality, and table 3-6 shows that shut-downs would occur a substantial portion of the year, particularly at a 35-cfs and NMFS Alternative 1 instream flow.

Table 3-6. Frequency of available flow to support project generation and flows exceeding the proposed upper limit for project generation, using synthetic flow data from October 1928–May 2017 (Source: Rugraw, 2014, as modified by staff).

Period	**% of Time Flows Support Generation[a]**				**% of time flows are >418 cfs[c]**
	8-cfs MIF	**13-cfs MIF**	**35-cfs MIF**	**NMFS Alt 1 MIF[b]**	
Jan 1–15	84	73	44	44	1.0
Jan 16–31	88	77	51	51	0.7
Feb 1–14	92	84	59	59	0.9
Feb 15–29	94	91	66	66	0.7

[58] This evaluation of instream flows does not consider any project shut-downs to meet a temperature criterion.

[59] Frequency categories used in this summary are majority as greater than 50 percent, infrequent as 10 to 50 percent, and rare as less than 10 percent. The minimum semi-monthly frequency of sufficient flow for project operation with an 8-cfs MIF would be 25 percent.

Period	% of Time Flows Support Generation[a]				% of time flows are >418 cfs[c]
	8-cfs MIF	13-cfs MIF	35-cfs MIF	NMFS Alt 1 MIF[b]	
Mar 1–15	98	95	75	81	0.7
Mar 16–31	99	98	84	89	0.2
Apr 1–15	98	98	88	91	1.3
Apr 16–30	99	98	90	93	0.4
May 1–15	99	98	89	92	0.2
May 16–31	98	95	84	87	0.9
Jun 1–15	94	92	76	83	0.0
Jun 16–30	90	82	54	67	0.0
Jul 1–15	76	62	33	43	0.0
Jul 16–31	55	43	15	24	0.0
Aug 1–15	42	29	3	8	0.0
Aug 16–31	34	18	0	3	0.0
Sept 1–15	27	8	0	0	0.0
Sept 16–30	25	6	0	1	0.0
Oct 1–15	26	9	2	3	0.1
Oct 16–31	36	16	4	6	0.0
Nov 1–15	50	31	8	8	0.1
Nov 16–30	61	44	20	20	0.1
Dec 1–15	70	55	31	31	0.5
Dec 16–31	77	61	37	37	1.3
Jan 1–Dec 31	71	61	42	45	0.4

Notes: Shading indicates when the project could operate more than 50 percent of the time. MIF = minimum instream flow; cfs = cubic feet per second

[a] Project could generate with 5 cfs to 105 cfs while releasing the specified MIF past the dam (e.g., for 8-cfs MIF, available flow is between 13 and 113 cfs).

[b] NMFS Alternative 1 MIF schedule is: 35-cfs November 1–March 1, 30-cfs March 2–May 31, and 25-cfs June 1–October 31.

[c] High inflow greater than 418 cfs would prevent project operation, according to a letter filed on June 29, 2018, by Rugraw (letter from Charlie Kuffner, Rugraw, LLC, to Savannah Downey, California State Water Resources Control Board, dated June 28, 2018).

Drought Plan

The Water Board recommends implementation of a drought plan to outline the project's operation, including flows, during a drought and/or multiple critically dry years (preliminary condition 4).

Our Analysis

The development of a drought plan as recommended by the Water Board would not be required in the operating plans to guide project operation, including minimum flows, during a drought and/or multiple critically dry years. The proposed project would operate in a run-of-river mode with a proposed minimum bypassed reach flow, operate as a non-consumptive use of water for power generation (i.e., all of the diverted flow would be returned to South Fork Battle Creek), and would not store flow in a reservoir. The project as proposed would not exacerbate drought conditions in downstream stream reaches.

Water Temperature

Rugraw proposes and California DFW recommends (10(j) recommendation 4) developing a water temperature monitoring plan with six monitoring stations and a provision for project shut-down when average daily water temperature in the bypassed reach exceeds 20°C. Rugraw proposes water temperature monitoring stations at: (1) the diversion/intake structure; (2) Old Highway 36 Bridge; (3) within the bypassed reach, just upstream of the tailrace; (4) the powerhouse tailrace; (5) downstream of the powerhouse, in mixed flows from the bypassed reach and powerhouse tailrace; and (6) Ponderosa Way Bridge downstream of Panther Grade.[60]

Interior and NMFS recommend (10(j) recommendation 2) that Rugraw develop a water temperature monitoring plan with seven monitoring stations between Rugraw's diversion dam pool and about 0.4 mile downstream of Panther Grade and curtail project

[60] In addition to Rugraw's proposed monitoring locations at the diversion/intake structure and the powerhouse tailrace, California DFW recommends monitoring locations in the penstock, just upstream of Angel Falls, upstream of Spring #4, and just upstream of Panther Grade. California DFW, however, does not recommend monitoring at Rugraw's proposed sites in the bypassed reach at the Old Highway 36 Bridge or just upstream of the tailrace, or downstream of Panther Grade.

operation when water temperature exceeds their recommended levels.[61] FWS and NMFS recommend limiting the 7-day average of the daily maximum (7DADM) temperatures both upstream and downstream of Angel Falls to 18ºC from June 1 to October 31 for salmonid migration/over-summering and 13ºC from November 1 to March 1 for salmonid spawning, based on EPA (2003) guidance for the Pacific Northwest.[62] Their March 2 to May 31 7DADM recommendations for salmon rearing and holding differ from one another with NMFS recommending 16ºC and FWS recommending 15.5ºC.[63]

Interior also recommends (10(j) recommendation 2) that, if water is not available to comply with the 7DADM criteria or if water temperature above the project's influence exceeds the criteria, Rugraw should restore streambed and riparian areas to provide additional shading to reduce instream water temperatures.

In comments on the draft EIS, the Water Board specifies a 20ºC 7DADM temperature threshold and development and implementation of a water temperature monitoring plan. They specify monitoring of temperature and DO for a minimum of 5 years at the diversion intake, just upstream of Spring #4, and below the bypassed reach; and meeting with the resource agencies to determine if the project is having a significant impact on water temperature and identify appropriate mitigative actions.

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[61] In addition to Rugraw's proposed locations at the diversion/intake structure, the powerhouse tailrace, in mixed flows from the bypassed reach and powerhouse tailrace, and Ponderosa Way Bridge, NMFS and Interior recommend monitoring locations just upstream of the diversion dam, just upstream of Angel Falls, and between Angel Falls and Spring #4. They do not, however, recommend monitoring at Rugraw's proposed sites in the bypassed reach at the Old Highway 36 Bridge or just upstream of the tailrace.

[62] EPA (2003) developed 7DADM guidance levels for the Pacific Northwest to protect coldwater salmonids, including Chinook salmon and steelhead, based on evaluation of numerous studies. Each 7DADM value is computed as the average of the maximum daily temperature for seven consecutive days, and is not associated with the Basin Plan objective that limits allowable temperature increases to 2.8ºC. Based on a linear regression of 2015–2017 water temperatures for ABS, 7DADMs in the 13–20ºC range are generally about 2–3ºC higher than corresponding average daily temperatures.

[63] In the section 10(j) meeting, FWS modified its recommendation for limiting temperature in the bypassed reach (see 10(j) meeting transcript filed on March 15, 2018). Prior to this, Interior had recommended curtailing project operation when 7DADM exceeds 18ºC; and NMFS had recommended limiting bypassed reach 7DADM temperatures to 13ºC from November 1 to March 1 for salmonid spawning, 16 ºC from March 2 to May 31 for salmonid rearing, and 18ºC for the remainder of the year. During the 10(j) meeting, FWS changed its recommendation to adopt the NMFS seasonal limits, and to also reduce the March 2 to May 31 criterion from 16°C to 15.5°C.

Our Analysis

Rugraw modeled water temperature in South Fork Battle Creek and in the powerhouse discharge using two separate models (Watercourse Engineering, 2015): the Water Temperature Transaction Tool (W3T) and a tunnel temperature model. In the following discussion, we refer to changes in temperatures as water moves downstream or through the pipeline-penstock system as cooling and warming; we refer to temperature changes under alternative project operation (i.e., 8-cfs, 13-cfs, and 35-cfs MIFs) as increasing and decreasing in comparison to baseline conditions, the no-action alternative, unless stated otherwise. The effects of NMFS Alternative 1 MIFs would be seen from March 2 through October 31, when the MIF would be 30 cfs from March 2 to May 31, and 25 cfs from June 1 to October 31.

Rugraw used W3T to simulate longitudinal temperature conditions for South Fork Battle Creek between the proposed diversion and Ponderosa Bridge (RMs 23.0 to 18.5).[64] The model used 12 subreaches: 4 for the bypassed reach and 8 for the reach between the powerhouse and Ponderosa Bridge located 2.1 miles downstream. The model was calibrated with data from 2007, 2013, and 2014; validated with 2015 data; and applied to April 29 to July 13, 2007.

The W3T model simulations for the dry year modeled, 2007, indicate diversion of water for the project would not have caused daily mean temperature to exceed 20ºC ABS, upstream of Spring #4, or downstream of the powerhouse discharge (Watercourse Engineering, 2015) under any of the simulated MIFs (i.e., 5, 8, 13, and 25 cfs). Although differences in simulated temperatures for instream flows compared to baseline conditions indicate occasional temperature increases in the bypassed reach, all of these periods resulted in a daily mean temperature less than 14ºC. The project's reduction of flow in the bypassed reach would reduce the proportion of warm water from the upper basin in late-spring through late summer when the creek is warmer than the spring inflow, which would increase the influence of cool water inflows from Spring #4 and hyporheic flows. This would result in lower temperatures with the project in operation compared to existing conditions, especially in the lowermost 0.2 mile of the bypassed reach.[65]

Results of Rugraw's tunnel temperature model for water routed through the proposed pipeline and penstock suggest that water flowing through the pipeline-penstock would warm when inflow at the dam is less than 14ºC and cool when inflow temperature

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[64] W3T is a one-dimensional steady-flow model developed by Watercourse Engineering for the National Fish and Wildlife Foundation under a Conservation Innovation Grant (Watercourse Engineering, 2015).

[65] The extent of flow reductions from project operation would depend on natural flows and any instream flow requirements of the project license.

is greater than 14ºC (Watercourse Engineering, 2015).[66] The most extreme simulated temperature changes were at the minimum operating flow of 5 cfs. For an inflow temperature of 20ºC, the model simulated a cooling for the range of powerhouse operation (i.e., 5 to 95 cfs) from 0.8ºC to 0.3ºC. Consistently the model simulated a 0.1ºC cooling effect for an inflow temperature of 15ºC. Whereas, the model predicts a 0.5ºC to 0.2ºC warming effect for an inflow temperature of 10ºC (figure 3-7). FWS and others questioned Rugraw's application of a constant 14ºC throughout the entire year for the pipe's wall temperature.[67]

We agree that the temperature of the buried pipe and penstock to a depth of at least 3 feet may vary somewhat seasonally,[68] so we used the warmest local average monthly air temperature as an indicator of worst-case temperature for the pipeline-penstock system. This indicates that the pipe's temperature would not exceed 20ºC, because the warmest average monthly air temperature reported for nearby Mineral is 19.8ºC (Western Regional Climate Center, 2018).[69] In addition, the buried pipeline would not be exposed to direct solar radiation and cause heating of the pipeline wall. Therefore, routing water through the pipeline-penstock system is not expected to increase the water's temperature when inflow temperature is near or greater than 20ºC.

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[66] The pipe-wall temperature setting is based on Rugraw's proposal to bury both the pipeline and penstock in accordance with general engineering and construction practices to ensure proper bedding and 3 feet of overhead ground cover. Temperature effects would result from conduction with the wall of the pipeline-penstock, and therefore would be controlled by the temperature differential between inflow and the wall.

[67] See 10(j) meeting transcript filed to the record on March 15, 2018.

[68] Burying the pipeline at a depth of 3 feet, as proposed, would put the bottom of the pipeline at a depth of 6 feet.

[69] The period of record for the Mineral weather station includes at least 77 years of monthly temperature data.

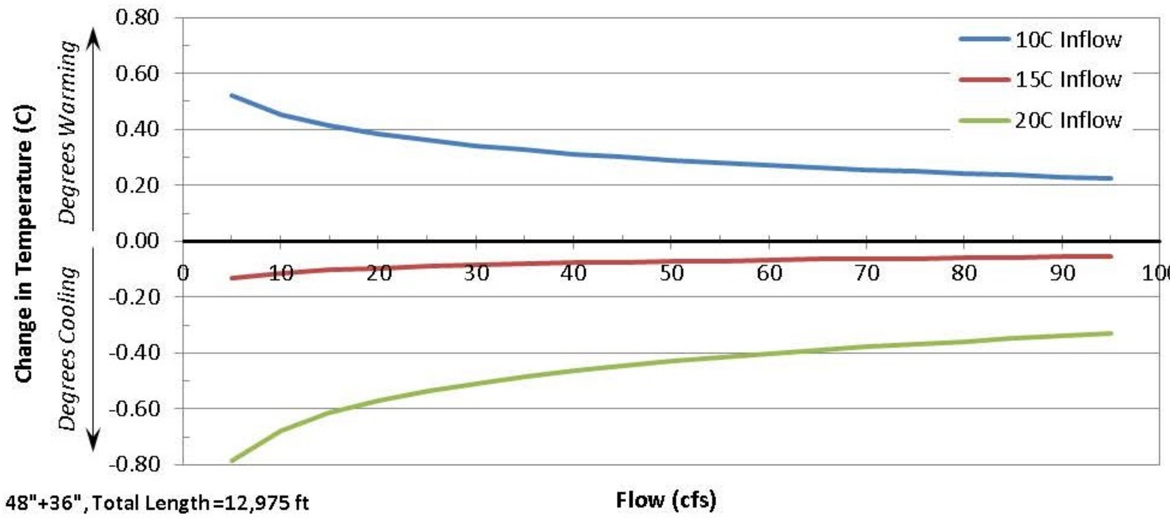

Figure 3-7. Simulated water temperature for proposed Lassen Lodge power tunnel (Source: Watercourse Engineering, 2015).

Although the temperature of water routed through the pipeline-penstock system was modeled, Rugraw applied the more conservative assumption that the temperature of water diverted through the powerhouse would not change. Even with this assumption, all simulated temperatures for project operation remained less than 20ºC.[70] Differences in simulated temperatures below the powerhouse tailrace ranged from a decrease of 1.2ºC in early May to an increase of 0.9ºC at the beginning of June for an 8-cfs instream flow. At a 13-cfs instream flow, differences in simulated temperatures below the powerhouse tailrace ranged from a decrease of 1.1ºC in early May to an increase of 0.7ºC at the beginning of June. Increases for a 13-cfs instream flow resulted in a maximum temperature of 17ºC below the powerhouse tailrace return and coincided with project inflow temperatures of 15ºC to 17ºC. Simulated temperatures below Ponderosa Bridge (RM 18.5) at a 13-cfs instream flow remain within ±0.5ºC of the baseline conditions, with a maximum increase of 0.2ºC. As discussed, all the W3T model's simulated temperatures for below the powerhouse had a daily mean temperature of less than 20ºC. This, combined with the expectation that routing water through the pipeline-penstock system would decrease temperature during the warmest part of the year, and any project-caused temperature effects would be attenuated as water flows downstream, indicates the project would result in negligible increases in water temperature below the powerhouse, including at Panther Grade, which is about 1.7 miles downstream of the powerhouse.

[70] The maximum simulated temperature for below the powerhouse was about 18ºC in early July at an 8-cfs instream flow.

A large, open meadow upstream of the proposed diversion dam site causes water temperatures to warm in upper South Fork Battle Creek soon after snowmelt, elevating temperatures at the proposed dam site. Water cools under existing conditions as it flows through the bypassed reach downstream of the dam site in late spring and early summer (Cramer and Ceder, 2013; Cramer et al., 2015; Watershed Sciences, Inc., 2011), likely because of the narrow channel, considerable shade downstream of Angel Falls, and cool inflow from hyporheic flows and Spring #4. The W3T model and limited monitoring data[71] indicate project operation would reduce temperatures in the bypassed reach during late-spring and summer, with the influence lessening as instream flow in the bypassed reach increases. Under the agencies' recommended higher minimum flow, the project would cease operation sooner in the year (table 3-6 and figure 3-8) and have no measurable effect on water temperature during these shut-down periods.

Our evaluation of the modeling shows that powerhouse discharge temperatures would be less than inflow temperatures when inflow temperatures are greater than 20ºC. As a result, project flow diversions in late spring and early summer would result in cooler water temperatures in the bypassed reach downstream of Spring #4's influence and in South Fork Battle Creek beyond the project reach, compared to baseline conditions.

Rugraw proposes and agencies recommend shutting down the project when specific water temperature criteria to protect coldwater fisheries habitat are exceeded. Figure 3-8 shows the effect of the proposed and recommended water temperature criteria on timing of potential project shut-down for the warmer months of the year when the temperature criteria may be exceeded,[72] based on water temperature data for each water year type (Watercourse Engineering, 2015).

Low river flows would have a greater influence on project shut-downs than water temperature criteria in most water year types, although that effect is more likely to occur in drier water years (figure 3-8). For example, in the 2007 dry water year, lack of flow would result in a seasonal project shut-down beginning July 11 at Rugraw's suggested 8-cfs MIF, June 19 at Rugraw's proposed 13-cfs MIF, and May 22 at NMFS and Interior's recommended 35-cfs MIF (figure 3-8). The project would not return to operation until after October under any proposed or recommended MIFs. Therefore, the project would be off-line and not affect water temperature in South Fork Battle Creek during these periods of this dry year, and the various water temperature criteria would have almost no effect on project operation.

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[71] Natural cooling of water between the proposed dam and Spring #4 has been documented for low flows in 2015 (figure 3-3; Cramer et al., 2015) and with aerial thermal imagery conducted at a flow of about 25 cfs on August 23, 2011 (figure 3-4; Watershed Sciences, Inc., 2011).

[72] Evaluation of water temperature criteria used April through October temperature data for the project intake and Old Highway 36 Bridge for 2006 (wet year), 2004 (above normal year), 2013 (below normal year), 2007 (dry year), and 2014 (critical dry year).

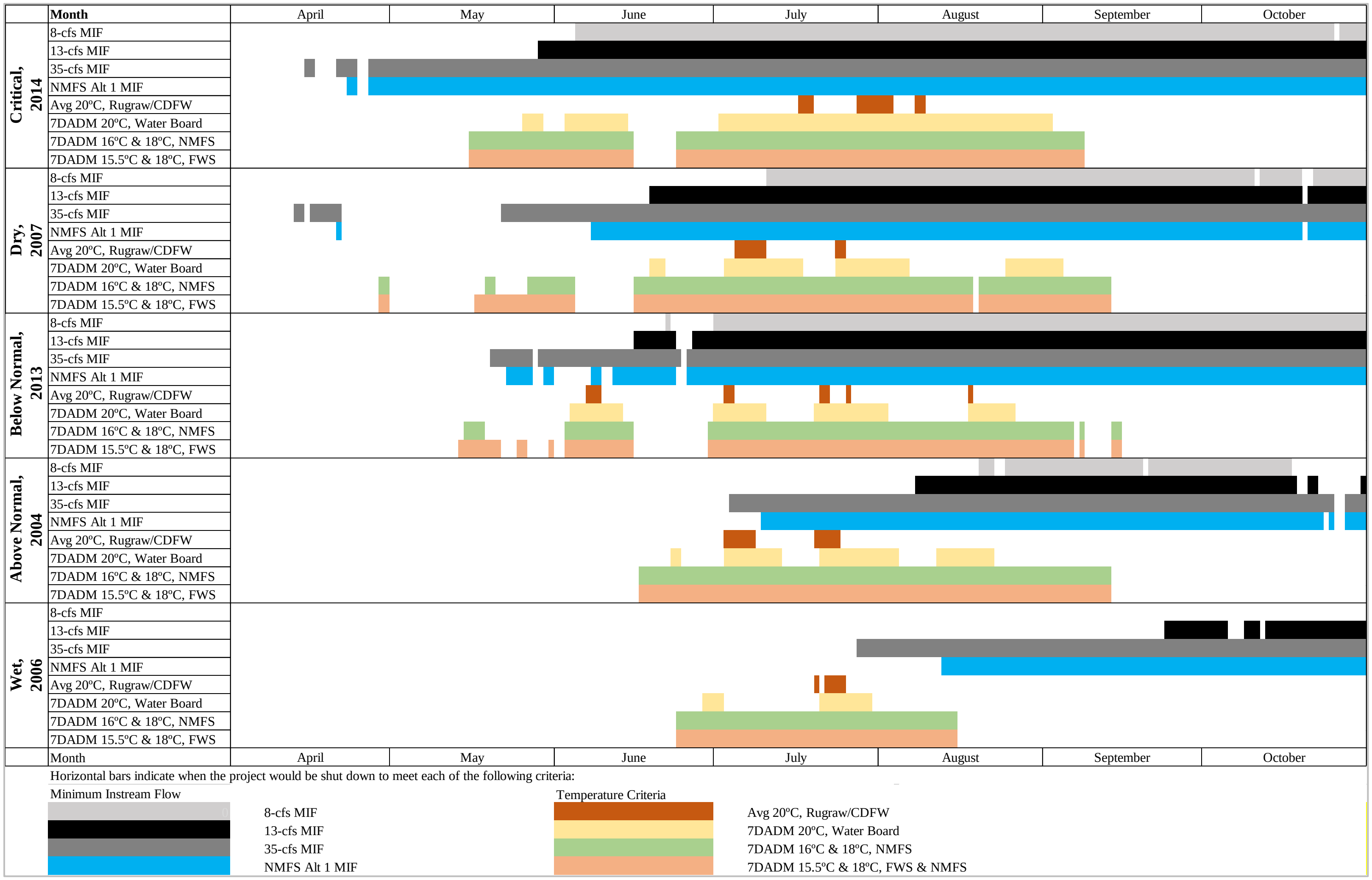
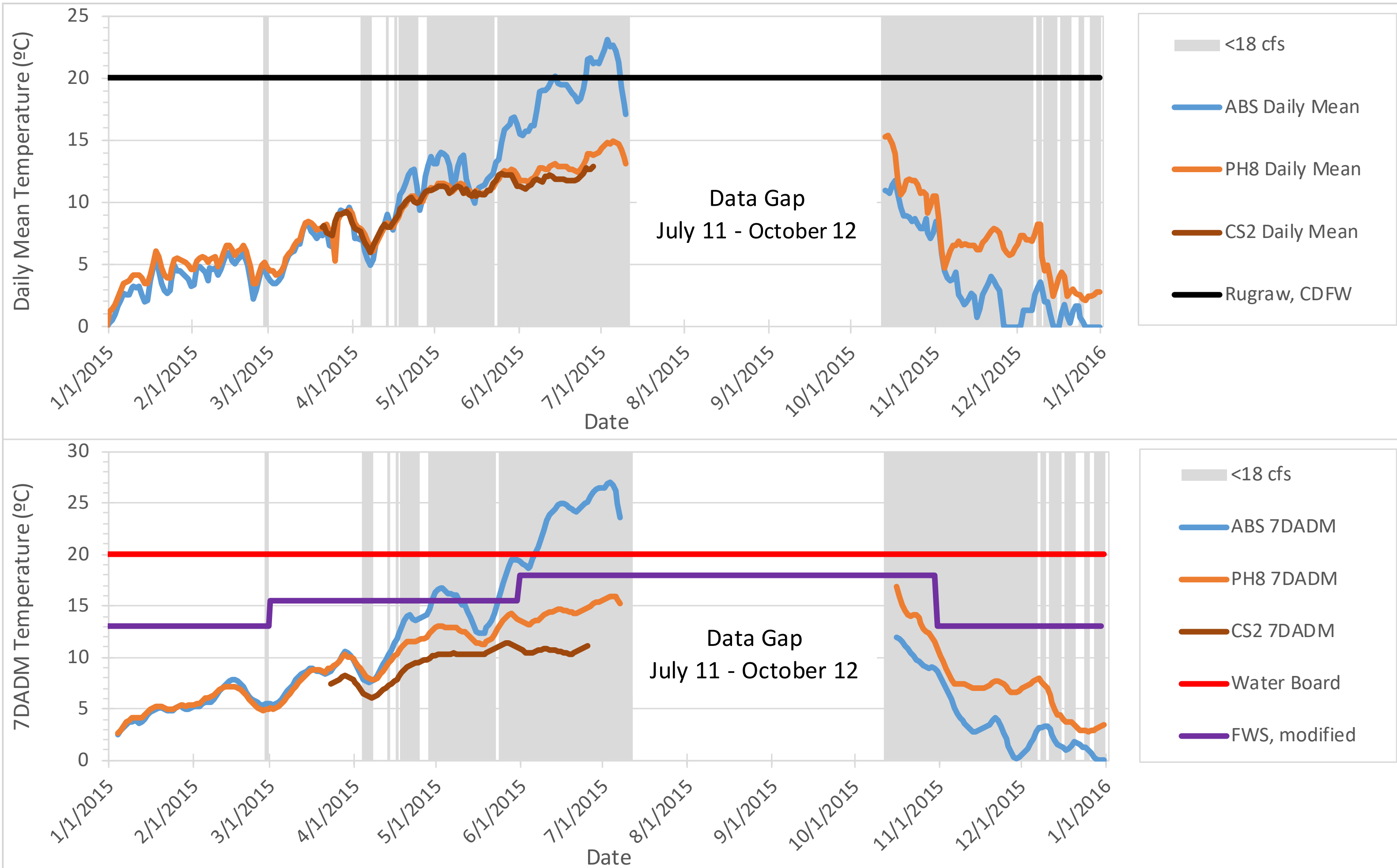


Figure 3-8. Time series for preclusion of project operation to meet proposed and recommended MIFs and temperature criteria in different water year types, based on historic temperatures at the proposed dam site; horizontal bars indicate when the project would be shut-down (Source: Watercourse Engineering, 2015; Rugraw, 2014; as modified by staff).

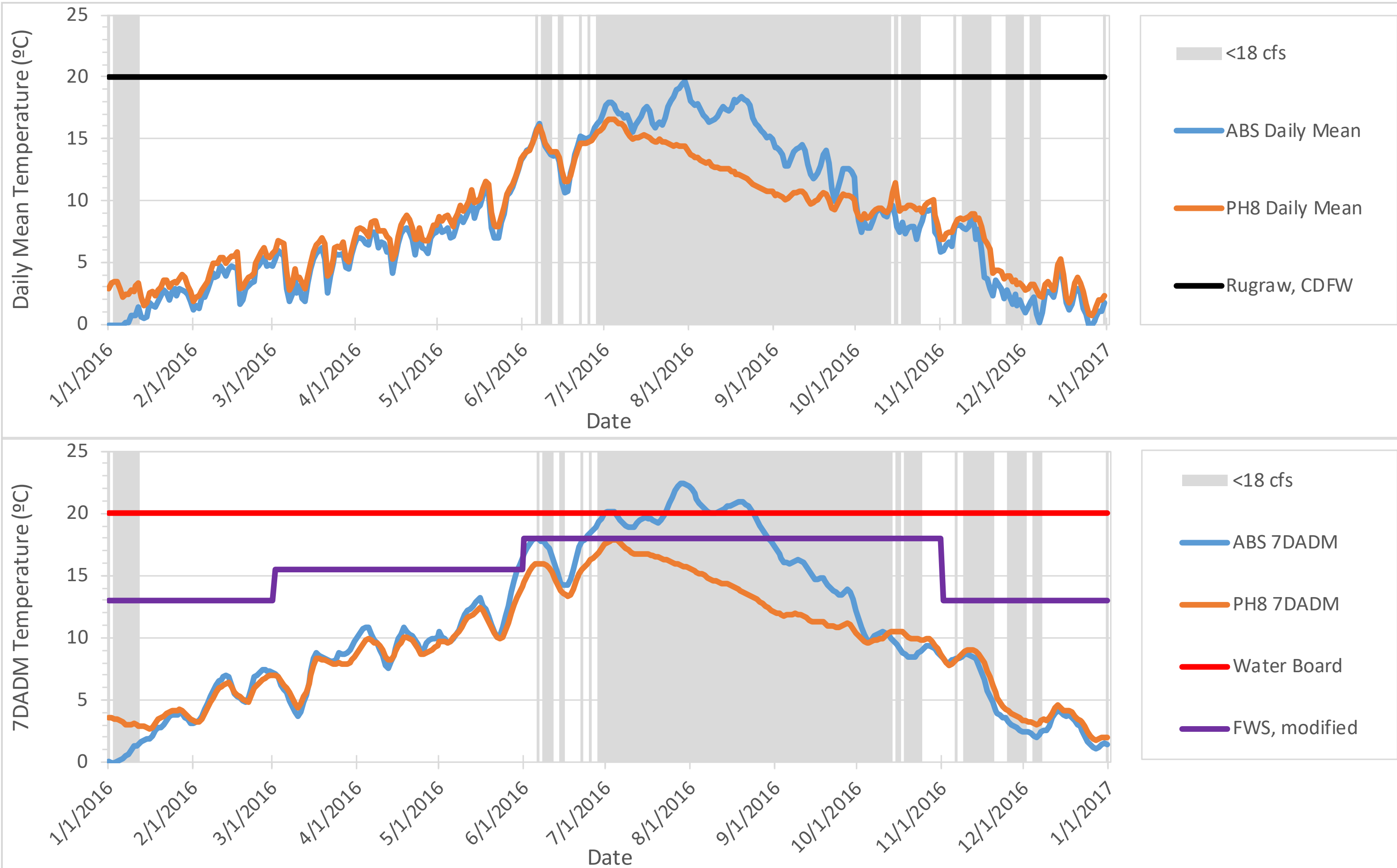
This analysis also shows that all of the proposed and recommended temperature criteria would be exceeded at the diversion dam (under existing conditions) during the months of April to September, but at different time intervals and durations depending on the water year types. Overall, some water temperature exceedances occur on days in June through August for the 20ºC daily average temperature criterion proposed by Rugraw and recommended by California DFW, in May through September for the Water Board's recommended 20ºC 7DADM, and in April through September for the NMFS recommended 16ºC and 18ºC and the FWS's recommended 15.5ºC and 18ºC 7DADM, but these frequencies substantially decrease in above normal and wet water years. The timing of many of these temperature criteria exceedances, however, would coincide with periods when the project would already not be in operation under any of the proposed or recommended MIFs (see figure 3-8).

To further assess how available flows and temperature criteria may affect potential project operation, we used the temperature data recently filed by Rugraw for 2015 through 2017, and compared daily mean and 7DADM temperature statistics to the proposed and recommended temperature criteria (figures 3-9 through 3-11). These data show that current inflowing temperatures (ABS) already exceeded all of the temperature criteria for short periods during the summer months during all three years, although effects were less pronounced in 2017, a wet water year. NMFS criteria and FWS modified criteria were exceeded in all years, while the Rugraw/California DFW and Water Board 20ºC daily average and 20ºC 7DADM criteria were not exceeded in 2016 and 2017. The 13ºC 7DADM criterion recommended by FWS and NMFS was not exceeded either at Above the Old Highway 36 Bridge or near the powerhouse in 2015 through 2017.



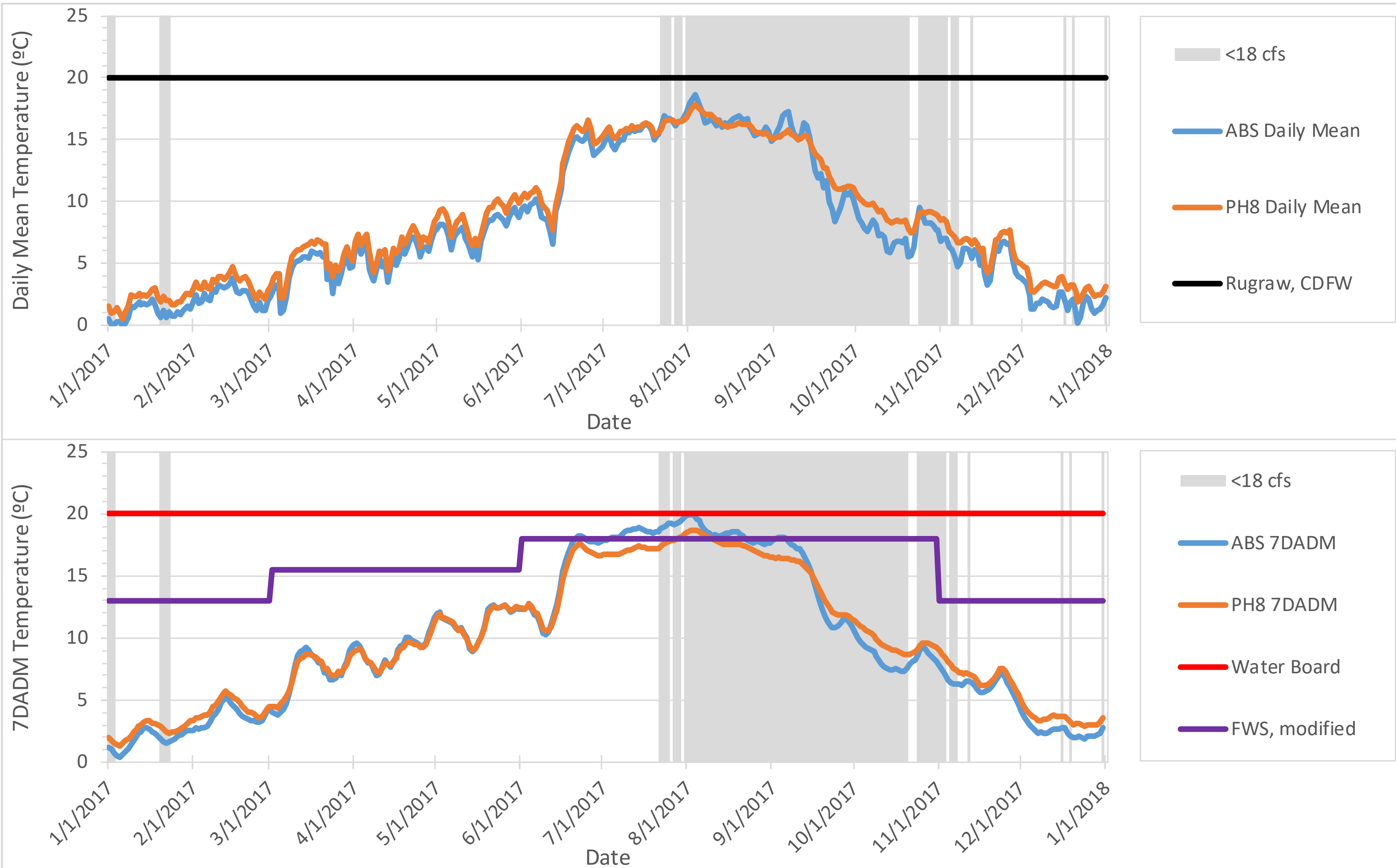
Notes: ABS = Above Old Highway 36 Bridge Station, PH8 = Powerhouse 8-Foot Falls, and CS2 = Cramer Station 2; shading indicates flow at the dam is <18 cfs and the project would not be operating at a 13-cfs or higher MIF.

Figure 3-9. Time series of water temperature compared to temperature criteria in 2015, a critical water year (Source: Rugraw, 2018, as modified by staff).



Note: ABS = Above Old Highway 36 Bridge Station and PH8 = Powerhouse 8-Foot Falls; shading indicates flow at the dam is <18 cfs and project would not be operating at a 13-cfs or higher MIF.

Figure 3-10. Time series of water temperature compared to temperature criteria in 2016, a below normal water year (Source: Rugraw, 2018, as modified by staff).



Note: ABS = Above Old Highway 36 Bridge Station and PH8 = Powerhouse 8-Foot Falls; shading indicates flow at the dam is <18 cfs and project would not be operating at a 13-cfs or higher MIF.

Figure 3-11. Time series of water temperature compared to temperature criteria in 2017, a wet water year (Source: Rugraw, 2018, as modified by staff).

To quantify how various temperature criteria may trigger additional project shut-downs, outside of those occurring because of inadequate flows, we prepared table 3-7. Table 3-7 provides the number of additional days of shut-down in April through October that would be caused by each of the proposed and recommended temperature criteria, at the range of proposed and recommended minimum flows. In the 8 years evaluated, these data show that even without the application of temperature criteria, the project would already be shut down a substantial portion of the year during critical, dry, and below normal water years, with the portion of the year shut down increasing with increasing minimum flows. The additional days of project shut-down caused by application of temperature criteria was not high for most years, but was highest at the lowest minimum flow (8 cfs) and with the "most stringent" temperature criteria (7DADM, FWS), as would be expected. The highest number of days of project shut-down was 214 for a 35-cfs MIF in 2015 (a critical water year), and application of temperature criteria did not affect the number of days of shut-down in that year for a 13-cfs, 35-cfs, or NMFS Alternative 1 MIF. The highest number of days of temperature-triggered shut-downs was 66 in 2004 (an above normal water year) for 7DADMs recommended by FWS and NMFS with an 8-cfs MIF. In comparison, the "Avg. 20ºC, Rugraw & California DFW" criteria caused 11 additional days of shut-down in 2004 (table 3-7).

Summary of Water Temperature Analysis

Water temperature monitoring and modeling by Rugraw has shown that South Fork Battle Creek currently experiences low flows and warm water temperatures during the summer months, but that there is some cooling of flows in the proposed bypassed reach as it passes downstream through the narrow canyon-like, heavily shaded channel, and is augmented with the cooler spring-inflow (e.g., input from Spring #4). Water temperature modeling has also shown that, with the project in operation, cooling through the bypassed reach would continue, and water passing through the pipeline/penstock may also experience some cooling during the summer months. However, that modeling was based on limited data. Subsequently, Rugraw recently filed an additional 3 years of temperature monitoring data (2015 through 2017) and those data continue to show warm water temperatures exceeding temperature criteria for salmonids in the upper end of the proposed bypassed reach during the summer months, depending on water year type.

To mitigate for warm water temperatures in the project reach, Rugraw proposes and resource agencies recommend shutting down the project when specific water temperature criteria to protect coldwater fisheries habitat are exceeded. Rugraw and California DFW specify a criterion of a daily average temperature of 20°C; the Water Board specifies a 7DADM of 20ºC; and NMFS and FWS specify 7DADM targets of 18ºC for June 1–October 31, 13ºC for November 1–March 1, and either 16ºC (NMFS) or 15.5ºC (FWS) for March 2–May 31. In the draft EIS, staff did not adopt project shut-downs tied to temperature criteria, because information in the public record at that time indicated occurrences of project operation causing warming would not be common. Although our re-evaluation of the available information documents a cooling trend throughout the proposed bypassed reach during late-spring and summer at flows of less than 18 cfs, this cooling trend frequently does not occur at higher flows. The recent water temperature data filed by Rugraw indicate that warm temperatures exceeding salmonid criteria could occur over a 2-month summer period.[73] These data also indicate that water temperature at the powerhouse site could be as much as 10°C cooler than at ABS, but this is downstream of the influence of Spring #4, so temperatures upstream of Spring #4 would likely be warmer.

Rugraw's modeling indicated maximum cooling within the bypassed reach of about 1°C, so if similar cooling occurred upstream of Spring #4, water temperatures in much of the bypassed reach could still exceed salmonid criteria during low-flow summer periods. If inflow temperatures are high because of conditions in the basin upstream of the project, however, this would not be a project effect. However, given the limited temperature data and existing model results, it is unclear how project operations may influence water temperature within the bypassed reach between ABS and just upstream of Spring #4. It is likely that a reduction in flows in the bypassed reach, subsequent to project operation, would result in an increase in water temperature between the diversion dam site and a site just upstream of Spring #4 during at least some periods. If this increase in temperature were to exceed resident salmonid criteria thresholds then the curtailment of project operation to protect aquatic resources in this reach would be appropriate.

Rugraw proposes and the agencies recommend several different temperature criteria to trigger a project shut-down, as previously described. Rugraw, California DFW, and the Water Board specify 20°C for the protection of resident salmonids (rainbow trout), although Rugraw and California DFW use average daily temperature while the Water Board specifies 7DADM. The NMFS and FWS variable seasonal criteria are targeting anadromous salmonids, which do not currently occur in the project reach. Application of a 7DADM criterion would focus solely on project effects on maximum daily temperatures and would average those effects for 7-day periods. In contrast, application of an average daily temperature criterion would identify all periods when the project may increase water temperature and not just using the maximum daily temperature. Therefore, we conclude that applying an average daily temperature criterion of 20°C combined with a determination of a project-caused increase in water temperature, identified by a higher temperature just upstream of Spring #4 influence compared to the temperature at the dam, to trigger project shut-down would protect resident salmonids from project temperature effects. Because operational experience may find that water temperatures behave differently than predicted, it may also be appropriate to provide periodic review of the results of temperature monitoring and any project shut-downs after commencement of project operation.

[73] Water temperature reached as high as 28°C at Above Old Highway 36 Bridge Station (ABS) in 2015, a critical water year.

To accomplish this strategy for protecting resident salmonids, Rugraw would need to conduct real-time temperature monitoring at the dam and just upstream of the Spring #4 influence. Although temperature monitoring at the other locations proposed by Rugraw and recommended by agencies would be useful for the BCSSRP, it would not be needed to determine when to shut-down the project or for project compliance purposes.

Under natural conditions, DO is reported to be as low as 6.3 mg/L at the proposed powerhouse location during flows of about 5 cfs at the proposed dam site (Tetra Tech, 2015a), but is 7.6–8.9 mg/L, which is 86–89 percent of saturation, at a flow of 13 cfs at the dam location (Sellheim and Cramer, 2013). These data indicate that DO drops to marginally acceptable levels for salmonids during at least some low-flow periods when the project would not be operating. The data collected at 13-cfs indicate that DO supports salmonids at the lowest flows at which the project could operate.[74] Because the project would have a small, shallow impoundment that would be operated in run-of-river mode, water would be quickly routed through it and would not thermally stratify or form anoxic conditions near its bottom. Therefore, releases from the dam are expected to have nearly the same DO levels as under existing conditions. Further downstream at Angel Falls, water would continue to be aerated to near saturation. Although project operation may slightly increase water temperature in the bypassed reach during some periods, these temperature changes are not expected to have a measurable effect on DO concentrations, because they would have minimal effect on the saturation of oxygen in water. For example, increasing the temperature from 18°C to 19°C[75] would decrease DO at saturation by 0.2 milligram per liter (USGS, 2018). As a result, the project would have minimal effects on DO, and DO monitoring as specified by the Water Board would not be warranted.

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[74] This assumes an 8-cfs MIF, where the project would start to operate at a flow of 13 cfs (i.e., the sum of the 8-cfs minimum flow and 5-cfs needed for minimum project operation).

[75] This is Rugraw's W3T model's maximum simulated temperature increase (Watercourse Engineering, 2015).

Table 3-7. Number of days of project shut-down between April 1 and October 31 that would be caused by insufficient flow and exceedance of temperature criteria over a range of water year types[a] (Source: Watercourse Engineering, 2015; Rugraw, 2014, 2018; as modified by staff).

	Critical		Dry	Below Normal		Above Normal	Wet		Cumulative Days of Shut-Down for Temperature Criteria
	2014[b]	2015[c, d]	2007[b]	2013[b]	2016[c]	2004[b]	2006[b]	2017[c]	
8-cfs MIF, Rugraw									
No temperature criteria	148	179	110	124	98	56	0	62	--
Average 20ºC, Rugraw & California DFW	0 (148)	0 (179)	6 (116)	3 (127)	0 (98)	11 (67)	5 (5)	0 (62)	25
7DADM 20ºC, Water Board	6 (154)	0 (179)	11 (121)	10 (134)	4 (102)	36 (92)	14 (14)	0 (62)	81
7DADM, NMFS[e]	20 (168)	6 (185)	38 (148)	18 (142)	20 (118)	66 (122)	53 (53)	47 (109)	268
7DADM, FWS[f]	20 (168)	8 (187)	46 (156)	25 (149)	21 (119)	66 (122)	53 (53)	47 (109)	286
13-cfs MIF, Rugraw & California DFW									
No temperature criteria	156	199	134	135	126	75	34	97	--
Average 20ºC, Rugraw & California DFW	0 (156)	0 (199)	0 (134)	3 (138)	0 (126)	11 (86)	5 (39)	0 (97)	19
7DADM 20ºC, Water Board	3 (159)	0 (199)	0 (134)	10 (145)	0 (126)	28 (103)	14 (48)	0 (97)	55

	Critical		Dry	Below Normal		Above Normal	Wet		Cumulative Days of Shut-Down for Temperature Criteria
	2014[b]	**2015[c, d]**	**2007[b]**	**2013[b]**	**2016[c]**	**2004[b]**	**2006[b]**	**2017[c]**	
7DADM, NMFS[e]	13 (169)	0 (199)	16 (150)	17 (152)	4 (130)	52 (127)	53 (87)	24 (121)	179
7DADM, FWS[f]	13 (169)	0 (199)	24 (158)	24 (159)	5 (131)	52 (127)	53 (87)	24 (121)	195
35-cfs MIF, FWS & NMFS									
No temperature criteria	194	214	171	163	173	118	96	133	--
Average 20ºC, Rugraw & California DFW	0 (194)	0 (214)	0 (171)	0 (163)	0 (173)	1 (119)	5 (101)	0 (133)	6
7DADM 20ºC, Water Board	0 (194)	0 (214)	0 (171)	0 (163)	0 (173)	3 (121)	11 (107)	0 (133)	14
7DADM, NMFS[e]	0 (194)	0 (214)	4 (175)	4 (167)	0 (173)	17 (135)	34 (130)	0 (133)	59
7DADM, FWS[f]	0 (194)	0 (214)	7 (178)	6 (169)	0 (173)	17 (135)	34 (130)	0 (133)	64
NMFS Alternative 1									
No temperature criteria	190	214	146	149	165	111	80	121	--
Average 20ºC, Rugraw & California DFW	0 (190)	0 (214)	0 (146)	1 (150)	8 (173)	6 (117)	5 (85)	12 (133)	12

	Critical		Dry	Below Normal		Above Normal	Wet		Cumulative Days of Shut-Down for Temperature Criteria
	2014[b]	**2015[c, d]**	**2007[b]**	**2013[b]**	**2016[c]**	**2004[b]**	**2006[b]**	**2017[c]**	
7DADM 20ºC, Water Board	0 (190)	0 (214)	0 (146)	6 (155)	8 (173)	9 (120)	14 (94)	12 (133)	29
7DADM, NMFS[e]	0 (190)	0 (214)	13 (159)	11 (160)	8 (173)	23 (134)	50 (130)	12 (133)	105
7DADM, FWS[f]	0 (190)	0 (214)	21 (167)	15 (164)	8 (173)	23 (134)	50 (130)	12 (133)	117

Notes: MIF = minimum instream flow; 7DADM = 7-day average of the daily maximum

[a] For temperature criteria, values are presented as number of days shut-down because of temperature criteria followed by total number of days shut-down in ()s, e.g., 6 (154) indicates total of 154 days shut-down with 6 of them caused by temperature.

[b] April 1 through October 31 data provided in Watercourse Engineering (2015) and Rugraw (2014).

[c] Measured data provided in Rugraw (2018). No reported temperatures would cause a shut-down for any period outside of April 1 through October 31.

[d] Flow and temperature data gap from July 11 to October 12 of 2015. Flow was considered insufficient to meet any of the MIFs evaluated, because flow was 10 cfs and 0.8 cfs on the day before and after this gap, respectively.

[e] NMFS 7DADM temperature targets are 13ºC for November 1–March 1, 16ºC for March 2–May 31, and 18ºC for June 1–October 31.

[f] FWS 7DADM temperature targets are 13ºC for November 1–March 1, 15.5ºC for March 2–May 31, and 18ºC for June 1–October 31.

Interior also recommends that, if EPA's (2003) 7DADM criteria are not met, streambed and/or riparian restoration projects should be implemented along South Fork Battle Creek to provide shading and potential cooling. However, as demonstrated above, water temperature may occasionally exceed the 7DADM targets at the diversion dam and in the bypassed reach under current conditions, and this would continue to occur with the project (see figure 3-8). This is primarily because of warm inflow to the project reach, not due to project-induced warming. If project-induced warming is detected by real-time monitoring, a project shut-down would reduce/stop water diversion and minimize any project effect on water temperature in South Fork Battle Creek. In addition, although streambed and/or riparian restoration projects may improve ambient water temperatures in South Fork Battle Creek, natural and anthropogenic conditions upstream of the project that cause reduced inflows and/or elevated water temperature are beyond the project's control. Given that Interior's 7DADM criteria are not met under existing conditions without the project, any streambed and/or riparian restoration projects would not address project effects. However, development of an operation compliance monitoring and reporting plan that consolidates all project operation requirements, discusses compliance monitoring, and provides the reporting procedures would efficiently document project compliance with water temperature requirements.[76]

Operational Effects on Aquatic Habitat and Biota

Effects of Flow Regulation on Aquatic Habitat

The proposed run-of-river operation would affect the seasonal instream flow pattern in the 2.4-mile-long reach of South Fork Battle Creek between the proposed diversion dam (RM 23.0) and powerhouse tailrace (RM 20.6) (bypassed reach); however, all flow would be returned to the stream 1.7 miles upstream of Panther Grade (RM 18.9) (see figure 3-2), and the flow pattern would remain unaffected downstream of the project's tailrace. Manipulation of instream flows in the bypassed reach would directly affect the capacity of that reach to support spawning, rearing, and other life stages of resident and possibly anadromous fish, and may also affect other physical and biological processes. In diverted or bypassed stream reaches that contain productive aquatic habitat, resource managers often establish instream flow regimes to maintain ecological functions, processes, and connectivity important for sustaining aquatic resources.

Rugraw proposes to maintain a minimum flow of 13 cfs in the bypassed reach, as needed to sustain functions that support fish and habitat in the stream. The MIF release would pass through a gate in the diversion dam and cascade over native boulders that would be retrieved from the instream excavations to simulate a natural boulder cascade. In its February 2, 2018, comments on the draft EIS, Rugraw suggests that Commission

[76] As discussed in 3.3.2.2, *Flow Gaging and Monitoring*, an operation and compliance monitoring plan would also document compliance with required project minimum flow and ramping rate restrictions.

staff also analyze an 8-cfs minimum flow. Rugraw also states it would consider seasonal minimum flows ranging from 8 to 13 cfs depending on the number of anadromous fish in the reach along with 30-cfs pulse flows if more than 12 adult anadromous fish are identified in the project reach. This 30-cfs pulse flow would be provided for a period of 2 days twice a month from February 1 to May 15 to facilitate steelhead passage. Rugraw does not specify that it is changing its flow proposal, but we have included an analysis of the 8-cfs minimum flow.[77]

In its preliminary 10(j) recommendations (recommendation 1), California DFW concurs with Rugraw's recommended 13-cfs minimum flow release for the protection of resident fish (along with the proposed temperature criteria not to exceed 20°C in the bypassed reach).[78] If anadromous salmonids are detected in the bypassed reach (through the anadromous fish monitoring program), California DFW recommends Rugraw develop in consultation with the resource agencies new flow and temperature criteria to protect anadromous salmonids.

In their preliminary 10(j) recommendations (recommendation 1), to provide for habitat connectivity and fish passage within the bypassed reach, NMFS and Interior recommended that Rugraw provide a year-round MIF in the bypassed reach of 35 cfs, or the natural flow (if the natural flow is less than 35 cfs). Following issuance of the draft EIS, NMFS recommended staff analyze an additional MIF alternative (NMFS Alternative 1) that varies by season for the following steelhead and Chinook life stages:

- 35 cfs for steelhead/Chinook spawning, November 1 to March 1;
- 30 cfs for steelhead/Chinook rearing, March 2 to May 31; and
- 25 cfs for steelhead over-summer, June 1 to October 31.

The Water Board indicated that it will prescribe an MIF upon review of the entire project record (preliminary condition 1).

Our Analysis

Rugraw is proposing to operate the project in a run-of-river mode. To maintain run-of-river operation, Rugraw proposes a constant water surface elevation (+/-0.5 inch) for the proposed 0.4-acre reservoir (4,310 feet msl) throughout the normal operating range of the project. Run-of-river operation would require Rugraw to release via the powerhouse and at the diversion dam (the minimum flow) a total flow equal to the inflow to the proposed project reservoir on a near-instantaneous basis (inflow equals outflow).

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[77] We have not specifically analyzed Rugraw's proposed periodic pulse flows, which would only be implemented if a minimum number of anadromous fish are documented in the project reach, but we include an analysis of habitat connectivity.

[78] As previously described, Rugraw proposes to discontinue project operation whenever the average daily stream temperature exceeds 20°C, measured within the project bypassed reach.

Although none of the commenting agencies discussed or recommended Rugraw's proposal for run-of-river operation, such operation would protect aquatic resources upstream and downstream of the project by maintaining a constant water level and aquatic habitat in the reservoir and natural flow fluctuations downstream of the powerhouse that closely represent the natural hydrograph in timing and magnitude. Changes in the amount of aquatic habitat downstream of the proposed powerhouse would occur because of natural flow fluctuations, and not hydropower operations. Rugraw's proposal to maintain the water surface elevation of the reservoir to within +/-0.5 inch, however, may be beyond the capabilities of currently available monitoring and flow regulation equipment. Maintaining that level of precision in a reservoir (even a small reservoir) would be difficult, where wind and waves may cause natural fluctuations in the water surface elevation that are more than 0.5 inch.

Rugraw developed its proposed 13-cfs minimum flow release in the bypassed reach using a rearing and spawning capacity model, a hydraulic geometry model, and a production potential model described in Cramer and Ceder (2013). Rugraw's carrying capacity model indicated that natural production of spring-run Chinook is unlikely to be sustainable in the project reach, as the velocities, depths, and areas of gravel are poorly suited for spring-run Chinook spawning, which typically peaks in September. Furthermore, the proposed project would typically not operate during the spring-run Chinook spawning period because of low streamflows, and consequently, it would have no effect on natural flows. Steelhead would encounter more favorable migration and spawning conditions in South Fork Battle Creek; however, their abundance would also be limited during the summer low flow period, unless juveniles are able to migrate downstream to more suitable spring-fed habitats. According to Cramer and Ceder (2013), flows of 30 to 50 cfs (and possibly less) would be sufficient to enable passage between all channel units within the bypassed reach. Based on our analysis, Rugraw's proposed 13-cfs minimum flow would reduce the percentage of time that 30 cfs or greater flows would be in the bypassed from March 1 through June 30 from 89 percent of the time (under natural conditions) to 25 percent of the time. From November 30 through February 28, Rugraw's proposed minimum flows would reduce the percentage of time that 30 cfs or greater flows would be in the bypassed reach from 48 percent of the time to 9 percent of the time. Consequently, Rugraw's proposed minimum flow would reduce but not eliminate habitat connectivity during the peak juvenile and adult steelhead migration periods.

Rugraw's production potential model used the existing habitat availability, carrying capacity, and life history information to estimate the maximum number of parr the bypassed reach could support, and the number of returns that would be expected under average conditions. The results of this modelling effort predicted a rearing capacity of 1,298 Chinook parr and 1,407 steelhead parr. In contrast, there is room for only one spring Chinook redd in the bypassed reach at the median flow during the peak spawning season for spring Chinook, and that one redd would produce an estimated 218 parr, far fewer fish than the habitat can support. Even if a wet water year could sustain

20 cfs through September and October, the Spring Chinook spawner capacity would increase to only 8 redds. In contrast, spawning capacity for steelhead is capable of producing 8,150 steelhead parr at 13 cfs and 18,908 parr at 31 cfs. Both parr estimates far exceed the steelhead rearing capacity of the reach, which was estimated to be 1,407 parr at 13 cfs and 3,190 parr at 31 cfs.

Although steelhead spawning capacity in the proposed bypassed reach would far exceed the rearing capacity, as noted above, natural flows during spring and fall would still occasionally exceed the project's turbine capacity, resulting in bypassed reach flows greater than 30 cfs. These peak flow events would likely maintain habitat connectivity and facilitate downstream movement of salmonids before the summer low flow period.

NMFS's and Interior's 35-cfs section 10(j) minimum flow recommendation, and NMFS's 35/30/25 cfs variable MIF alternative (NMFS Alternative 1) are based on results of FWS's 2016 physical habitat simulation (PHABSIM) analysis using bypassed reach data provided by Cramer Fish Sciences (Cramer Fish Sciences, personal communication, 2015, as cited in Interior, 2018) that predicted the usable habitat for steelhead and spring Chinook salmon juveniles and fry. The PHABSIM study found that a flow of 35 cfs, would provide suitable habitat for spring-run Chinook fry, spring-run Chinook juveniles, steelhead fry and steelhead juveniles equal to 97.3, 98.9, 100.0, and 89.9 percent, respectively, of the maximum possible habitat (as depicted by weighted usable area [WUA], an index of available habitat) for the two species and two of their life stages (table 3-8). The same study showed that the minimum flow of 13 cfs would provide habitat for spring-run Chinook fry and juveniles, and steelhead fry and juveniles equal to 32.2, 68.8, 50.4, and 82.8 percent, respectively, of the maximum possible WUA for the two species and two life stages. The recommended 35-cfs minimum flow regime would also likely maintain full habitat connectivity in the bypassed reach.[79]

Table 3-8. Percent of maximum WUA for each species and life stage at a range of recommended MIFs for the proposed bypassed reach of South Fork Battle Creek (Source: Interior, 2018).

Species/Life Stage	**Percent of Maximum WUA at Range of Minimum Instream Flows**					
	5 cfs	**10 cfs**	**13 cfs**	**35 cfs**	**30 cfs**	**25 cfs**
Chinook Juvenile	9.9	21.6	32.2	97.3	89.5	75.0
Chinook Fry	37.7	59.0	68.8	98.9	99.1	100.0
Steelhead Juvenile	18.6	38.6	50.4	100.0	96.0	84.4
Steelhead Fry	40.0	73.9	82.8	89.9	98.5	100.0

[79] According to Sellheim and Cramer (2013), "modest flows of 30 to 50 cfs (and possibly less) would be sufficient to enable passage between all channel units within the bypassed reach."

Under NMFS's 35/30/25 cfs minimum flow Alternative 1, a 30-cfs minimum flow (from March 2 to May 31) would provide 89.5 and 99.1 percent of maximum WUA for Chinook juvenile and fry rearing and would provide 96.0 and 98.5 percent of maximum WUA for steelhead juvenile and fry rearing. A 25-cfs minimum flow (from June 1 to October 31) would provide 84.4 and 100.0 percent of maximum WUA for steelhead juvenile and fry over summer rearing. It is assumed that juvenile Chinook would not be present in the project bypassed reach during the summer, as the vast majority of Central Valley spring-run Chinook out-migrate as fry from December through March (NMFS, 1999). NMFS did not provide any information as to how they developed their 35-cfs minimum flow alternative for steelhead and Chinook spawning, as spawning WUA was not evaluated in Interior's PHABSIM analysis.

Based on our analysis of the synthetic daily mean flow data for South Fork Battle Creek, NMFS's 35/30/25 cfs minimum flow alternative would have no effect on habitat connectivity (the percentage of time that 30 cfs or greater would be in the bypassed reach), compared to existing conditions from January 1 through May 31 and from November 1 through 31. However, it would reduce the percentage of time that 30 cfs or greater would be in the bypassed reach from June 1 through October 31 from 24 percent of the time (under existing conditions) to 4 percent of the time.

While Interior's PHABSIM analysis did not evaluate Rugraw's 8-cfs minimum flow alternative, their analysis did include WUA calculations for both 5 and 10 cfs (table 3-8). Extrapolating between the WUA available at 5 and 10 cfs, it can be seen that the amount of available habitat for Chinook and steelhead fry and juveniles at 8 cfs would be substantially less than that realized under the 13-cfs, 35-cfs, and 35/30/25-cfs minimum flow regimes (table 3-8). WUA would be reduced by a range about 30 to 51 percent for both species and life stages from a 13-cfs minimum flow, with an even greater reduction from the agency-recommended flows. While an 8-cfs minimum flow would increase the amount of time the project would operate during the spring and fall, it would subsequently reduce habitat connectivity for salmonids. This reduction in habitat connectivity would be the same as for the 13-cfs minimum flow (from 9 to 25 percent of the time depending on season).

At present, neither steelhead nor spring-run Chinook salmon are present in the proposed bypassed reach. Panther Grade at RM 18.9 and other natural and man-made barriers prevent these species from entering the project reach. While PHABSIM assessments are typically more robust than hydraulic geometry assessments, Interior's PHABSIM study used Chinook and steelhead WUA calculations to develop its flow recommendations. Although it can be reasoned that steelhead and resident rainbow trout (both of which are *O. mykiss*) have similar juvenile rearing habitat requirements, the agency's resulting section 10(j) minimum flow recommendation was based on an average of the combined maximum WUAs for both Chinook and steelhead. However, setting the minimum flow at 35 cfs (or at 35/30/25 cfs depending on season) to provide maximum habitat area for anadromous fish does not take into consideration other factors that limit the salmonid carrying capacity of the proposed bypassed reach. These limiting factors include naturally occurring summer low flows, high water temperatures, the availability of rearing habitat, and restricted habitat connectivity, all of which affect the distribution and abundance of aquatic biota in the proposed bypassed reach. In fact, under existing conditions, the natural flow regime within South Fork Battle Creek during the summer low flow period is not capable of supporting and maintaining the maximum WUA targeted by the agencies during most years.

Although passage at Panther Grade is questionable, if steelhead are detected in the project reach, Rugraw proposes to evaluate passage impediments upstream of the proposed powerhouse and, determine the flow at which the impediments are passable. If passage impediments are identified, Rugraw proposes to remove up to 4 of these barriers and modify project operation to provide 30 cfs in the bypassed reach for a period of 2 days, twice a month (4 days total per month) from February 1 to May 15 (the steelhead spawning period) to facilitate passage. Rugraw also proposes to survey and photograph potential passage impediments across a range of flows and estimate the flow necessary to provide upstream passage. Rugraw suggests that if appropriate, it would provide barrier modification for up to four locations where blasting or other methods may be employed to provide passage over a wider range of flows. While Rugraw's proposal to investigate and potentially remove barriers to upstream migration are reasonable, if anadromous species are introduced to the project reach, these measures are not warranted at this time, because anadromous species are not able to access the project reach because of downstream man-made and natural barriers.

Ramping Rates

Rapid changes in stream flow associated with hydroelectric project operation have the potential to adversely affect aquatic resources. If water recedes in a project-affected reach faster than what would occur naturally (from changes in generation, emergency shut-downs, etc.), adverse effects can include stranding fish in shallow, low gradient gravel bar areas and off-channel habitat; temporary loss of fish habitat or loss of habitat access; and the dewatering of amphibians, aquatic insects, and plant life (Hunter, 1992). Rapid changes in stream flow also can affect fish behavior leading to reduced spawning success (Bauersfeld, 1978). 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. 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; Olson, 1990).

With its response to agency preliminary conditions and recommendations, Rugraw amended its proposed ramping rate requirements to be consistent with California DFW and Water Board ramping rate recommendations of 0.1-foot/hour. Rugraw also indicates it would monitor stream stage for ramping purposes at a gage located at a narrow stream transect immediately downstream of the diversion point and fish ladder, or at another appropriate location.

Consistent with the Water Board's recommended ramping rate (preliminary condition 2), California DFW's 10(j) recommendation 2 would have Rugraw provide a controlled flow transition to avoid stranding, stressing, or displacement of native aquatic species. To accomplish this, the agencies recommend a 0.1-foot/hour (1.2-inch/hour) maximum ramping rate when returning the water conveyance facilities to service following forced or scheduled outages. California DFW also recommends scheduling planned maintenance requiring dewatering of the conveyance facility only during the period when the project is off-line during the summer months to minimize potential effects on fish that may be present in the affected stream reaches. Per California DFW's preliminary 10(j) recommendations, the Water Board also recommends ramping rates of 0.1 foot per hour.

In their preliminary 10(j) recommendation 1, NMFS and Interior recommend Rugraw ramp flow changes at a rate no greater than a 1-inch stage/hour, based on a gage located between Angel Falls and Spring #4.[80]

Our Analysis

Even though the proposed project would be operated in a run-of-river mode with infrequent ramping events, any rapid changes in streamflow associated with project start-ups or shut-downs could adversely affect aquatic resources in South Fork Battle Creek. For example, project start-ups could suddenly decrease the amount of water in the bypassed reach and strand fish and other aquatic biota. A rapid shut-down could also suddenly decrease the amount of flow immediately downstream of the powerhouse and rapidly increase the amount of flow in the bypassed reach. However, the project is designed to continue flow through the powerhouse by bypassing the flow from the turbine to the tailrace in the event of a rapid shut-down, resulting in little change in river stage below the diversion dam and the powerhouse. In a relatively small, snowmelt-driven system like upper South Fork Battle Creek, streamflows would typically increase above the proposed project's minimum flow in late fall and remain above that level until mid-summer. In late summer and fall, when the project would typically be shut down because of low flows, periodic rain events may increase the streamflow enough to support project operation for a limited number of days, resulting in additional up- and down-ramping events. However, these ramping events would be relatively infrequent, and there would be no ramping during planned maintenance activities because these would be scheduled to occur during the summer low-flow period when the project is off-line.

[80] We note that in its comments on the draft EIS, Interior also recommends a flow recession rate of less than 1 foot over 3 weeks or 1/3 foot per week to protect FYLF. We discuss these flow recession rates under *Effects on Special-status Wildlife Species* in section 3.3.3.2.

The proposed project's bypassed reach is relatively high gradient and confined (with few side channels, low gradient gravel bars, and other potential stranding areas). Numerous studies in California have shown that ramping rates in the 1 to 6 inches/hour range minimize any adverse effects on aquatic biota. For example, in 2004, PacifiCorp completed a literature-based assessment of the potential impacts 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/hour resulted in minimal stranding and were well within the natural range of those found in unregulated river systems (PacifiCorp, 2004). PG&E also recently implemented a 6-inch/hour or less ramping rate at the Spring Gap-Stanislaus Hydroelectric Project to avoid stranding or displacement of fish and other aquatic species. Both ramping rate restrictions recommended by resource agencies (0.1-foot/hour and 1-inch/hour) are conservative and, if implemented correctly, would likely eliminate any sudden changes in flow in the bypassed reach and reduce the potential for stranding in the high gradient and confined channel of South Fork Battle Creek. However, we note that California DFW's 0.1-foot/hour restriction is slightly less conservative than the 1-inch/hour recommendation of NMFS and Interior and would therefore be slightly less protective.

Fish Habitat Assessment Plan

Maintaining or enhancing fish populations and other aquatic biota in rivers and streams requires adequate streamflow (i.e., water depth, water velocity, and habitat space); access to sufficient spawning habitat; complex rearing habitat; appropriate food sources at different life stages; and suitable water temperatures, and other water quality parameters (Bjornn and Reiser, 1991). As discussed above in *Effects of Flow Regulation on Aquatic Habitat*, any license issued for the proposed project would likely include a number of habitat measures, such as modified instream flows that would change existing aquatic habitat conditions in South Fork Battle Creek. These altered aquatic habitat conditions could affect the distribution and abundance of resident rainbow trout (the only salmonid currently known to be present in the proposed bypassed reach) and BMI, and may also eventually affect the distribution of anadromous Chinook salmon and steelhead (if they are eventually provided access to the proposed bypassed reach).

To monitor the effects of the proposed project on aquatic habitat, the Water Board recommends Rugraw develop a fish habitat assessment plan (preliminary condition 12). The fish habitat assessment plan would be prepared in consultation with Water Board staff and other relevant resource agencies and include monitoring of habitat features (such as water temperature, stream depth, flow velocities, water quality, sediment transport, etc.) associated with resident and anadromous fish populations potentially found within the project area. Water Board preliminary condition 12 specifies that, if anadromous fish are observed within the project area at any time and the fish habitat assessment plan does not include provisions to address habitat features that pertain specifically to anadromous species, Rugraw would revise the plan to include provisions to expand the habitat monitoring to include anadromous fish habitat; and measures to facilitate anadromous fish passage through the bypassed reach.

Our Analysis

Under current conditions, high water temperatures, the availability of low flow rearing habitat, and restricted habitat connectivity are the primary limiting factors affecting the distribution and abundance of aquatic biota in the proposed bypassed reach. Construction and operation of the proposed project would alter the existing flow, water temperature, water quality, and sediment transport characteristics within the bypassed reach, which in turn could affect the distribution and abundance of resident rainbow trout and potentially Chinook salmon and steelhead, if introduced to the reach. Although long-term monitoring of aquatic habitat conditions in the project's proposed bypassed reach, as recommended by the Water Board, could allow Rugraw and the resource agencies to evaluate any changes in aquatic habitat over time, general monitoring of fish habitat would not necessarily isolate any project-specific effects on the resource. Consequently, fish habitat monitoring data would provide little information to inform an evaluation of project-specific effects.

BMI Monitoring Plan

BMI are a good indicator of the biological health of streams and are a critical component of the food web in aquatic communities.[81] Their distribution and relative abundance are affected by a variety of naturally occurring and human-induced factors, including the annual hydrologic cycle, the timing and magnitude of spring outflows, streambed substrate composition, channel gradient, bank erosion and sediment deposition, pollution, riparian habitat degradation, instream-mining, and recreation. Taxa that are especially sensitive to disturbance are considered intolerant and are typically found in streams and rivers of good water quality. Other taxa are tolerant of disturbance, heavy sedimentation and poor water quality. Many of the tolerant taxa are the first to reestablish an area after a scouring event or habitat disruption.

Rugraw does not propose any measures to monitor BMI in the project-affected reach of South Fork Battle Creek. However, in its response to agency preliminary conditions and recommendations, Rugraw agreed to conduct a baseline BMI survey in the proposed bypassed reach.

In their preliminary 10(j) recommendation 5, NMFS and Interior recommend Rugraw develop and file with the Commission, after consultation with the resource agencies, a BMI monitoring plan (benthic plan) describing the sampling to be conducted in the project-affected bypassed reach to assess the effects of the new flow regime and other changes stipulated by the new license on the macroinvertebrate community. Surveys would be conducted at least 1 year prior to construction and in years 1 through 4

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[81] BMI refers to benthic macroinvertebrates that are insects and other visible invertebrates in and on the streambed.

and every 4 years thereafter through the term of the license (unless an alternative monitoring schedule is approved in consultation with the resource agencies). Interior further stipulates that if BMI total biomass, taxa richness, or Ephemeroptera, Plecoptera, and Trichoptera index[82] decreases by more than 50 percent following construction of the project, Rugraw would prepare a riparian restoration plan targeted at increasing BMI production. NMFS recommends that if the resource agencies determine, based upon the results of BMI monitoring, that the project is having unmitigated impacts on BMIs, Rugraw should include in the technical report, its recommendations for mitigating impacts on BMI.

Our Analysis

BMI have several characteristics that make them potentially useful indicators of water quality and overall stream health. They are relatively non-mobile, and thus well suited for assessing site-specific effects. They are also abundant in most streams, and sampling is relatively easy and inexpensive. Finally, the sensitivity of aquatic insects to habitat changes makes them excellent indicators of overall environmental quality. Disadvantages of monitoring BMI include a high degree of natural variability within or between sample sites, sample seasons, and sample years. In 2001 and 2002, Terraqua Inc. and Kvam Aquatic Sciences (2003) found that macroinvertebrates were mostly healthy throughout the Battle Creek watershed. In South Fork Battle Creek, general taxa richness was found to be mostly in the "good" to no impact condition ranges, indicating, during the sampling period, that this stretch of the stream had a healthy macroinvertebrate community.

As noted above, any license issued for the Lassen Lodge Project would likely alter aquatic habitat conditions in South Fork Battle Creek. However, it is anticipated that Rugraw's proposed mitigation measures including run-of-river operation, minimum flows, ramping rates, BMPs during construction, and sediment and woody debris passage at the dam, would adequately protect aquatic habitat and BMI in the project-affected reach. Although continued sampling of BMI, as recommended by resource agencies, would enable trends to be evaluated over time, general monitoring of BMI would not necessarily isolate any project-specific effects on the resource. Consequently, BMI monitoring would provide little information to inform an evaluation of project-specific effects.

Salmonid Monitoring Plan

Reduced flows in the proposed project's bypassed reach, even with mitigation provided by the recommended minimum flow requirement, could result in some loss of

[82] The EPT index is named for three orders of aquatic insects that are common in the BMI community: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). The EPT index is based on the premise that high-quality streams usually have the greatest species richness.

available habitat for resident (and potentially anadromous) fish populations, including ESA-listed steelhead and spring-run Chinook salmon.

Rugraw proposes to develop a salmonid monitoring plan (SMP) with two monitoring approaches: (1) genetic sampling for steelhead and (2) snorkel surveys for steelhead and spring-run Chinook salmon. If adult steelhead are passed above the downstream dams, Rugraw proposes to monitor the 1.7-mile-long reach above Panther Grade up to the proposed project powerhouse to assess steelhead spawning success. If steelhead spawning is documented above Panther Grade, Rugraw would then conduct genetic sampling to determine the success of steelhead spawning upstream of Panther Grade and subsequently evaluate impediments to steelhead passage through the proposed bypassed reach. If steelhead are able to surmount Panther Grade and successfully spawn in 2 of 3 years (1 year space of absence), and impediments to upstream passage occur in the bypassed reach between the project's tailrace and the base of Angel Falls, Rugraw proposes to modify project operations that may improve accessibility and subsequently production of steelhead within the bypassed reach. However, if successful steelhead spawning is detected at a frequency of less than 2 out of 3 years, Rugraw asserts that this would indicate that steelhead access to the project area is opportunistic and not sufficient to sustain a population, and therefore, no action to improve steelhead production in the bypassed reach would be taken. Rugraw's proposed genetic surveys would cease after 4 consecutive years if no steelhead are observed in the reach.

Rugraw's proposed snorkel surveys would occur within the bypassed reach (when safe), and within a month of each 400 cfs + flow event for the duration of the license. The snorkel surveys would be exclusively for the identification of presence or absence of anadromous fish. Rugraw proposes to notify the resource agencies when/if anadromous species are found within the bypassed reach.[83] If anadromy is established within the bypassed reach at a later date (based on the results of these snorkel surveys and/or steelhead genetic testing), Rugraw proposes to develop an adaptive management plan, in consultation with resource agencies, to mutually determine if modifications to project operation could improve production of anadromous species within the bypassed reach.

Interior and NMFS recommend (10(j) recommendation 4) that Rugraw's proposed SMP include provisions to monitor the presence of all life stages of both anadromous and resident salmonids within the bypassed reach, and provide for quarterly snorkel surveys (seasonally), through the term of license, within the entire bypassed reach. The agencies specify that the design and execution of the SMP would, in consultation with the resource agencies, use standard fisheries sampling techniques (Kohler and Hubert, 1999). Rugraw would inform resource agencies if either steelhead/rainbow trout and/or Chinook salmon are present within the reach as soon as possible, via email or telephone.

[83] Adult salmon and steelhead must pass Coleman, Inskip, and South Diversion dams to reach the project area, and the fishway at Inskip is to be equipped with video counting equipment operated by California DFW or Interior.

The Water Board recommends that Rugraw develop, in consultation with the Water Board and other relevant resource agencies, a fish population monitoring plan, with provisions for monitoring all fish species within and downstream of the project area (preliminary condition 11). Consistent with Rugraw's proposal, the Water Board recommends that any observation of ESA- or California Endangered Species Act- (CESA-) listed species trigger a review of the need for additional measures to manage the population; any such measures would be developed in consultation with relevant resource agencies.

Our Analysis

In rivers and streams, resident and anadromous salmonids require adequate streamflow (i.e., water depth, water velocity, and habitat space); sufficient spawning habitat (spawning gravel); sufficient rearing habitat; appropriate food sources at different life stages; and proper environmental conditions (particularly water temperature, DO, and turbidity) (Bjornn and Reiser, 1991). As discussed above, any license for the proposed Lassen Lodge Project would likely include a number of measures that would change aquatic habitat conditions in the bypassed reach of South Fork Battle Creek. As is the case for BMI, these altered habitat conditions could affect the distribution and abundance of resident rainbow trout, and potentially ESA-listed steelhead and spring-run Chinook salmon, should they gain access to the reach. Monitoring, if conducted, is typically based on the presence or absence of particular species, numbers of particular species, or on community parameters (such as productivity, density, and diversity), and is usually conducted over multiple years.

Long-term monitoring within the proposed bypassed reach could help Rugraw to adaptively manage the project's operations to protect and enhance salmonid resources (if project operations affect those resources) and assist fishery agencies in managing the fishery (a non-project function). Although seasonal monitoring, as NMFS recommends, would allow for the seasonal observation of steelhead and/or Chinook salmon, as well as other species present in the bypassed reach, it is not known if Panther Grade is a complete barrier to upstream fish migration. Even after passage is provided at Coleman, Inskip, and South Diversion dams, information included in the *Coleman National Fish Hatchery Adaptive Management Plan* (Hymanson et al., 2016), estimates Chinook and steelhead passage success over "Unnamed #10" at RM 13.26 is 50 percent and estimated passage success over Panther Grade ("Panther Falls") is 20 percent. If we multiply 50 percent (0.5) by 20 percent (0.2), that results in a cumulative passage success over Panther Grade of only 10 percent, which is another indication that few fish, if any, would ever make it to the project area. In addition, under current conditions, anadromous Chinook salmon and steelhead are unable to pass upstream of the downstream Coleman, Inskip, and South Diversion dams. Therefore, Rugraw's proposal to conduct steelhead genetic sampling and snorkel surveys upstream of Panther Grade to the base of Angel Falls for anadromous salmonids is appropriate only after adequate high flows are available to support potential passage at Panther Grade. These natural flow conditions, however, would be unrelated to project operations.

Although Rugraw's proposal to conduct genetic sampling for steelhead and snorkel surveys could provide information on the distribution of resident and anadromous salmonids in the bypassed reach, this distribution would be unrelated to project operations (it would depend on successful fish passage at downstream dams and over Panther Grade, for the anadromous species), and there appears to be no project-related basis for requiring such monitoring as a condition of any license issued. If anadromous species eventually gain access to the project reach as a result of the BCSSRP, Rugraw and the resource agencies could, at that time, develop an appropriate monitoring program to determine the distribution of salmonids within the project bypassed reach. For resident salmonids, mitigation measures already proposed by Rugraw should adequately protect the limited fish population within the bypassed reach. While regular monitoring of resident trout populations would enable trends to be evaluated over time, monitoring results would not necessarily isolate any project-specific effects on the resource. Consequently, monitoring resident fish populations would provide little information to inform an evaluation of project-specific effects.

Fish Passage

Physical barriers to fish migration can include natural structures such as waterfalls, cascades, and debris dams, and artificial barriers such as dams, diversions, and improperly placed culverts.

Project intakes also have the potential to entrain fish residing upstream of any project-related diversion structure. Fish that become entrained into a project intake and turbine would be removed from the local population and could be killed or injured. Small fish, especially newly emerged fry, have the greatest potential for entrainment because fry have poor swimming ability, whereas adult salmonids have a much greater swimming ability and generally can avoid entrainment, unless fish desire to migrate downstream.

Rugraw proposes to construct an upstream fish passageway and a control/fish screen structure at the project diversion works to ensure fish are able pass the diversion dam (both upstream and downstream) when the power plant is operating or shut down. Both structures would be designed in coordination with California DFW incorporating NMFS Southwest Region Fish Screening Criteria for Anadromous Salmonids and NMFS Northwest Region Anadromous Salmonid Passage Facility Design. The control/fish screen structure would include nine 4-foot by 8-foot stainless steel perforated flat panel screens and a juvenile fish return pipe to return any fish entering the fish/screen control structure into South Fork Battle Creek near the bottom of the proposed fish passageway (see below). The fish screens would be automatically cleaned by a travelling screen cleaner as frequently as necessary to prevent flow impedance and violation of the approach velocity criteria.

Rugraw's proposed upstream fish passageway would be designed post-license issuance in consultation with California DFW following recommended fish ladder design standards. In addition, Rugraw would use temporary diversion culverts, or phased construction, to allow fish to egress the affected area during the construction of the diversion dam, intake, and control/fish screen structures.

Our Analysis

Under existing conditions, the proposed project's bypassed reach supports a population of resident rainbow trout.[84] No anadromous fish are expected to be present in the project area until passage barriers on lower South Fork Battle Creek are removed through the BCSSRP (which is scheduled for completion by 2021 to 2023), although Angel Falls, located at RM 22.3 about 0.7 mile downstream of the diversion dam site, would remain a long-standing natural barrier to upstream migration at all flows. Thus, the only fish that would currently benefit from upstream passage at the diversion dam would be rainbow trout that reside in the 0.7 mile of stream between Angel Falls and the diversion dam. As we previously described, reseeding of the stream with trout occurs naturally from upstream and does not depend on the ability of trout downstream to migrate upstream over passage barriers. Should anadromous salmonids gain access to the bypassed reach in the future, they would not require passage at the diversion dam because the impassable Angel Falls would prevent fish from reaching the dam. Any upstream passage facility at the dam would likely only be used by a limited number of resident fish that would not require upstream passage to complete their life history. In addition, the project's three 8-foot wide pneumatic gates would be lowered (deflated) when the project is not operating. In the lowered position, resident rainbow trout would likely be able to volitionally migrate upstream past the diversion dam.

Rugraw's proposed fish screen structure at the project diversion dam would prevent all life stages of fish moving downstream from entering the pipeline and penstock and experiencing injury and mortality during turbine passage. Because a Pelton turbine is proposed, any fish entering the turbine would likely experience nearly 100 percent mortality. The fish screen would be in operation whenever flows are being diverted for power generation. An estimate of when the project could operate (based on natural inflows) is presented in table 3-6. This estimate shows that there would be sufficient inflow for the project to operate under a 13-cfs instream flow[85] the majority of time (greater than 50 percent of the time) from January 1 through mid-April, and June 1 to mid-July; infrequently (10 to 49 percent of the time) from mid-April through May, mid-July through August, and mid-October through December; and rarely (less than 10 percent of the time) during September to mid-October (table 3-6). Therefore, the project would likely be operating in the spring spawning period for rainbow trout and during the

[84] In some years, low flows and high water temperatures can lead to a severe reduction in rainbow trout abundance in the proposed bypassed reach, as observed during summer 2014.

[85] This evaluation does not consider any project shut-downs to meet temperature criteria.

early-summer when fry are hatching and juveniles are rearing, as well as other periods of the year when adult fish would be present. The screens would be beneficial in preventing entrainment of several life stages of rainbow trout, particularly in a system where recruitment primarily occurs from upstream.

Sediment and Woody Debris Management

Regulated flows may alter three key components of habitat for aquatic resources: (1) the characteristics and distribution of substrate material in streams, (2) the availability of woody debris in downstream reaches, and (3) turbidity in the bypassed reach. Woody debris can provide enhanced habitat for fish and other aquatic organisms, and project operation could affect the quantity and quality of aquatic habitat in the proposed project area by altering the existing availability and dispersal of woody debris. In its letter filed August 31, 2016, Rugraw proposes to re-introduce small and large woody material retained in project facilities to be re-deposited downstream of the diversion structure as recommended by NMFS (10(j) recommendation 6). Rugraw also proposes to annually sluice sediments from the project's reservoir during annual high flows, which are defined as flows of 400 cfs or greater at the diversion site. Rugraw states that in a year when natural flows never reach 400 cfs, the sediment deposits in the reservoir behind the diversion would be evaluated to determine if sluicing of sediments would be desired. In such cases when sluicing is desired, the sluicing could be scheduled by the operator at flows less than 400 cfs. Sluicing could take place during project operations when streamflows exceed 108 cfs (MIF of 13 cfs plus maximum penstock diversion to powerhouse of 95 cfs) by opening the bottom of the sluice gates on either side of the diversion to bypass flow greater than 108 cfs.[86]

In its letter filed June 21, 2016, NMFS recommends (10(j) recommendation 6) that, through consultation with NMFS, Interior, California DFW, and the Water Board, Rugraw develop a DSMP that describes the operations and actions that would ensure the periodic downstream transport of small and large woody material and sediment past the project's dam. NMFS also recommends that the DSMP detail the monitoring of sediment retention upstream of the sluice gates, the debris and sediment distribution downstream of the proposed dam, and assess the riparian habitat's response to the project's operations. In its letter filed June 24, 2016, Interior also recommends such a DSMP (10(j) recommendation 6). Both agencies recommend monitoring of: (1) reach-wide parameters (e.g., total length and gradient, average width and depth; (2) wetted width of each riffle; (3) water velocity; (4) relative substrate composition (i.e., fines, gravel, cobble, boulder, and bedrock); (5) a pebble count; and (6) substrate consolidation and percent embeddedness. Rugraw, in its March 31, 2017, response to the Commission's

[86] Rugraw's March 31, 2017, letter responding to our February 24, 2017, additional information request indicates the project would have a maximum penstock diversion to the powerhouse of 95 cfs; however, we note that Rugraw's final license application indicates that the maximum hydraulic capacity of the turbine is 105 cfs.

additional information request, proposes to prepare a DSMP, but it would not include downstream monitoring.

In its comments on the draft EIS, the Water Board comments that sediment sluicing would have a direct effect on water quality in the bypassed reach and specifies a need to monitor the duration that the bypassed reach would have elevated turbidity, especially when sluicing at flows less than 400 cfs; and clarified that its recommended water quality monitoring plan (preliminary condition 6) is intended to include periods of operation and maintenance. The Water Board recommends development of a DSMP (in consultation with the resource agencies) that outlines monitoring methods, timing and duration of monitoring, a metric to determine the level of significance of impacts, and adaptive management triggers and actions. In addition, the Water Board recommends requiring the licensee to consult with the Water Board and California DFW in years that flows remain less than 400 cfs and monitor the impacts of sluicing on sediment transport and turbidity in the bypassed reach.

Our Analysis

Rugraw's proposal to annually sluice sediment from the project's reservoir during high flows and to potentially sluice sediment during lower flows (less than 400 cfs) would help to maintain sediment supply to the bypassed reach and would also help manage aggradation above the dam and thereby reduce the potential for clogging project facilities. Maintaining sediment supply in the bypassed reach through annual sluicing would provide gravel necessary for trout and other resident fish spawning, as well as maintain habitat diversity. However, while the proposed sluicing at higher flows would limit the effects of the sluicing event on water quality and turbidity, sluicing at lower flows may be detrimental to water quality, particularly turbidity downstream of the project's diversion.

NMFS and Interior both recommend the periodic downstream transport of small and large woody material as part of their recommended DSMP (10(j) recommendation 6). Although woody debris is nearly absent in the bypassed reach under existing conditions (Sellheim and Cramer, 2013), a provision to transport any available woody debris downstream would provide an opportunity to reduce the proposed project's potential to intercept woody debris and thereby reduce operational effects on aquatic habitat. Both large and small woody debris can offer hydraulic and thermal refuges, nest building material, protection from predation, nutrients, and maintain habitat diversity.

In the March 15, 2018, 10(j) meeting, FWS expressed concern that cutting logs to make it easier to allow them to pass downstream of the dam could result in the wood not being retained in the bypassed reach and thereby negatively affect BMI and fish habitat.[87] FWS stated a preference for not reducing the size of large woody material, and we agree that large woody material tends to be more stable and provide greater benefits at lengths

[87] A transcript of the meeting was filed to the record on March 15, 2018.

that exceed the channel width. A standard rule is that large woody material length should be approximately two times the width of the channel. Rugraw noted that it plans to pass large woody material by lowering the three 8-foot wide pneumatic gates. If woody material arrives at the dam that is too large to pass downstream in this manner, Rugraw could consult with FWS and California DFW to identify a safe method to handle the associated material.

Flushing sediments from the dam's impoundment may not be 100 percent effective and could result in accumulation of sediments in the impoundment. Revising the DSMP to include a monitoring plan developed in consultation with NMFS, FWS, the Water Board, and California DFW would provide a way to determine the effectiveness of flushing sediment and woody material out of the impoundment and determine any need for adapting the program to be more effective. A conceptual approach for accomplishing this goal would be to establish one to three cross-sections in the area to be impounded prior to filling the impoundment, and then monitor these cross-sections about three times in the first decade of project operation to determine whether long-term accumulation of sediment and/or woody material is occurring in the impoundment. Evidence of long-term aggradation could then be used to trigger a modification of the DSMP to more effectively route sediments through the impoundment.

Turbidity levels exceeding the Basin Plan water quality objectives could occur during and immediately following Rugraw's proposed flushing of sediments out of the impoundment, especially at flows of less than 400 cfs. Although the probability of the project causing a plume of turbid water is low for typical operation, sluicing sediment could result in a turbidity plume. Monitoring turbidity upstream and downstream of the impoundment would document whether the project causes turbidity to exceed the Basin Plan objectives. Evaluation of these results and consultation with the Water Board would provide insight into whether the DSMP should be revised to reduce negative effects on turbidity and potentially fish in the bypassed reach.

Proposed sediment sluicing and passage of woody debris over the proposed small diversion dam likely would be successful. It is unlikely that the proposed 8-foot-high dam would substantially affect sediment and woody debris movement in South Fork Battle Creek, particularly with proposed operational measures. There would be no basis for requiring the detailed monitoring program recommended by the agencies to verify the probable minor effects of the proposed project on sediment and woody debris movement in the bypassed reach.

Pesticide Use Plan

Rugraw would likely use pesticides to control pests near project buildings, roads, and other physical structures as a component of its project facilities maintenance program. Using pesticides to maintain project facilities presents a risk of contaminating surface waters in the project area. Contamination of project-area waters could affect aquatic biota including federally listed species. To protect aquatic habitats and ESA- and CESA-listed species, the Water Board recommends Rugraw develop a pesticide use plan (preliminary condition 9) with provisions to restrict use of pesticides as defined by the Basin Plan, and in the case of a pesticide spill, notify relevant resource agencies as soon as practical and suspend all pesticide-related activities.

Our Analysis

The development of a project-specific pesticide use plan as recommended by the Water Board would provide a comprehensive description of Rugraw's standard operating procedures for pesticide use and application at the project, measures to protect water quality, and any other measures needed to protect ESA- or CESA-listed species, found downstream of pesticide application areas. It would also allow quick notification of appropriate agencies that manage relevant resources if a pesticide spill occurs, which would facilitate Rugraw's evaluation of the spill and its effects in a timely manner. However, California's Department of Pesticide Regulation[88] and the Tehama County Agricultural Commissioner[89] regulate pesticide use, not the Commission. Rugraw's compliance with state and local regulations would adequately protect the water quality of surface and ground waters, endangered species, and other wildlife.

Aquatic Nuisance Species

To address the potential infestation and/or spread of invasive aquatic plant or animal species in the proposed project area, the Water Board recommends (preliminary condition 8) Rugraw develop an aquatic invasive species monitoring plan in consultation with relevant resource agencies. The plan would identify potential sources related to or conditions associated with the proposed project that have the potential to transport or spread aquatic non-native invasive species on material and equipment; identify BMPs to reduce and/or minimize the transportation or spread of aquatic non-native invasive species; and include monitoring and corrective action steps to address potential spread of invasive species.

Our Analysis

Aquatic nuisance species are nonnative aquatic plant or animal species that threaten the diversity or abundance of native species, the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependent on such waters. Once nonnative species become established in a new environment where natural predators, pests, or disease that kept them in check in their native environment are missing, they may spread rapidly and cause unanticipated negative biological and

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[88] The Department of Pesticide Regulation is required by law to protect the environment from harmful pesticides by prohibiting, regulating, or controlling uses of these pesticides (California Department of Pesticide Regulation, 2018).

[89] The Tehama County Agricultural Commissioner enforces regulations to protect ground and surface water and endangered species and other wildlife from pesticide contamination (Tehama County, 2018).

economic impacts. The longer infestations are allowed to progress, the more extensive the damage and control costs, and less efficient the control efforts. However, if populations are detected early enough, eradication may still be possible. Though prevention is the best strategy for managing invasive species, “early detection and rapid response” efforts are the most effective and cost-efficient responses to invasive species that become introduced and established. Two of the most well-known aquatic invasive species are zebra and quagga mussels. Zebra and quagga mussels have caused billions of dollars in economic and ecological damage to the Great Lakes and have spread throughout North America. Quagga mussels are present in Lake Mead (Nevada and Arizona) and Lake Havasu, California. Eurasian watermilfoil, a non-native aquatic macrophyte, is also abundant throughout the western United States. Eurasian watermilfoil spreads quickly and can adversely impact aquatic ecosystems by forming dense canopies that often shade out native vegetation. Monospecific stands of Eurasian watermilfoil adversely affect aquatic habitat and water quality, can impact power generation and irrigation, and can interfere with recreational activities.

Although Rugraw did not conduct aquatic nuisance species surveys in the proposed project area, aquatic nuisance species are abundant in California and may be introduced into the proposed project’s small impoundment or bypassed reach where they could cause impairments of project function, as well as impacts on the environment. Such introductions could occur during contracted project construction and maintenance or through small-scale recreation activities in the basin. Developing an aquatic invasive species management plan, in consultation with the Water Board, could incorporate several measures to help prevent the introduction and/or spread of aquatic nuisance species into the proposed project area, including construction BMPs, to prevent the spread of aquatic nuisance species; a monitoring program to serve as an early warning system in case of the spread of invasive species; guidelines for project operation and maintenance to prevent the spread of aquatic invasive species; and control measures for dealing with the presence and movement of aquatic invasive species (e.g., bullfrog) at or near project facilities. Coupled with annual reporting, these measures would adequately monitor and help prevent the introduction or spread of aquatic invasive species within the proposed project area.

3.3.2.3 Cumulative Effects

Water Quality and Temperature

Historically, South Fork Battle Creek generally had excellent water quality that was highly influenced by inflow from cool-water springs. However, two recent events (flume failure and a large forest fire) elevated turbidity in the lower South Fork Battle Creek. On December 3, 2014, collapse of a section of the South Dam Canal flume in Devil’s Gulch, located approximately 7.5 miles downstream of the proposed powerhouse resulted in an episodic torrent of water and a large amount of sediment entering the creek (FWS, 2015). Lightning started the August 2012 Ponderosa Fire that burned approximately 28,000 acres southeast of Manton, which was then salvage logged. FWS reports that lower South Fork Battle Creek has received a large influx of sediment presumably from the Ponderosa Fire and that the turbidity response to flow increased substantially in Battle Creek at RM 6.1 (FWS, 2015). The maximum turbidity during juvenile migrant fish trap sampling conducted by FWS since September 1998 was 35 nephelometric turbidity units (NTU) for years before the Ponderosa Fire and 832 NTU after the fire, and the ratio of turbidity to flow[90] increased from less than 1 NTU/cfs for the period of 1998 to 2013, to 5 NTU/cfs in 2015. Turbidity is expected to decrease as these areas recover and plant cover increases.

The BCSSRP is an ongoing phased restoration program being implemented to restore salmon and steelhead populations in the Battle Creek Basin. Phase 1B, which consists of reconstructing the Inskip Powerhouse tailrace and constructing a bypass pipeline and chute system to Coleman Canal, was conducted between 2012 and 2017 (Battle Creek Salmon and Steelhead Restoration Project, 2017). Phase 2, which consists of installing a fish screen and ladder on Inskip Diversion Dam; constructing a South Powerhouse tailrace connector; removing South Diversion Dam and conveyance system; and removing Lower Ripley Creek Feeder, Soap Creek Feeder, and Coleman Diversion Dams, is scheduled for 2017–2023. Construction for this program is expected to result in short-term localized increases in turbidity. As described above, constructing the proposed Lassen Lodge Project could increase turbidity during construction, although these effects are expected to be short-term and localized near construction sites that are distant from the Phase 2 restoration activities. The project's sediment sluicing may also increase turbidity above natural levels, although attenuation is expected to substantially reduce any elevated turbidities prior to water reaching the lower end of the proposed bypassed reach. Adapting project operations in response to any exceedance of the Basin Plan's turbidity objectives is also expected to reduce any negative effect of the project on turbidity. Therefore, construction of the Lassen Lodge Project would not have adverse cumulative effects on turbidity within the Battle Creek Basin, combined with other distant potential turbidity sources in the basin.

Under existing conditions, water temperature in South Fork Battle Creek may be affected by several factors including natural inflow from springs, hyporheic connections, weather, solar radiation, vegetative shading, and topographic shading; and controllable streamflow and releases from cold springs that are currently intercepted by PG&E's Battle Creek Project (FERC No. 1121). Peak summer water temperature exceeds 20°C (up to 26° to 28°C in 2015) in the upper end of the proposed bypassed reach during some years, but springs in the lower end of the proposed bypassed reach and near Panther Grade reduce summer water temperature substantially. Farther downstream, PG&E's

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[90] The ratio of turbidity to flow was used to normalize differences in rainfall and discharge between years.

Battle Creek Project has historically warmed the creek substantially, especially from March through October (Reclamation et al., 2004).[91]

The ongoing BCSSRP will also manage water temperature in the lower South Fork Battle Creek by increasing instream flows and releasing cold spring water to the natural stream channel using an adaptive approach based on temperature in the Battle Creek Project reaches (Reclamation et al., 2004; Jones & Stokes, 2005).

Rugraw's modeling studies indicated that project operation would not have a substantial effect on water temperatures in the bypassed reach, although operation could result in some cooling in the reach under some conditions. In addition, if project operation results in warmer water temperatures, Rugraw is proposing to shut down project operations when bypassed reach water temperatures exceed 20°C to protect salmonid habitat. Therefore, operation of the project would have negligible, adverse cumulative effects on water temperature in South Fork Battle Creek or lower Battle Creek.

Fishery Resources

Under existing conditions, the proposed project's bypassed reach supports an at-risk population of resident rainbow trout that has been adversely affected by drought and high water temperatures in some years. The diversion of water associated with the proposed project would alter the natural hydrology, geomorphology, and water quality in the bypassed reach downstream of the diversion dam, which in turn would affect the quality and quantity of aquatic habitat for resident trout and possibly anadromous fish if they are able to access the reach in the future. In addition to these project-related effects, non-project related timber harvest activities on SPI land, hatchery operations, rural development, forest fire management, ongoing fishery restoration programs associated with the BCSSRP, barrier removals associated with PG&E's Battle Creek Project license implementation, and other measures will continue to affect aquatic habitat and fish community structure in South Fork Battle Creek. Upon completion of the BCSSRP restoration measures, steelhead and winter- and spring-run Chinook salmon, species listed under the ESA, are expected to increase in abundance in South Fork Battle Creek, but it is not known if they will ever enter the proposed project area. While the amount of available aquatic habitat in the project area is very limited under existing conditions, it is anticipated that implementation of Rugraw's proposed MIF release, ramping rate requirements, large woody material and sediment mitigation measures, and construction-related BMPs would adequately protect this habitat from additional degradation. Consequently, the proposed project would have a negligible cumulative effect on fishery resources in South Fork Battle Creek.

[91] PG&E's Battle Creek Project starts approximately 6.5 miles downstream of the proposed Lassen Lodge powerhouse.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

Rugraw surveyed vegetation and other terrestrial resources within a 400-foot-wide corridor centered on the project alignment and within the multipurpose areas outside of the 400-foot-wide survey corridor in May, June, and September 2013.[92] Vegetation types within upland portions of the project area consist primarily of grasslands, chaparral, and forested communities.

Annual grassland communities (grasslands dominated by species that reseed every year) occur mostly in the western portion of the project area. This vegetation community is dominated by non-native annual grasses and forbs, many of which are classified as noxious weeds.

Chaparral communities occur in patches throughout the western and central portions of the project area. Chaparral vegetation types found in the project area include mixed chaparral, montane chaparral, and masticated woodland communities.

Forested communities within the project area consist primarily of Sierran mixed conifer forest, montane hardwood, blue oak woodland, and ponderosa pine communities and plantations. Sierran mixed conifer forest is the most common forested community type in the project area. The species composition and density of this vegetation type varies within the project area and has been affected by past and ongoing logging activities, fires, and other disturbances. Montane hardwood is the second most common forested community type in the project area. Montane hardwood communities are found scattered throughout the project area, with the exception of the eastern edge. Blue oak woodland communities occur in scattered patches in the western portion of the project area, with the largest stands in the northwestern corner of the project area. Ponderosa pine vegetation communities are found in scattered patches throughout the entire project area, including four small plantations. Table 3-9 shows the vegetation communities/ habitat types and their approximate area estimated during the 2013 field surveys.

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[92] This survey area included the original transmission line alternative along Manton School Road and did not include the Powerhouse Road alternative.

Table 3-9. Vegetation communities/habitats within the proposed project lands (Source: Rugraw, 2015).

Vegetation Communities	**Acres**
Annual Grassland	64.81
Agricultural	4.36
Irrigated Hayfield	*3.88*
Old Orchard	*0.48*
Blue Oak Woodland Communities	67.21
Blue Oak-Foothill Pine-Interior Live Oak	*37.11*
Blue Oak Woodland	*30.10*
Chaparral	86.78
Masticated Woodland	*6.60*
Mixed Chaparral	*17.23*
Montane Chaparral	*62.95*
Disturbed/Developed	17.19
Disturbed	*6.00*
Himalayan Blackberry (Rubus armeniacus)	*2.08*
Residential-Developed	*2.12*
Road	*6.99*
Montane Hardwood Communities	92.43
Montane Hardwood	*23.55*
Montane Hardwood-Conifer	*68.88*
Ponderosa Pine and Plantation	41.05
Plantation	*24.25*
Ponderosa Pine	*16.80*
Riparian and Wetland	7.29
Riparian	*3.45*
Riverine-Montane Riparian	*3.77*
Wetland	*0.07*
Rock	4.40
Sierran Mixed Conifer	340.36
Total	**725.88**

Wetlands

Rugraw assessed wetlands with the project area using the FWS National Wetlands Inventory online map source and verified the results with field surveys in May, June, and September 2013.

The project area only contains one wetland, which covers about 0.7 acre. The wetland is located at the top of an intermittent stream channel that leads into Soap Creek, a perennial stream that flows through the west-central portion of the project area near the proposed transmission line route (see figure 1-1). Vegetation in this small, emergent wetland consists of a mix of non-native and native herbaceous species. Table 3-10 shows the total area of wetlands and streams within the proposed project lands.

Table 3-10. Wetlands and other waters within the proposed project lands (Source: Rugraw, 2015).

Feature Type	Acres	Linear Feet
Wetlands		
Wetland A	0.07	NA
Total Wetlands	*0.07*	*NA*
Other Waters		
Perennial Streams	1.82[a]	4,515
Intermittent Drainages	0.62	6,727
Ephemeral Drainages	0.05	1,065
Total Other Waters	*2.49*[a]	*12,307*
Total	**2.56**[a]	**12,307**

[a] Does not include Panther Creek; Panther Creek was not delineated because of steep topography.

Noxious Weeds

Noxious and invasive weeds include those identified by the California Department of Food and Agriculture and the California Invasive Plant Council as having known ecological, environmental, or economic impacts.

Rugraw identified noxious weeds that are known to occur or may occur within the project area using the California Invasive Plant Council's Cal WeedMapper online database and verified results with field surveys in May, June, and September 2013. The database search identified 60 noxious weeds known to occur in the project area. Of these, Rugraw observed 32 species during field surveys. Field surveys revealed that noxious weeds occur throughout the majority of the proposed project lands, with the heaviest infestations in the western and west-central portions of the proposed project lands along the transmission line ROW. These surveys also found that noxious weeds appear to occur most commonly in annual grassland and disturbed or developed habitats. The most abundant and/or widespread noxious weeds observed on proposed project lands include yellow star thistle, Himalayan blackberry, medusa head, common wild oats, bull thistle, annual dogtail, cheatgrass, and rattail six weeks grass.

Special-status Plants

Special-status plants include those listed as threatened or endangered at the state level and those listed by the California Native Plant Society as rare. Species listed as threatened or endangered under the ESA are discussed in section 3.3.4, *Threatened and Endangered Species*. Rugraw identified special-status plants that are known to occur or may occur in the project area by reviewing relevant literature, maps, and previous field survey reports, and it conducted field surveys in May, June, and September 2013.

Rugraw observed one special-status plant species, Coleman's rein orchid (*Piperia colemanii*), during the 2013 field surveys. Eight individuals were observed in one location in the central portion of the proposed project lands along the proposed transmission line route. The plants identified during the 2013 field surveys were found in burned Sierran mixed conifer habitat; however, this species also occurs in chaparral and lower montane coniferous forest habitats. It typically blooms from June through August.

Previous botanical surveys documented the presence of one additional special-status plant species, long-fruit jewelflower (*Streptanthus longisiliquus*), but this species was not found in 2013. Desktop analysis revealed that 15 additional special-status plant species have previously been reported within 10 miles of the proposed project, and 11 others have not been documented but could be present.

Wildlife

The project area contains habitat for a variety of wildlife species. Rugraw's field surveys of the proposed project lands conducted in May, June, and September 2013 documented either directly (by observation) or indirectly (by tracks, burrows, scat, call, song, or other evidence) the presence of 33 bird, 11 mammal, five reptile, and one amphibian species. This count does not include special-status or threatened or endangered wildlife species that are discussed below and in section 3.3.4, *Threatened and Endangered Species*. Species most commonly observed in the proposed project lands during the 2013 field surveys include sagebrush lizard, scrub jay, Steller's jay, yellow-rumped warbler, California quail, Oregon dark-eyed junco, northern flicker, acorn woodpecker, raven, turkey vulture, black-tailed jackrabbit, and mule deer.

Special-status Wildlife Species

Special-status wildlife species include those species listed as endangered or threatened under the CESA, candidates for listing under the CESA, and those listed by California DFW as fully protected, species of special concern, or those appearing on the California watch list. Special-status bird species also include those listed by FWS as birds of conservation concern and bald and golden eagles, which are federally protected under the Bald and Golden Eagle Protection Act. Species that are listed or are candidates for listing as threatened or endangered at the federal level are discussed in section 3.3.4, *Threatened and Endangered Species*.

Rugraw identified special-status wildlife species that are known to occur or may occur within the project area using desktop research, literature review, and field habitat assessments of proposed project lands in May, June, and September 2013. The 2013 field habitat assessments included a 1-mile buffer around the proposed project facilities. Table 3-11 shows the status, habitat requirements, and likelihood of occurrence for each species that could occur within the proposed project lands.

3.3.3.2 Environmental Effects

Effects of Project Construction and Operation on Vegetation

Construction of the project would require vegetation clearing and ground disturbance, which would result in permanent and temporary disturbances that could alter vegetation community structure on proposed project lands through vegetation removal, soil compaction, or changes in interspecific competition associated with the introduction of invasive plants. Disturbance of vegetation communities on proposed project lands also has implications for wildlife species associated with these habitats.

Table 3-11. Special-status wildlife species potentially occurring on proposed project lands (Source: Rugraw, 2015).

Species (*scientific name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
Amphibians			
Cascades frog (*Rana cascadae*)	SSC	Inhabits wet mountain areas and lays eggs in shallow stream pools, lake margins, and clear mountain ponds with silty, sandy, or gravelly substrates.	Species was not observed during 2013 surveys. Potential habitat exists along the entire project reach, with potential breeding habitat present in stream pools. Nearest mapped occurrence is about 3 miles upstream (historic). Populations near Mount Lassen identified in the 1920s may now be extinct.
Foothill yellow-legged frog (*Rana boylii*)	CACT	Habitat includes streams, rivers, and pools with cobble-sized rocky substrate. Eggs are attached to gravel or rocks in moving water near stream margins.	Species is known to occur within the project area and a probable sighting was documented in 2013 surveys at the Old State Highway Route 36 Bridge. Has also been documented downstream in South Fork Battle Creek and Soap Creek.
Birds			
American peregrine falcon (*Falco peregrinus anatum*)	CAFP, BCC, BGEPA	Occurs in mountain ranges, river valleys, and coasts, near wetlands, lakes, rivers, or other water. Nests on cliff banks, dunes, ledges, buildings, and artificial structures.	Species was not observed during 2013 surveys, but has been previously documented in the project area. Suitable nesting habitat occurs in several areas along the south-facing slope ranging approximately

Species (*scientific name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
			80 to 960 feet above the creek and consisting of a series of 20- to 100-foot-tall cliffs. Nearest mapped location is 5.25 miles south of the proposed project lands, east of Paynes Creek.
Bald eagle (*Haliaeetus leucocephalus*)	CAE, CAFP, BCC	This species nests in mature trees and snags and on cliffs, rocks, and artificial structures, generally within 1 mile of water. Forages over water and other open habitats. Nesting activity occurs from January through August.	Species was not observed during 2013 surveys, but may opportunistically use the project area for foraging or roosting. Nearest known nest location is approximately 4.9 miles north of the transmission line ROW.
Calliope hummingbird (*Stellula calliope*)	BCC	Commonly feeds in montane chaparral and wet meadow habitats. Nests in woodlands or forests, often in a pine or montane riparian tree.	Species was not observed during 2013 surveys. Suitable feeding and nesting habitat occurs throughout much of the project area.
Cassin's finch (*Carpodacus cassinii*)	BCC	Nests in tall trees in open, montane coniferous forests and forages in nearby meadows or grasslands.	Species was not observed during 2013 surveys. Suitable habitat occurs throughout much of the project area.
Golden eagle (*Aquila chyrsaetos*)	CAFP, BCC, BGEPA	Nests on steep cliffs or in large trees and forages in grasslands and other open terrain habitats.	Species was not observed during 2013 surveys, but may forage in annual grasslands along the western end of the transmission line ROW. Potential nesting habitat is located on

Species (*scientific name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
			south-facing cliffs just outside the proposed project lands.
Lewis's woodpecker (*Melanerpes lewis*)	BCC	Suitable habitat includes open, deciduous and conifer habitats with scattered snags and live trees for nesting and perching. Uses logged and burned areas. Prefers oaks and acorns in winter.	Species was not observed during 2013 surveys. Open, forested, logged, and burned areas within the project area provide suitable wintering habitat. The project area is outside this species' summer range.
Northern goshawk (*Accipiter gentilis*)	SSC	Prefers subalpine and upper montane forests with relatively dense canopy closure and open understories.	Species was not observed during 2013 surveys, but is has been previously documented and is known to occur within the project vicinity (near Panther Creek).
Oak titmouse (*Baeolphus inornatus*)	BCC	Preferred habitat includes oak dominated woodlands, chaparral, and riparian habitats.	Species was observed during 2013 surveys west of Soap Creek in a blue oak tree within montane chaparral habitat. Suitable habitat occurs on south-facing slopes in blue oak woodland and blue oak-foothill pine-interior live oak habitats within proposed project lands.
Olive-sided flycatcher (*Contopus cooperi*)	SSC, BCC	Prefers forested habitats with large, tall trees overlooking open terrain, for nesting, roosting, and foraging.	Species was observed during 2013 surveys in Sierran mixed conifer habitat atop cliffs above Panther Creek. Suitable habitat on proposed

Species (*scientific name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
			project lands includes any tall trees overlooking open terrain.
Osprey (*Pandion haliaetus*)	WL	Suitable habitat includes large trees, snags, cliffs, or structures near riparian or open water habitats.	Species was observed during 2013 surveys flying over the west end of the project area near Manton, California. Nearest documented nesting location is approximately 3.5 miles north of the project transmission line ROW, but suitable nesting habitat occurs within the project area.
Prairie falcon (*Falco mexicanus*)	WL, BCC	Suitable nesting habitat includes cliffs and bluffs. Foraging habitat consists of grasslands and other open terrain.	Species was not observed during 2013 surveys. Potential nesting habitat occurs on south-facing cliffs in the project vicinity. Annual grasslands and fields at the western end of proposed project lands provide suitable foraging habitat.
Mammals			
American pika (*Ochotona princeps*)	CACT	Occurs in mid-montane to high alpine talus slopes near meadows, and is found in rocky areas within forests or near lakes at lower elevations.	Species was not observed during 2013 surveys, but may occur on south-facing talus slopes just outside proposed project lands. Nearest documented occurrence is approximately 1.5 miles east of proposed project lands.

Species (*scientific name*)	Status	Habitat Requirements	Potential to Occur on Proposed Project Lands
Sierra Nevada red fox (*Vulpes necator*)	CAT	Occurs in high elevation barren, conifer, and shrub habitats; montane meadows; and subalpine woodland. Potential den sites include natural cavities in talus slopes, rockslides, or boulder piles.	Species was not observed during 2013 surveys and is not expected to occur on proposed project lands with regular frequency because of a lack of suitable habitat, but potential denning sites may exist in south-facing talus slopes and rockslides just outside proposed project lands. Nearest documented occurrence is approximately 3.2 miles east of the proposed project.
Spotted bat (*Euderma maculatum*)	SSC	Roosts in crevices of cliffs, caves, and buildings. Foraging habitat includes grasslands and other open habitats near water.	Species was not observed during 2013. Suitable roosting habitat in the project area includes south-facing cliffs and the steep north-facing slope between the project bypassed reach and penstock/pipeline alignment. Suitable foraging habitat occurs throughout the project area. Nearest documented occurrence is approximately 4.5 miles southeast of the proposed project.

Notes: CAE = California Endangered, CAT = California Threatened, CACT = California Candidate Threatened, CAFP = California Fully Protected, SSC = California Species of Special Concern, WL = California Watch List, and BCC = FWS Bird of Conservation Concern (FWS, 2008); BGEPA = Bald and Golden Eagle Protection Act

Rugraw estimates that construction of the project would result in a permanent loss of 68.79 acres of vegetation and temporary disturbance of an additional 11.37 acres. Permanent disturbances to vegetation would occur primarily as a result of the construction of the diversion dam, powerhouse, switchyard, and substation. Permanent conversion of forested habitat to herbaceous or shrub habitats along the pipeline/penstock, station service line, and 12-mile-long and 40-foot-wide transmission line ROW would also be considered a permanent disturbance. Temporary disturbances to herbaceous communities would occur as a result of pipeline and penstock construction, ROW clearing, and the establishment of temporary multi-use work areas. However, these communities would be expected to recover over time. Table 3-12 summarizes total anticipated permanent and temporary disturbance to each vegetation community/habitat type on proposed project lands.

Table 3-12. Permanent and temporary impacts on vegetation on proposed project lands (Source: Rugraw, 2015).[93]

Vegetation Community/ Habitat Type	Permanent Disturbance (acres)	Temporary Disturbance (acres)	Total Disturbance (acres)
Annual Grassland	4.69	-	4.69
Blue Oak Woodland	3.18	-	3.18
Blue Oak-Foothill Pine-Interior Live Oak	3.87	-	3.87
Disturbed	0.89	0.28	1.16
Irrigated Hayfield	0.19	-	0.19
Masticated Woodland	0.65	-	0.65
Mixed Chaparral	0.24	-	0.24
Montane Chaparral	6.46	-	6.46
Plantation	1.17	1.12	2.29
Ponderosa Pine	2.01	-	2.01
Residential-Developed	0.02	-	0.02
Riparian	0.31	-	0.31

[93] Although it is not expressly stated in the amended final license application, based on Rugraw's comments at the draft EIS public meeting on January 3, 2018, we understand these values depict effects of vegetation disturbance for all project facilities including the South Powerhouse Road transmission line route.

Vegetation Community/ Habitat Type	Permanent Disturbance (acres)	Temporary Disturbance (acres)	Total Disturbance (acres)
Riverine-Montane Riparian	0.69	-	0.69
Road	3.08	-	3.08
Rock	0.57	-	0.57
Himalayan Blackberry (*Rubus armeniacus*)	0.18	-	0.18
Sierran Mixed Conifer	30.60	9.97	40.57
Wetland	0.01	-	0.01
Total	**68.79**	**11.37**	**80.16**

Effects of project operations would include ongoing vegetation maintenance within the pipeline/penstock, station service line, and transmission line ROWs. Project operations also have potential to affect riparian vegetation if the project alters the streamflow regime and disrupts natural processes of sediment scour and deposition. These processes create suitable sites for riparian tree seed germination.

To minimize the effects of project construction and operation on vegetation communities on proposed project lands, Rugraw proposes the following measures:

- Limit ground-disturbing activity and vegetation clearing.
- Delineate the limits of construction, work areas, and multipurpose areas with flagging, fencing, and/or stakes, and prohibit ground disturbance outside of these limits.
- Reclaim temporarily disturbed stream and riparian habitat through restoration of preconstruction conditions and riparian plantings and/or seeding, where applicable, with approved seed mixes.
- Revise the proposed Noxious Weed Management and Revegetation Plan, which includes measures to ensure weeds and non-native invasive vegetation do not reestablish at onsite disposal areas during project construction, and modify the plan to include provisions for riparian plantings along disturbed portions of South Fork Battle Creek to provide overhanging vegetation.
- Map, evaluate, and quantify, by vegetation type, vegetation that would be removed as a result of project construction.

- Restore vegetation directly removed or disturbed during project construction as appropriate and in accordance with California forestry regulations and best practices.

Rugraw has prepared a Noxious Weed and Revegetation Management Plan that outlines methods that would be used to reestablish vegetation in areas temporarily disturbed by project construction. Rugraw's plan proposes monitoring of revegetated areas for 2 years following construction, with additional seeding and planting as needed to meet a defined success criteria of 70 percent cover during the 2-year monitoring period.

Interior recommends that, if vegetation restoration success criteria as defined in the Noxious Weed and Revegetation Management Plan are not achieved by the end of Rugraw's proposed 2-year monitoring period, Rugraw should continue to reseed and monitor disturbed areas until success criteria are met.

Our Analysis

Project construction would result in the permanent removal of 68.79 acres of vegetation and temporary disturbance of an additional 11.37 acres. Clearing of vegetation in the 12-mile-long and 40-foot-wide transmission line ROW during project construction and operation would result in the permanent conversion of some forested habitats to herbaceous or shrub habitats. These disturbances would alter vegetation community structure and associated wildlife habitat on proposed project lands. However, because table 3-12 provides effects of vegetation disturbance for all project facilities, we cannot isolate effects of the proposed transmission line compared to other proposed project facilities.

Although some permanent removal of vegetation for construction of project facilities is unavoidable, Rugraw's proposals to limit ground disturbances and removal of vegetation, and to clearly delineate work area boundaries, would minimize temporary effects. Rugraw's proposal to map and quantify disturbances by vegetation type would provide a baseline for establishing targeted restoration goals and facilitate successful restoration of vegetation in areas of temporary disturbance.

Rugraw's implementation of a Noxious Weed and Revegetation Management Plan would ensure that temporarily disturbed areas are revegetated as soon as possible upon completion of construction activities. Rugraw's revisions to ensure restoration of overhanging riparian vegetation along disturbed portions of the South Fork Battle Creek streambanks would further minimize effects on these habitats, and would provide shade to help regulate water temperature in the stream.

Rugraw's Noxious Weed and Revegetation Management Plan proposes monitoring of revegetated areas for 2 years following construction, with additional seeding and planting as needed to meet the defined success criteria of 70 percent cover. However, the proposed plan does not include a description of any additional measures if success criteria are not met. If Rugraw implements the provisions outlined in the

Noxious Weed and Revegetation Management Plan and modifies the plan to include additional reseeding and monitoring if restoration success criteria are not met by the end of the 2-year monitoring period, as Interior recommends, this would ensure successful restoration of temporarily disturbed vegetation on proposed project lands.

The existing stream channel in the bypassed reach is primarily bedrock with the floodplain constrained by canyon walls. Any riparian grasses and trees that could provide canopy cover depend on sediment deposited in bedrock crevices for germination sites. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, Rugraw proposes to provide sediment flushing flows to maintain sediment transport dynamics in the bypassed reach. These flows and uncontrolled natural high flows would continue to provide habitat for riparian species establishment. As described in appendix C, project operations would result in slightly steeper declines in the winter snowmelt flow pulse; however, we expect these flows would still provide sufficient soil moisture to promote seed establishment and maintain existing riparian structure.

Potential Spread of Noxious Weeds

Ground disturbances and removal of vegetation associated with construction of the project could create opportunities for colonization and spread of noxious and invasive weeds. Additionally, operation and maintenance activities could result in the spread of noxious weed species within proposed project lands via transport on maintenance equipment and personnel. Invasive plants and noxious weeds pose threats to native ecosystems by displacing native species and altering habitat characteristics.

To minimize the potential introduction and spread of noxious weeds during project construction and operation, Rugraw would implement the environmental measures listed above, including the implementation of a Noxious Weed and Revegetation Management Plan.

Interior recommends that, if success criteria are not met by the end of Rugraw's proposed 2-year monitoring period, Rugraw should continue its noxious weed control and monitoring program until the goal of less than 10 percent cover of noxious weeds is achieved.

Water Board preliminary condition 14 would require Rugraw to develop a vegetation and weed management plan. The plan would address aquatic and terrestrial non-native, invasive weeds and species within and adjacent to the project boundary, and would include provisions for protection of special-status plant species and an adaptive management component to reduce existing occurrences, and prevent the spread of non-native invasive aquatic weeds.

Our Analysis

The Noxious Weed and Revegetation Management Plan provides methods that Rugraw would use to prevent the spread of noxious weeds during project construction and control target noxious weeds following cessation of construction activities. The proposed plan is generally consistent with Water Board preliminary condition 14; however, the plan does not include chemical or mechanical treatment of existing noxious weed infestations, which occur on portions of proposed project lands. These populations would provide seed sources that could generate new populations in areas of project disturbance. If Rugraw modifies its plan to include treatment of existing noxious weed populations on proposed project lands, consistent with Water Board preliminary condition 14, the potential for the spread of these species to areas disturbed during construction activities would be further minimized. Specifically, noxious weed treatment techniques would need to focus on preventing existing populations from setting seed during periods of ground disturbance related to construction activities. Treatments prior to construction would reduce the likelihood that existing populations are able to establish in newly disturbed construction sites.

Water Board preliminary conditions 19–22 would require Rugraw to adopt measures that would reduce the potential for transport of noxious or invasive plants, seeds, or propagules on materials and equipment. These measures would also reduce the potential spread and effects of noxious weeds.

Revegetation of disturbed areas as soon as possible upon completion of construction activities would limit openings for potential noxious weed colonization. Rugraw's Noxious Weed and Revegetation Management Plan proposes noxious weed monitoring for 2 years following construction, with a goal of 20 percent cover of noxious weeds 1 year after the completion of construction, and less than 10 percent cover of noxious weeds at the end of the 2-year monitoring period. However, the plan does not include additional measures if success criteria are not met. If Rugraw implements the Noxious Weed and Revegetation Management Plan and modifies the plan to include continued noxious weed management and monitoring efforts until success criteria are met, as Interior recommends, the potential spread of noxious weeds during and following construction of the proposed project would be minimized.

Rugraw's proposed measures to limit ground disturbance, restore vegetation in disturbed areas, and implement a Noxious Weed and Revegetation Management Plan would minimize potential for colonization and spread of noxious and invasive weeds on proposed project lands during and after project construction.

Effects on Special-status Plants

Project construction and operation could affect special-status plants by removal or disturbance of individual plants, habitat loss or degradation, and introduction and spread of non-native invasive plants, including noxious weeds.

To minimize the potential effects of project construction and operation on Coleman's rein orchid and other special-status plants that could occur on proposed project lands, Rugraw proposes to implement the following measures in addition to those proposed and discussed above for other vegetation:

- Conduct monitoring during construction to ensure that measures to protect biological resources are implemented appropriately. Staff trained in the identification of special-status species and their habitats would be on-site to ensure surveys are conducted appropriately and that impacts on any special-status species that may be present on the proposed project lands are avoided through the proper implementation of measures such as minimization of ground-disturbing activity and vegetation clearing and proper delineation of work areas.
- Provide environmental training to construction staff regarding laws, regulations, and BMPs to protect threatened and endangered species and special-status plant species and their habitats.
- Conduct preconstruction surveys in all areas where disturbance would occur in suitable habitat for threatened and endangered and special-status plant species where surveys have not previously been conducted, and implement specified protection measures as necessary.

Water Board preliminary condition 5 would require Rugraw to consult annually with relevant resource agencies to review current lists of rare, threatened and endangered species and special-status plant and wildlife species, identify any additional species that have the potential to be adversely affected by the project, and develop or update species-specific study plans whenever new potential effects or newly listed species are identified. Rugraw would then be required to conduct studies for species identified as vulnerable to effects from project construction or operation.

Water Board preliminary condition 14 would require Rugraw to develop a vegetation and weed management plan, as described above, which must include provisions for protection of special-status plant species.

Our Analysis

Rugraw only observed one special-status plant species during its 2013 field surveys, Coleman’s rein orchid. This species is not expected to be affected by project construction or operation because Rugraw has sited the proposed project facilities to avoid the location where a single population of this species was found.

Rugraw’s proposal to provide training to construction staff regarding BMPs to protect threatened and endangered species and special-status plant species and their habitats, and conduct preconstruction inspections and implement protection measures where appropriate, including adjustment in the project alignment, would reduce the potential effects on special-status plant species that may be present on proposed project lands. Because of minor project alignment changes done to minimize site impacts or to avoid cultural resource sites and that occurred after the May and June 2013 field surveys, small areas of the proposed project lands were not surveyed during the appropriate flowering period to identify special-status plant species. Rugraw proposes to conduct preconstruction inspections for special-status plant species in those areas that were not surveyed in 2013. These additional inspections would further minimize the likelihood of construction effects on special-status plants.

Rugraw's proposed measures to avoid or minimize effects on vegetation and reduce the potential spread of noxious weeds would also limit potential effects on special-status plant species.

Noxious weed control methods, as proposed in Rugraw's Noxious Weed and Revegetation Management Plan, would include mechanical and chemical herbicide treatments that could affect special-status plants, if present. However, Rugraw's plan does not include provisions to protect special-status plant species during noxious weed treatment application. Modification of Rugraw's Noxious Weed and Revegetation Management Plan to include measures to avoid effects on special-status plants, in accordance with Water Board preliminary condition 14, would ensure that these species are protected during noxious weed control activities. Specific measures could include plant surveys prior to treatment application, consultation with appropriate agencies if special-status plants are found, avoidance of special-status plants during noxious weed treatments, and possible relocation of individuals in collaboration with appropriate agencies.

Annual consultation meetings (Water Board preliminary condition 5) would also provide an opportunity for the measures to be modified if a species becomes delisted. Further, the process of annual consultation would allow California DFW and the U.S. Department of Agriculture, Forest Service (Forest Service) to provide input based on unpublished data, recent studies, and other sources of information that may not be available in public databases. Although we recognize the benefits of annual review and consultation, the Commission typically includes in its licenses a standard license article with a fish and wildlife reopener provision, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*.

Effects of Project Construction and Operation on Wildlife

Vegetation clearing, construction noise, potential introduction and/or spread of noxious weeds, and increased human activity may affect wildlife and their habitats during construction of the project.

Effects on wildlife habitat as a result of vegetation clearing for project construction and vegetation maintenance on ROWs and around other project features during project operation could include permanent and temporary habitat loss, degradation, and fragmentation. Potential introduction or spread of invasive or noxious weeds could also contribute to degradation of wildlife habitat.

Noise associated with project construction activities and equipment, including helicopters, could temporarily displace individuals and could disturb feeding or mating behaviors. The presence of work crews on proposed project lands during project construction and operation would contribute to noise and may result in additional displacement or disturbance of wildlife species.

Injury or mortality of individuals may occur from collisions with vehicles, construction equipment, or structures; and/or inadvertent crushing of inhabited dens, burrows, snags, or logs.

To minimize the effects of project construction and operations on wildlife within proposed project lands, Rugraw proposes to implement measures to minimize effects on vegetation, limit the spread of noxious weeds, minimize effects on special-status plants, and avoid effects on wetlands, as described in the sections above, as well as implement the following:

- Conduct preconstruction surveys for migratory birds within 100 feet of the project (disturbance area) prior to construction if disturbance would occur during the nesting season (typically April 15 to July 31).
- Establish and mark a 100-foot-buffer around active nests of bird species protected under the Migratory Bird Treaty Act, and limit disturbance in this area until chicks have fledged.
- Conduct preconstruction pedestrian or aerial nest surveys in suitable habitat within 1 mile of the project disturbed area during the appropriate nesting time periods needed to identify raptor nest locations and establish the status of nests.
- Apply an appropriate buffer to active raptor nests during project construction.
- Avoid potential bat roosting habitat, including rock crevices, cliffs, and snags.

Our Analysis

The potential for direct effects on wildlife including injury, mortality, or disturbances associated with equipment or crews would be largely restricted to the construction period and many displaced individuals would be expected to return to the area upon completion of construction activities. Effects on birds would be greatest during their nesting season. Some recurring disturbances would occur during ROW maintenance activities.

Rugraw's proposal to avoid potential bat roosting habitat would avoid direct effects on roosting bats. However, noise associated with project construction could impact roosting bats if construction occurs during the pup season (generally June 1–August 31) and is within the general area of active roosts. These effects would be unavoidable, but temporary.

Conducting preconstruction surveys for nesting migratory birds and raptors would identify areas most susceptible to effects of noise and vegetation clearing. Implementing protection buffers in these areas, as proposed, would reduce potential for nest abandonment, accidental damage to nests, and accidental injury to nesting adults or nestlings. However, Rugraw does not describe how it would determine the appropriate buffer distance to protect nesting raptors. Different raptor species have different levels of sensitivity to noise and human presence during nesting seasons. If Rugraw prepares a raptor protection plan that identifies species-specific avoidance buffer distances, based on input from California DFW, potential effects on raptors would be minimized. Revegetation of disturbed areas and treatment of noxious weeds, as discussed above, would also reduce potential changes to habitat structure and restore wildlife habitat to existing conditions in temporarily disturbed areas. Rugraw's proposed measures, with our recommended modification to identify raptor nest buffers, would minimize these effects as described in the previous sections on vegetation.

Transmission Line Effects on Birds

Operation of a 12-mile transmission line would present a collision risk and electrocution hazard for avian species that reside within or traverse proposed project lands. The risk of avian mortality associated with above-ground transmission lines is greatest on small voltage (69 kV or less) lines such as the proposed 60-kV line because of the close spacing of conductors. Large-bodied birds such as raptors and wading birds are at greatest risk because of their long wing spans that can reach between conductors. Additionally, larger species are often less agile in flight compared to smaller species, and thus are less able to avoid collisions with lines.

To reduce the likelihood of avian injury or mortality from collisions with the transmission line and potential electrocution, Rugraw proposes to design and construct the transmission line in compliance with APLIC[94] guidance to reduce risk of electrocution and collisions to avian species. Interior agrees with Rugraw's proposal to design and construct its transmission line as described above. Additionally, Interior (10(j) recommendation 7) recommends that Rugraw prepare an avian protection plan. Interior recommends that Rugraw's avian protection plan be developed using FWS's Avian Protection Plan Guidelines.

Our Analysis

APLIC guidelines provide specific recommendations for conductor spacing and conductor arrangement to reduce risk of avian electrocutions. However, the guidelines also include a variety of nest and perch deterrents, perching poles, and nest platforms to

[94] APLIC is a collaboration among numerous electrical utilities and research groups and FWS that was formed to identify the causes of, and develop methods and designs to minimize, avian electrocutions and collisions at power lines. APLIC has released guidelines to address avian electrocution (APLIC, 2006), collision (APLIC, 2012), and the development of national Avian Protection Plan guidelines (APLIC and FWS, 2005).

further reduce risk of birds spending time near conductors. APLIC guidelines also provide descriptions of devices for marking lines to increase visibility and allow birds to avoid collisions. Line-marking devices are most effective when placed at stream crossings, near wetlands, near ridgelines, or at other locations along the line where avian densities are likely to be high and collision risk is greatest.

Design and construction of the transmission line with consideration to the APLIC guidance would reduce the risk of avian mortality due to electrocution or collision with the line. However, without knowing what specific measures Rugraw proposes, including types and locations of marking devises, or what, if any, measures beyond conductor separation, would be used to reduce electrocution risk, it is difficult to know whether further protection measures are warranted. Preparation of an avian protection plan, as recommended by Interior under 10(j) recommendation 7, would provide the detail needed to ensure that the risk of effects to birds associated with the transmission line are effectively minimized. If Rugraw prepares an avian protection plan that describes how APLIC guidelines were considered in the design and construction of the project transmission line, effects of avian electrocution and collision would be reduced.

Effects on Special-status Wildlife Species

Potential effects of project construction and operation on special-status wildlife species would be similar to other wildlife species and could include loss, degradation, and fragmentation of habitat; injury or mortality because of collisions with vehicles or equipment; and disturbances associated with noise and the presence of work crews during project construction and maintenance activities.

To minimize the potential effects of project construction and operation on special-status wildlife species and their habitats, Rugraw proposes to implement the following measures in addition to those listed under the preceding terrestrial resource sections:

- Avoid ground-disturbing activity on or near talus slopes to protect Sierra Nevada red fox and American pika.
- Refrain from collecting rocks from in-water environments between March 1 and August 31 to avoid disturbing FYLF and their habitat.
- Conduct preconstruction surveys for juvenile and adult FYLF immediately prior to construction when in-water work would occur during the breeding season (typically mid-March to August).
- Avoid construction activities in riparian areas during the time that egg masses of FYLF are present (typically mid-April through mid-May); if egg masses of FYLF are found, postpone construction.
- Relocate juvenile and adult FYLF found within the project reach and up to 500 feet downstream, to outside the project construction area to an area immediately upstream of the project area.

Water Board preliminary condition 13 would require Rugraw to develop an amphibian monitoring plan in consultation with the appropriate agencies, to monitor and evaluate effects on the CRLF, FYLF, and Cascades frog.

California DFW has also recommended that Rugraw prepare a FYLF monitoring plan (10(j) recommendation 2) that would include annual monitoring for all life stages between March and October, and development of appropriate measures to offset effects on this species if population effects are detected after 5 years of monitoring.

In its reply comments, Rugraw noted that it is in agreement with California DFW recommendations and Water Board preliminary conditions.

In comments on the draft EIS, California DFW comments that our analysis did not consider effects of water pulses in the bypassed reach associated with the project tripping off-line. California DFW also comments that it does not support Rugraw's proposal to transport FYLF out of the construction area. Rather, California DFW recommends Rugraw conduct preconstruction surveys and monitor during construction activities. California DFW recommends that, if surveys or monitoring activities determine FYLF are present, Rugraw should stop work and contact California DFW.

In comments on the draft EIS, Interior discusses desired recession rates in the bypassed reach following spring snowmelt pulse flows to protect FYLF. Interior also modified 10(j) recommendation 8 to include FLYF in its recommended sensitive amphibian management plan.

During the section 10(j) meeting, FWS modified its recommendation to clarify that spring pulse-flow recession rates should not exceed a 1-foot drop in stage over a 3-week period (Interior 10(j) recommendation 9). FWS developed this recommendation noting that FYLF can deposit egg masses in less than 1 foot of water. Because the eggs take 2 to 3 weeks to develop and hatch, a drop in stage greater than 1 foot in 3 weeks could result in dewatering egg masses, leading to desiccation and reduced reproductive success. During the meeting, FWS further clarified that it is not recommending this recession rate be applied to flow pulses associated with storm events. Rather, the 1-foot per three-week rate would apply to the recession in base flows starting at the point the spring snowmelt pulse starts to level out. Interior also indicated that the primary manageable threats to FYLF in the project area are bullfrogs and chytrid fungus.[95]

Our Analysis

Construction of the project would require vegetation clearing and associated disturbance to habitat for Sierra Nevada red fox and American pika. Proposed project operation would result in changes to the current flow regime in South Fork Battle Creek, which could result in effects on amphibian habitat.

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[95] Bullfrogs are known to spread chytrid fungus, which can result in disease and mass die-offs of amphibians.

Rugraw's proposal to conduct monitoring during construction to ensure that measures to protect biological resources are implemented appropriately, and provide training to construction staff, would reduce risk of accidental injury or mortality to sensitive species during construction. Avoiding disturbance to talus slopes would minimize potential effects on Sierra Nevada red fox and American pika, which are most likely to have dens in these areas.

Rugraw's proposed measures to conduct preconstruction surveys for FYLF during the breeding season, avoid construction or other disturbances to riparian habitats during key time periods, and relocate individuals if necessary, would minimize effects on this species. Measures designed to limit project construction effects on aquatic resources and wetlands, including reducing potential for erosion and managing stormwater runoff, limiting in-water work to the July 1 to October 15 period, and avoiding construction in wetlands would also reduce effects on the FYLF by protecting water quality. However, while Rugraw's proposed measures would protect egg masses, juvenile frogs, and adult frogs from construction effects, they do not address potential effects on larval frogs. Relocating larval frogs in addition to juvenile and adult frogs would further reduce effects on this species. After hatching, larval FYLF tend to move to nearby areas beneath cobble and gravel, and display frantic swimming patterns to avoid predation that could result from movement downstream from the hatching location. Juveniles tend to move upstream after metamorphosis (AmphibiaWeb, 2017); therefore, relocating juvenile and adult individuals to areas upstream of the project would reduce potential for frogs migrating back into the construction zone. If the relocation spot is too close to the project, though, larval frogs could move back into the hazardous area.

California DFW recommends Rugraw stop work if biological monitors observe FYLF during construction and notify California DFW immediately. However, it is not clear why development of appropriate procedures for relocating this species cannot be developed prior to the start of construction to avoid unnecessary delays. If Rugraw, in consultation with California DFW, modifies its special-status amphibian protection plan to include specific criteria for handling FYLF during relocation activities, identifies proposed relocation sites to ensure that they do not re-enter the construction zone, and notifies California DFW if relocation activities are needed, effects of construction on this species at all life stages would be reduced. We anticipate the recommended protocols would provide proper handling techniques to prevent stress to individuals and limit the potential for take associated with moving individuals out of harm's way during construction activities.

Project operations could affect FYLF and Cascades frog habitat if operations change the streamflow regime and conditions in breeding and rearing habitats. Effects of hydropower projects on the FYLF can vary greatly based on stream geometry, vegetation and sediment type, and many other site-specific variables that can affect the way in which changes in flow regime may alter their habitat (Yarnell et al., 2011). In general, hydropower projects tend to affect FYLF habitat in two ways: (1) flow pulses outside of the typical season (spring) can disrupt breeding and larval development by scouring egg masses, or displacing individuals, particularly when they occur during the summer (Forest Service, 2016); and (2) low winter flows can facilitate vegetation encroachment into the channel and pool stagnation, which also promotes the establishment of bullfrogs (Fuller et al., 2011; California DFW, 2017a).

As described in section 3.3.2.1, *Aquatic Resources, Water Use and Quantity*, the project would operate as a run-of-river project. Therefore, there would be no unnatural flow pulses and no effects on FYLF associated with summer pulses. Staff reviewed USGS models (Gotvald et al., 2012) to estimate the 2-year recurrence interval flow, or channel maintenance flow, for South Fork Battle Creek. This analysis indicates a flow of about 370 cfs every other year would be required to maintain current stream channel morphology, which provides habitat for FYLF. We recognize that project operations would remove some higher flow levels, including a portion of the above 370 cfs bankfull flows, from the hydrograph in the bypassed reach. The project would divert a maximum of 105 cfs through the powerhouse, but would not operate at flows above 418 cfs. With an inflow of 417 cfs, 105 cfs would go through the powerhouse and 312 cfs would go through the bypassed reach. At an inflow of 418 cfs, the project would begin the shutdown procedure, and flows in the bypassed reach would ramp up to 418 cfs. Staff's analysis of Rugraw's synthetic flow record indicates that, from October 1 through April 30, flows over 418 cfs occurred a total of 109 times in the 88-year synthesized record and occurred on average in about half of the years in the record. Flows over 418 cfs ranged from 419 to 1,470 cfs, with an average of 591 cfs, and a standard deviation of 199 cfs. Because these high flows would continue to occur with similar frequency as under current conditions, the project would not eliminate high winter flood pulses that prevent vegetation encroachment, move sediment, and prevent pool stagnation.

Over the term of the license, certain situations may affect the power grid and require unplanned shut-down of project operations. In these circumstances, a flow diverter in the powerhouse would direct water away from the turbine and into the tailrace. The project would not shut down water diversion at the intake and return flow to the bypassed reach. As such, there would not be a pulse of water in the bypassed reach associated with unexpected shut-down conditions. Therefore, we do not expect unplanned project shut-downs to adversely affect habitat for FYLF or Cascades frog.

Following the 10(j) meeting, staff conducted additional analysis to determine how project operations would affect the rate of base flow recession rates in the bypassed reach. Using the synthesized flow record for the 30-year period from 1987 to 2016 and the stage-discharge curve for the cross-section ABS, we developed graphs for each water year type, depicting curves for existing conditions and recommended project operational scenarios, along with lines that show a stage recession rate of 1 foot over 3 weeks. We present the results of this analysis in appendix C. Table 3-13 presents a summary of our results, indicating the number of years under each MIF scenario when project operation would have exceeded the recommended recession rate.

Table 3-13. Summary of years when flow stage recession rates would exceed 1 foot over 3 weeks at a range of proposed and recommended minimum flows, from 1987 to 2016 (Source: staff).

Minimum Instream Flow	Years Exceeding FWS Recommended Recession Rate (1 foot/3 weeks)	Total Number of Years Exceeding FWS Recommended Recession Rate
Existing Condition	--	0
8 cfs	1996 (W); 1998 (W); 2005 (AN); 2010 (BN); 2009 (D);	5
13 cfs	1996 (W); 1998 (W); 2005 (AN); 2009 (D)	4
20–30 cfs	1998 (W); 2005 (AN);	2
35 cfs	1998 (W)	1

Notes: W = Wet water year; AN = Above normal water year; BN = Below normal water year; D = Dry water year.

Our analysis indicates that, in some years, project operations could dewater FYLF egg masses that are deposited in less than 1 foot of water and take 3 weeks to develop. However, this effect would be rare and occur in only 4 years out of 30 at an instream flow of 13 cfs, and even less at higher minimum flows. Additionally, during many below normal, dry, and critical water years, project operation would maintain a stable minimum flow in the bypassed reach and prevent drops in stage that could dewater egg masses, providing a benefit over existing conditions (see appendix C). Results from field studies show optimum depth for FYLF egg masses ranges between 0.7 and 1.6 feet (Yarnell et al., 2011). The breeding season may also span several weeks (Yarnell et al., 2011) and eggs develop in 2 to 3 weeks (Lind and Yarnell, 2011). Given this variability in breeding timing, depth of egg masses, and development rates, the rare dewatering of some egg masses in the bypassed reach is not likely to affect the FYLF population in Battle Creek.

The Water Board and California DFW recommend postconstruction monitoring for FYLF and Cascades frog. Rugraw agrees with these recommendations. However, the recommended measures do not indicate how monitoring would be used to identify project-related effects, what level of effects would be considered adverse, or what mitigation would be implemented. Additionally, a multitude of variables could affect frog populations in the project area, and it is unclear how the monitoring would isolate project effects from other non-project effects. Because monitoring alone would not provide protection, habitat enhancement, or mitigation, we cannot analyze any benefits of this measure. We discuss measures to control bullfrog and chytrid fungus in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*.

Rugraw's proposals to avoid ground-disturbing activity on or near talus slopes to protect Sierra Nevada red fox and American pika, and avoid potential roosting habitat for bats, including the spotted bat, would avoid or minimize effects on these special-status mammals. However, noise associated with project construction could affect roosting spotted bats if construction occurs during the pup season (generally June 1–August 31) and is within the general area of active roosts. These effects would be unavoidable, but temporary.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Threatened and endangered species include those species listed as endangered or threatened under the ESA and those species that have been proposed for listing or are candidates for listing under the ESA. Rugraw identified such species that are known to occur or may occur within the project area using desktop research, literature review, and field habitat assessments of the project area conducted in May, June, and September 2013, as described in section 3.3.3, *Terrestrial Resources*. Staff furthered considered threatened and endangered species that may occur in the project area based on comments received from Interior.

Threatened and Endangered Plants

One federally threatened plant species, slender Orcutt grass (*Orcuttia tenuis*), could occur on proposed project lands. FWS listed slender Orcutt grass as a threatened species under the ESA on March 26, 1997 (62 FR 14338). This species occurs in the Sierra Nevada and Cascade mountain foothills and is found in vernal pool habitats, which are seasonal wetlands that fill with water during fall and winter rains and dry up during spring and summer. Blooming occurs from May through October.

Rugraw did not encounter this species and documented no vernal pool habitats during the 2013 field surveys of proposed project lands. However, FWS indicated that suitable habitat for slender Orcutt grass exists within the project vicinity and that this species is known to occur in the Dales area along Highway 36, about 20 miles west of the project site. FWS designated critical habitat for slender Orcutt grass on August 6, 2003 (68 FR 46684). Proposed project lands do not contain critical habitat for this species. The closest critical habitat for this species is about 15 miles west of the project.

Threatened and Endangered Wildlife

Six wildlife species listed as threatened, proposed threatened, or candidates for listing are known to occur, or may potentially occur, on proposed project lands. This section describes the status, habitat requirements, and likelihood of occurrence for each of these species.

California Red-legged Frog

FWS listed the CRLF (*Rana draytonii*) as a threatened species under the ESA on May 23, 1996 (61 FR 25813), and it is also listed as a California species of special concern. This aquatic frog is found in ponds or along stream edges with ample emergent vegetation within humid forests, woodlands, grasslands, and coastal scrub habitats. This species requires calm or slow-moving aquatic habitats, which may be permanent or ephemeral, for breeding. Throughout its range, bullfrogs, habitat loss, degradation, and modification are the primary threats to this species.

Rugraw conducted field surveys in 2013 using FWS's *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog*. Surveyors did not observe this species, although suitable habitat exists at two locations on proposed project lands. Of the six sites surveyed, suitable habitat was identified at the Gun and Rod Club Pond and Manton School Road Pond. The Gun and Rod Club Pond is located near the west-central portion of the transmission line corridor, east of Soap Creek. Manton School Road Pond is located near Manton School Road, but well removed from the proposed transmission line. As such, we do not expect project effects in this location. Both ponds are approximately 200 feet from the project centerline, and neither pond is located near the proposed diversion dam construction site or any streams that may be affected by the project. The presence of predatory fish and bullfrogs reduces the suitability of potential habitat at these sites. Similarly, marginal habitat was found at the South Fork Battle Creek powerhouse location. However, the physical characteristics of this site indicate that the presence of the CRLF is unlikely. Surveyors did not observe this species in previous surveys conducted in the area in 1996 and 1998. The nearest documented occurrence is about 44 miles south of the project site. FWS designated critical habitat for the CRLF on March 13, 2001 (66 FR 14626). Proposed project lands do not contain critical habitat for this species. The nearest critical habitat unit is about 45 miles south-southeast of the project site.

Northern Spotted Owl

FWS listed the northern spotted owl (*Strix occidentalis caurina*) as a threatened species under the ESA on June 26, 1990 (55 FR 26114), and it is listed as a California species of special concern. This large owl species requires mature forest stands with large trees and snags. The northern spotted owl prefers sites with both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy. Threats to this species include loss of habitat and competition with the barred owl (*Strix varia*) (FWS, 2011).

Surveyors did not observe the northern spotted owl during 2013 field surveys. Proposed project lands do not contain high-quality habitat for this species because of historical logging and other disturbances, and lack of mature forest stands. However, mixed conifer patches along Battle Creek provide marginally suitable nesting habitat. FWS designated critical habitat for the northern spotted owl on January 15, 1992 (57 FR

1796) and revised the designation on August 13, 2008 (73 FR 47326). The designation includes portions of western Washington, Oregon, and California. Proposed project lands do not contain critical habitat for this species. The nearest critical habitat unit is about 40 miles north-northwest of the project site.

Western Yellow-billed Cuckoo

FWS listed the western distinct population segment (DPS) of the yellow-billed cuckoo (*Coccyzus americanus occidentalis*) as a threatened species under the ESA on October 3, 2014 (79 FR 59991). This medium-sized bird requires dense, deciduous riparian forest with large areas of contiguous closed canopy and well-developed understories. It prefers willow and cottonwood trees for nesting. The western yellow-billed cuckoo also requires low elevation streams and rivers with unrestricted floodplains.

Surveyors did not observe the western yellow-billed cuckoo during 2013 field surveys. This species is not expected to occur on proposed project lands because of the lack of well-developed riparian habitat. The western yellow-billed cuckoo is extremely rare with an estimated 50 breeding pairs remaining in California. The decline of this species has been attributed to habitat loss. Remaining breeding pairs are believed to be limited to the Sacramento and Owens valleys. FWS proposed designation of critical habitat for western DPS of the yellow-billed cuckoo on August 15, 2014 (79 FR 48547), but this designation has not been finalized. Proposed project lands do not contain proposed critical habitat for this species.

Because there is no suitable habitat for western yellow-billed cuckoo in the project area, we have no further discussion of this species.

California Wolverine

FWS proposed the California wolverine (*Gulo luteus*) for listing under the ESA on November 15, 1994 (59 FR 58982). This species is also currently listed as threatened under CESA and is fully protected in California. This rare mammal species has been documented in a variety of forested habitats, but may also use shrub, wet meadow, and montane riparian habitats. Den sites include caves, cliffs, hollow logs, ground cavities, and under rocks. In the northern Sierra Nevada range, most documented sightings occur at 6,400 to 10,800 feet elevation.

Surveyors did not observe the California wolverine during 2013 field surveys. This species is not expected to occur on proposed project lands, because the elevation of proposed project lands is outside the range where this species is typically found. The nearest documented occurrence is approximately 3.8 miles north of the project site. FWS has not designated critical habitat for this species. Therefore, proposed project lands do not contain critical habitat for this species.

Because proposed project lands are outside the range of most reported California wolverine sightings, we have no further discussion of this species.

Valley Elderberry Longhorn Beetle

FWS listed the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) as a threatened species under the ESA on August 8, 1980 (45 FR 52803). FWS proposed this species for delisting on October 2, 2012 (77 FR 60237), but subsequently withdrew its proposal on September 17, 2014 (79 FR 55879). This beetle is exclusively associated with elderberry plants (*Sambucus* spp.), generally within riparian habitats, and requires mature plants (2 to 8 inches in diameter) for reproduction. This species and its host plant also occur in interior live oak and mixed oak woodlands, and chaparral in the Sierra foothills, where it prefers dry, rocky outcroppings of granite, where elderberry bushes are often observed growing out of cracks in the rock.

Surveyors did not observe the valley elderberry longhorn beetle or its host plan during 2013 field surveys. The nearest documented occurrence of this species is approximately 5.7 miles southwest of the project site. FWS designated critical habitat for the valley elderberry longhorn beetle at the time of its listing on August 8, 1980 (45 FR 52803). Proposed project lands do not contain critical habitat for this species. The nearest critical habitat unit is about 120 miles south of the project site.

Vernal Pool Fairy Shrimp

FWS listed the vernal pool fairy shrimp (*Branchinecta lynchi*) as a threatened species under the ESA on September 19, 1994 (59 FR 48136). This small aquatic invertebrate occurs exclusively in vernal pool habitats in northern California and Oregon. It closely resembles at least four other species of fairy shrimp that occur in similar habitats and can be difficult to distinguish (FWS, 2005).

Surveyors did not observe the vernal pool fairy shrimp during 2013 field surveys and documented no vernal pool habitat on proposed project lands. FWS designated critical habitat for the vernal pool fairy shrimp on August 6, 2003 (68 FR 46684), but proposed project lands do not contain critical habitat for this species. The nearest critical habitat unit is about 30 miles southwest of the project site.

Threatened and Endangered Fish

As described in section 3.3.4.1, *Threatened and Endangered Species, Affected Environment*, the proposed project has the potential to affect ESA-listed Central Valley spring-run Chinook salmon, Sacramento River winter-run Chinook salmon, and California Central Valley steelhead (if the BCSSRP successfully removes downstream barriers to anadromy in South Fork Battle Creek); and their designated critical habitat. South Fork Battle Creek up to Angel Falls is also considered EFH for Chinook salmon.

A brief description of the federally listed species, their designated critical habitat, and Chinook salmon EFH found in the project vicinity is presented in the following sections. More detailed information describing the life history, designated critical habitat, status, and occurrence of ESA listed fish species in the Battle Creek basin is available in Rugraw's Lassen Lodge Hydroelectric Project Biological Assessment (Tetra Tech, 2015b).

Central Valley Spring-run Chinook Salmon

The Central Valley spring-run Chinook salmon Evolutionarily Significant Unit (ESU) was listed as threatened by NMFS under the ESA on September 16, 1999 (64 FR 50394). The ESU comprises all naturally spawned populations of spring-run Chinook salmon in the Sacramento River and its tributaries. Critical habitat for Central Valley Spring-run Chinook salmon was designated on September 2, 2005 (70 FR 52488) and includes South Fork Battle Creek up to RM 21.4, which is about 0.8 mile upstream of the proposed powerhouse site and at the base of Angel Falls.

Historically, Central Valley spring-run Chinook salmon was one of the most abundant and widely distributed salmon races. The Central Valley drainage as a whole supported runs as large as 600,000 fish between the late 1880s and the 1940s (California DFW, 1998). This race once migrated into headwaters of tributaries to the Sacramento and San Joaquin Rivers. They now only exist in the main stem and in a few tributaries to the Sacramento River. Gold mining and agricultural diversions caused the first major declines in spring-run Chinook salmon populations. Further extirpations followed construction of major water storage and flood control reservoirs on the Sacramento and San Joaquin Rivers and their major tributaries in the 1940s and 1950s (Moyle et al., 1995).

Adult Central Valley spring-run Chinook salmon enter the Sacramento River from late March to July, over-summer in coldwater habitats, and then spawn from mid-August through early October. Incubation occurs from mid-August to mid-March, with rearing and emigration occurring from mid-August through April. Adult Chinook salmon require cold, freshwater streams with suitable gravel for reproduction. For maximum survival of incubating eggs and larvae, water temperatures must be between 41°F and 55.4°F (Moyle, 2002). After emerging between November and March, Chinook salmon fry tend to seek shallow, nearshore habitat with slow water velocities and move to progressively deeper, faster water as they grow. Spring-run juveniles frequently reside in freshwater habitat for 12 to 16 months.

Factors leading to the decline of spring-run Chinook salmon populations include gold mining and agricultural diversions (Moyle et al., 1995), loss of habitat in upper elevation headwaters blocked by dams, degradation of habitat conditions (e.g., water temperature), entrainment in water diversions, and overharvest. The human-caused factor that has had the greatest effect on the abundance of spring-run Chinook salmon runs is loss of habitat, primarily in the rivers upstream of the Delta. Water diversions and reservoir operations also affect streamflow, which influences the quantity, quality, and distribution of Chinook salmon spawning and rearing habitat.

Central Valley spring-run Chinook salmon are currently unable to access the proposed Lassen Lodge project reach because of existing downstream barriers. The most upstream passage barrier is the South Diversion Dam on South Fork Battle Creek. Analyses of habitat conditions in the upper South Fork Battle Creek indicate that natural production of spring-run Chinook salmon is unlikely to be sustainable in the project reach. The velocities, depths, or areas of gravel patches are poorly suited for spawning of spring-run Chinook salmon at the prevalent flows in September when spawning peaks.

Sacramento River Winter-run Chinook Salmon

The Sacramento River winter-run Chinook salmon ESU was listed as threatened under the Federal ESA on August 4, 1989 (NMFS, 1989). NMFS subsequently upgraded the Federal listing to endangered on January 4, 1994 (NMFS, 1994). The ESU includes all naturally spawned populations of winter-run Chinook in the Sacramento River and its tributaries, as well as populations from two artificial propagation programs, one at the Livingston Stone National Fish Hatchery and the other at Bodega Marine Laboratory (NMFS, 2005). NMFS designated critical habitat for Sacramento River winter-run Chinook salmon on June 16, 1993 (NMFS, 1993). The proposed project reach does not include critical habitat for Sacramento River winter-run Chinook.

Prior to construction of Shasta Dam, winter-run Chinook salmon spawned in the upper reaches of the Sacramento River, the McCloud River, and the lower Pit River. Spawning is now restricted to approximately 44 miles of the mainstem Sacramento River, immediately downstream of Keswick Dam (Yoshiyama et al., 1998). During the mid-1960s, more than 20 years after the construction of Shasta Dam, the winter-run Chinook population exceeded 80,000 fish (Reclamation, 1986). The population declined substantially during the 1970s and 1980s. In 1996, returning spawners numbered 1,337 fish and in 2001, returning adults were estimated to be 8,224 (California DFW, 2013).

Winter-run Chinook salmon spend 1 to 3 years in the ocean. Adults leave the ocean and migrate through the Delta into the Sacramento River from December through July with peak migration in March. Adults spawn from mid-April through August (Moyle, 2002). Egg incubation continues through October. The primary spawning habitat in the Sacramento River is above Red Bluff Diversion Dam at RM 243, although spawning has been observed downstream as far as RM 218 (NMFS, 2001). Downstream movement of juvenile winter-run Chinook salmon begins in August, soon after fry emerge.

One of the main factors in the decline of Chinook salmon is habitat loss and degradation. On the Sacramento River, Shasta Dam blocked access to historical spawning and rearing habitat. Other factors affecting abundance include the effects of reservoir operations on water temperature, harvesting and fishing pressure, entrainment in diversions, contaminants, predation by non-native species, and interaction with hatchery stock.

Cramer et al. (2015) determined that there is no capacity for winter-run Chinook salmon within the proposed project area, because natural stream temperatures during June through mid-August, when their eggs would be incubating, typically exceed levels lethal to eggs for several weeks during that period. However, winter-run Chinook could eventually stray into the lower reaches of South Fork Battle Creek as a result of the proposed Battle Creek Winter-Run Chinook Salmon Reintroduction Project.

Central Valley Steelhead

The Central Valley steelhead DPS was listed as threatened by NMFS on May 18, 1998 (63 FR 13347). Critical habitat for the Central Valley steelhead was designated by NMFS on September 2, 2005 (70 FR 52488) and overlaps 1.7 miles of the proposed bypassed reach extending up to Angel Falls at RM 22.3. Steelhead do not have current access to the critical habitat designated in the project action area because of downstream barriers, and the historical use of this habitat by steelhead is unknown.

Unlike Chinook salmon, steelhead typically rear in freshwater for 1 to 2 years before migrating to the Pacific Ocean. Steelhead may spawn more than once and return to the Pacific Ocean between spawning. From 1967 to 1993, the estimated number of steelhead passing the Red Bluff Diversion Dam (2 miles southeast of Red Bluff, California, on the Sacramento River) ranged from a low of 470 to a high of 19,615. While estimates vary, perhaps 10 percent of these fish spawned in Battle Creek and about 28 percent were believed to have spawned at Coleman National Fish Hatchery (Reclamation et al., 2006). In the Central Valley, naturally producing populations only occur in the Sacramento River and its tributaries. More than 90 percent of the adult steelhead in the Central Valley are produced in hatcheries (Reynolds et al., 1990).

Central Valley steelhead adult migration occurs from July through February. Spawning occurs from December through April and, possibly in May, in most years in streams with cool, year-round, well-oxygenated water (Reclamation et al., 2006). Incubation generally occurs from December through April. Following emergence, fry live in small schools in shallow water along streambanks. As the steelhead grow, they establish individual feeding territories.

Juvenile steelhead typically rear for 1 to 2 years in streams before emigration, which generally occurs in spring. Steelhead may remain in the ocean from 1 to 4 years, growing rapidly as they feed in the highly productive currents along the continental shelf (Barnhart, 1986). Steelhead return to natal streams to spawn as 2- to 4-year-old adults.

Central Valley steelhead population declines are attributed to blockage from upstream habitats, entrainment from unscreened diversions, hatchery practices, and degraded habitat conditions due to water development and land use practices. Dams at low elevations on all major tributaries block access to an estimated 95 percent of historical spawning habitat in the Central Valley (Reclamation et al., 2006).

Anadromous steelhead are currently unable to access the proposed project reach because of existing downstream barriers. The most upstream passage barrier is the South Diversion Dam on SF Battle Creek, 6 RM below the project action area (see figure 3-1). An abundant population of resident rainbow trout was the only fish species observed in the reach during the stream habitat survey. Quarterly electrofishing surveys by FWS just upstream of Panther Grade have also indicated that rainbow trout and riffle sculpin are the only fish species present above Panther Grade (Whitton et al., 2010).

Steelhead would be a more likely anadromous species to be present in the reach above Panther Grade, based on its ability to pass through difficult migratory barriers. The smaller gravel patch sizes that are present in that reach would be more suitable for steelhead than the larger-bodied Chinook salmon. Two barriers upstream of Panther Grade are largely impassable.

3.3.4.2 Environmental Effects

Slender Orcutt Grass, Vernal Pool Fairy Shrimp, and Valley Elderberry Longhorn Beetle

Project construction and operations would have no effect on slender Orcutt grass, vernal pool fairy shrimp, and valley elderberry longhorn beetle because these species are not likely to occur within proposed project lands.

Although these species and their habitats have not been documented on the proposed project lands, to avoid any potential effects of project construction and operation on these species and their habitats, Rugraw proposes to implement the measures discussed above under section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, including preconstruction inspections in all areas of suitable habitat for threatened, endangered and special-status plant species where surveys have not previously been conducted. Additionally, during design of the transmission line, Rugraw would inspect vegetation at the location of pole placements within unsurveyed areas to ensure there would be no disturbance to vernal pool habitat or elderberry plants. Rugraw also proposes to implement the measures discussed above under sections 3.3.1.2, *Geology and Soil Resources, Environmental Effects,* and 3.3.2.2, *Aquatic Resources, Environmental Effects*, which include steps that would be taken to preserve water quality in aquatic habitats. Interior requested formal consultation for potential effects on slender Orcutt grass and vernal pool fairy shrimp. Rugraw maintains that slender Orcutt grass and vernal pool fairy shrimp are not likely to occur in the project area and argues that no further consultation with Interior is necessary. However, to ensure that these species are not affected, as part of a construction plan, biological monitors (trained in identifying species and habitats) would investigate proposed areas of disturbance during project design to ensure that any sensitive species would be avoided by the project. If vernal pool habitat is discovered along the transmission line route, the route would be modified as necessary to avoid this habitat.

Interior also requested that Rugraw develop plans and BMPs for the conservation of listed species, following existing conservation guidelines and/or plans. Rugraw agrees to this request.

Our Analysis

Rugraw documented no vernal pool habitat on proposed project lands during 2013 field surveys. Two of the ESA-listed species, slender Orcutt grass and vernal pool fairy shrimp, are exclusively associated with vernal pool habitat. To ensure that these species are not affected, prior to construction, Rugraw would conduct additional inspections in all areas of proposed disturbance and inspect vegetation at the location of pole placements within previously unsurveyed areas during design of the transmission line. Also, as part of a construction plan, biological monitors (trained in identifying species and habitats) would be on-site during construction to ensure that any potential habitat would be avoided by the project. If vernal pool habitat is discovered along the transmission line route, the route would be modified as necessary to avoid this habitat.

Similarly, Rugraw's 2013 surveys documented no valley elderberry longhorn beetles or host plants. To ensure that the valley elderberry longhorn beetle is not affected by the project, Rugraw's preconstruction inspection of proposed disturbance areas would include confirmation that no elderberry plants are present in the area. Biological monitors would be on-site during construction, as noted above, to further ensure that this species is not affected.

Avoidance of vernal pool habitat and elderberry plants would also protect slender Orcutt grass, vernal pool fairy shrimp, and valley elderberry longhorn beetle. Additionally, preconstruction inspections would be conducted to ensure that these species and habitats are not present in proposed disturbance areas.

Measures designed to limit effects on aquatic resources, as previously described, would also reduce potential effects on vernal pool fairy shrimp. Similarly, proposed measures to limit effects on special-status plant species would also avoid effects on slender Orcutt grass, if present in the project area.

Rugraw's proposal to conduct monitoring using onsite trained staff, provide environmental training to staff, and implement other environmental measures as described under the terrestrial resources section, and measures to avoid or minimize effects on water quality as described under the geology and soil resources and aquatic resources sections, would reduce the likelihood of effects on threatened and endangered species.

Based on a lack of documented occurrence of these species and their habitat on proposed project lands and Rugraw's proposed measures to avoid or minimize effects on aquatic and terrestrial resources, the project would have no effect on slender Orcutt grass, vernal pool fairy shrimp, and valley elderberry longhorn beetle.

California Red-legged Frog

The CRLF is not likely to occur within proposed project lands. Rugraw's 2013 survey did not detect any evidence of this species; also, at locations where suitable habitat exists (Gun and Rod Club Pond and Manton School Road Pond), conditions were not favorable for the survival of the species because of the presence of predatory fish and bullfrogs. Furthermore, the Gun and Rod Club Pond is about 200 feet from the proposed transmission line route, about 10 miles from the proposed diversion dam construction site, and would not be directly affected by construction or operation activities. The Manton School Road Pond is located on Manton School Road, well removed from the proposed transmission line route. Marginal habitat at the South Fork Battle Creek diversion and intake location is not likely to support CRLF because of the physical characteristics of the site, including swift flow and minimal pool, emergent vegetation, or cover habitat.

To avoid any potential effects of project construction and operation on the CRLF and its habitat, Rugraw proposes to implement the measures discussed above for both terrestrial and aquatic resources. In addition, Rugraw proposes to develop an amphibian monitoring plan, in consultation with appropriate agencies, to monitor and evaluate long-term effects on the CRLF and other amphibian species, consistent with Water Board preliminary condition 13. Rugraw also proposes to prepare a CRLF protection plan in collaboration with FWS, consistent with Interior 10(j) recommendation 8, which would include measures for the conservation of CRLF to provide for and allow CRLF to become reestablished,[96] and protection from manageable threats. However, Interior's recommended plan would also include measures to control bullfrogs. Interior notes bullfrogs are predators of CRLF and are able to outcompete CRLF for resources. Interior, contends dams and impoundments associated with hydroelectric projects have been shown to improve conditions for the establishment of bullfrog populations (Fuller et al., 2011), by creating deep water breeding habitat, warming water temperatures, promoting bullfrog dispersal through pond level reductions, and modifying the natural hydrograph in streams below dams. Interior also requests formal consultation for potential effects on CRLF. Rugraw states Interior provides no evidence to suggest bullfrogs have contributed to the possible extirpation of CRLF on proposed project lands. Finally, Rugraw proposes to develop plans and BMPs for the conservation of listed species, following existing conservation guidelines and plans, consistent with Interior's request.

During the section 10(j) meeting, FWS noted that bullfrogs are known to carry and transmit chytrid fungus to other amphibian species. Chytrid fungus resides in aquatic habitats and causes a disease (*Chytridiomycosis*) known to result in high mortality of native frog populations (Vredenburg et al., 2010; Adams, 2017). FWS-recommended bullfrog control measures include decontamination of all equipment used instream to reduce the potential spread of chytrid fungus. FWS also noted that, if CRLF become

[96] We interpret re-establishment to mean natural immigration from nearby populations and not reintroduction through restocking or transport of individuals to the project area.

established in the project area, there would be potential for incidental take during implementation of bullfrog control measures.

Our Analysis

The CRLF has not been documented on proposed project lands and is not likely to occur because of unfavorable conditions at suitable habitat locations identified in Rugraw's study. The closest known population is over 40 miles away. Interior, however, has concerns that modifications associated with the proposed project could alter habitat conditions in such a way that would facilitate the establishment of bullfrog populations. We agree with Interior's analysis that in general, hydroelectric developments may modify existing habitat conditions to favor bullfrog. However, Interior provides no project specific rationale for this statement and it is unlikely that this general principal applies to the proposed project.

Interior's rationale states that hydro projects promote bullfrog dispersal by dropping water levels in breeding areas, triggering adults to disperse to better habitat. However, the proposed project would operate as run-of-river. The project would not store water for release at later times, so the water level in the impoundment is not expected to fluctuate as Interior suggests. Additionally, the project would preserve the summer low flow and winter high flow components of the natural hydrograph and is not expected to alter stream channel structure to favor bullfrog over CRLF.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, we do not expect the proposed project to have substantial effects on water temperature. Although some warming would occur under certain conditions, these effects are only expected to raise water temperature by 0.2ºC–0.5ºC. Under other inflow scenarios, the project would actually provide a cooling effect. Therefore, we find the project would not modify temperatures to benefit bullfrog over CRLF.

Further, while the final license application notes the presence of bullfrogs in the project area, the only sighting was at a man-made pond along Manton School Road, over 10 miles from the proposed project impoundment location and well removed from any hydraulic connection to South Fork Battle Creek. The proposed transmission line route is well removed from this pond (0.4 mile), and no project effects are anticipated to occur in this area. However, we agree that the small, 0.4-acre project impoundment could conceivably provide bullfrog breeding habitat. The state of California considers bullfrog an invasive aquatic species. If bullfrog colonize the impoundment, they could inhibit potential recolonization of CRLF through predation. Additionally, bullfrogs are carriers of chytrid fungus, an amphibian disease that is causing large reductions in frog populations throughout the western United States and has been documented in Tehama County (Olson et al., 2013). Chytrid fungus can also spread to uninfected drainage areas on contaminated clothing or equipment that is not properly treated to kill any potential chytrid fungus. If Rugraw's aquatic invasive species management plan includes: (1) surveys for bullfrog in the impoundment area; (2) bullfrog control measures in the impoundment following detection of bullfrogs; and (3) protocols for decontaminating equipment used in streams that have potential to spread chytrid fungus, the project would not promote bullfrog competition with CRLF or the spread of chytrid fungus.

Rugraw's proposed measures, including biological monitoring, providing environmental training to staff, and development of plans and BMPs following existing conservation guidelines, as recommended by Interior, would further reduce the likelihood of any effects on this species if later found on proposed project lands. Further, if Rugraw stops work and notifies FWS if any CRLF are observed during preconstruction surveys, potential effects would be reduced.

In addition to bullfrog control measures, Interior 10(j) recommendation 8 calls for a plan that would include measures for the conservation of CRLF to provide for and allow CRLF to become reestablished,[97] and protection from manageable threats. While Rugraw states it would prepare such a plan, Interior does not describe what specific measures the plan would include or how Rugraw would provide for reestablishment. Because there is no evidence CRLF currently occur in the project, there is no nexus for reestablishment measures. Therefore, we cannot analyze the benefits of this measure.

Because the CRLF has not been documented on proposed project lands, and Rugraw has proposed environmental measures to protect the species if later found, the project would have no effect on the CRLF. If CRLF are identified at the project in the future, there could be potential for incidental take during control measures for bullfrog. The Commission's standard license reopener policies would provide a mechanism to review potential project effects and protective measures at that time.

Northern Spotted Owl

Proposed project lands contain only a minimal amount of marginally suitable habitat, consisting of several mixed conifer patches along Battle Creek. If present, potential construction effects on this species would be limited to temporary disturbances from noise and the presence of construction equipment and crews. If present on proposed project lands during project operation, potential effects on this species would be limited to effects associated with the proposed transmission line (collision and electrocution) (see discussion in *Transmission Line Effects on Birds*).

To minimize the potential effects of project construction and operation on the northern spotted owl, Rugraw proposes to implement the measures discussed above under terrestrial resources. These measures include design and construction of the transmission line consistent with APLIC standards, and preparation of an avian protection plan, as recommended by Interior in 10(j) recommendation 7.

[97] We interpret re-establishment to mean natural immigration from nearby populations and not reintroduction through restocking or transport of individuals to the project area.

Interior also recommends that Rugraw develop plans and BMPs for the conservation of listed species, following existing conservation guidelines and/or plans. Rugraw agrees to this recommendation.

Our Analysis

Because limited northern spotted owl habitat occurs in the project area, the project is not expected to directly affect the northern spotted owl. However, if present, the northern spotted owl could be disturbed by noise from equipment and crews during construction and maintenance activities.

Rugraw's proposed measures to conduct monitoring using onsite trained staff, provide environmental training to staff, and develop plans and BMPs following existing conservation guidelines, as Interior recommends, would reduce the likelihood of effects on this species during project construction, should it occur.

Operation of the transmission line would present a long-term collision hazard for the northern spotted owl. However, mortality from collision with the line or electrocution is unlikely because of the limited amount of suitable habitat for this species in the project vicinity. Design and construction of the transmission line and preparation of an avian protection plan, as Interior recommends under 10(j) recommendation 7, would further reduce the likelihood of effects on the northern spotted owl by minimizing collision and electrocution risk, if this species were to occur in the project area.

By letter dated December 5, 2017, Commission staff requested concurrence from FWS on our determinations of effects under the ESA. FWS responded by letter filed December 21, 2017, that the northern spotted owl is not expected to occur in the project area and that "no further action pursuant to the Act is necessary."

Effects of Project Construction and Operation on Listed Fish Species

Potential effects of the proposed project on these federally listed fish species would be limited to effects on their designated critical habitat. Temporary construction actions and subsequent project operations have the potential to directly and indirectly affect designated Chinook salmon and steelhead critical habitat in the proposed project reach. For example, construction activities could affect critical habitat through temporary increases in turbidity, loss of food resources and habitat, degradation of water quality, construction debris, and disturbance and noise. Project operation could also affect critical habitat through an altered flow and water temperature regime in the proposed bypassed reach, which in turn could affect habitat quality and availability for spring-run Chinook salmon and steelhead.

Because access to the proposed project reach of South Fork Battle Creek is currently blocked by downstream barriers, the proposed project would have no direct or indirect effects on Central Valley spring-run and Sacramento River winter-run Chinook salmon or Central Valley steelhead. No effects are expected during construction because construction would occur well upstream of their current accessible range and should be completed before downstream barriers are removed pursuant to the BCSSRP. Project operations would also have no effect on Chinook salmon and steelhead because of their inability to currently access the project action area; even if the BCSSRP is successful in removing downstream man-made barriers to fish migration, it is not known if fish would be successful in passing the downstream natural barrier to fish migration at Panther Grade. However, if these anadromous species are successful in reaching the project area, protection and enhancement measures recommended for any license issued would be protective of those fish reaching the project area.

Our Analysis

Tailrace construction is the only construction activity that could affect critical habitat in the proposed project reach. Although there are project actions at the proposed intake area that could have immediate adverse effects on stream habitat near the intake, such as temporary increases in turbidity, these effects would likely be negligible by the time waters reach steelhead critical habitat located about 0.7 mile downstream of Angel Falls.

As proposed by Rugraw, all tailrace construction activities would be outside of the ordinary high water and in the dry. However, these activities could still result in increased turbidity and suspended sediment in South Fork Battle Creek from upslope areas. As described in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects*, implementation of an erosion and sediment control plan (and its associated BMPs) should minimize the amount of erosion and sedimentation resulting from project construction, and implementation of an SWPPP would minimize sediment releases and any elevation of the turbidity level that could result from construction disturbance. Additionally, any in-channel construction would occur within the designated work window or with an approved extension. As a result, no destruction or adverse modification of existing critical habitat in the project action area would result from project construction.

Project operation also could affect Chinook and steelhead designated critical habitat. In response to comments on the draft EIS, we have included a detailed analysis of the effects of proposed project operation on the Chinook and steelhead physical or biological features (PBFs) in appendix B of this final EIS. PBFs are those physical or biological features of a landscape that a species must have to survive and reproduce.

Central Valley Spring-run Chinook Salmon

Central Valley spring-run Chinook salmon do not currently have access to the project reach because of several downstream barriers. Because the species would not be present, the project would not directly or incidentally take, harm, or harass Chinook salmon; consequently, the proposed project would have no effect on Central Valley Chinook salmon. As discussed in more detail in appendix B, construction and operation of the proposed project may cause short-term increases in turbidity and alter the water temperature and flow regime in the proposed project's bypassed reach; as a result, the project may affect, but is not likely to adversely affect, designated critical habitat for Central Valley Chinook salmon.

Sacramento River Winter-run Chinook Salmon

Chinook salmon spawning is currently restricted to approximately 44 miles of the mainstem Sacramento River, immediately downstream of Keswick Dam. Because the species would not be present in the proposed project reach, the project would not directly or incidentally take, harm, or harass Chinook salmon; consequently, the proposed project would have no effect on Central Valley Chinook salmon.

Central Valley Steelhead

As is the case for Chinook salmon, steelhead currently do not have access to the proposed project reach because of several downstream barriers. Consequently, the proposed project would have no effect on Central Valley steelhead. As discussed in more detail in appendix B, construction and operation of the proposed project may cause short-term increases in turbidity and alter the water temperature and flow regime in the proposed project's bypassed reach; as a result, the proposed project may affect, but is not likely to adversely affect, designated critical habitat for Central Valley steelhead.

Essential Fish Habitat Analysis and Determination

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 water bodies 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). Foreign waters off Canada, while still salmon habitat, are not included in the Pacific salmon EFH because they are outside United States jurisdiction. The Pacific Coast Salmon Plan covers Chinook salmon, coho salmon, Puget Sound pink salmon (odd-numbered years only), and any other ESA-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.

EFH for Chinook salmon have been identified in the Upper Cow – Battle Creek HUC 18020118, which includes the proposed project reach.

We conclude that the proposed project would have only minor, short-term, adverse effects on Chinook salmon EFH. With this EIS, we are providing NMFS with our EFH assessment and request that NMFS provide any EFH conservation recommendations.

3.3.5 Recreational Resources

3.3.5.1 Affected Environment

Regional Recreational Resources

Lassen National Forest is the closest recreational resource to the project area in Tehama County. The southwest entrance to Lassen Volcanic National Park is located in nearby Mineral. The county includes three wildlife areas (Battle Creek Wildlife area, Merrill’s Landing Wildlife Area, and the Tehama Wildlife Area) and two ecological reserves (Butler Slough Ecological Reserve and Dales Lake Ecological Reserve). Both wildlife areas and ecological reserves offer opportunities for wildlife viewing, birdwatching, hunting, and hiking (California DFW, 2017b). Tehama County is also home to two state parks: the William B. Ide Adobe State Historic Park and the Woodson Bridge State Recreation Area (California Parks, 2017).

Existing Recreational Resources in the Proposed Project Area

No developed recreation sites or specific recreational land use designations lie within proposed project lands or within 1 mile of proposed project facilities. Some interspersed U.S. Department of the Interior, Bureau of Land Management (BLM) parcels are located in the project vicinity, but these sites are not open to the public. The majority of proposed project lands is in private ownership with limited public access, with all access roads to SPI land gated and locked. No overnight camping or fires are allowed on SPI land. The timberlands are patrolled by SPI, and signage indicates that trespassers will be prosecuted.

The closest developed recreation site to the project site is Battle Creek Campground, about 1.5 miles upstream of the diversion dam site. Lassen National Forest operates the 50-unit campground. The public land fronting South Fork Battle Creek is limited to a few hundred feet at the campground; adjacent land upstream is closed to public use. Along South Fork Battle Creek, the closest sites commonly used for boating are about 2.5 miles downstream.

Recreational Use

No formal recreational use occurs on proposed project lands. Outdoor recreation visitors may travel to nearby Lassen National Forest, Lassen Volcanic National Park, and BLM lands. Total visitation at nearby Lassen Volcanic National Park was 536,068 persons in 2016, with 85 percent of those visits occurring from June to October (National Park Service, 2017). Lassen National Forest, which also operates the nearby Battle Creek Campground, had an estimated 323,000 visitors in 2015; approximately 22 percent of those visitors stayed overnight, and 2 percent of those visitors traveled to remote wilderness areas (Forest Service, 2017a). The Forest Service's information page for Battle Creek Campground reports that the campground has heavy usage with 50 designated sites and a maximum of 8 people per site (Forest Service, 2017b).

River Recreation

Whitewater rafting 2.5 miles downstream of the project site is a moderately popular recreational activity. That stretch of South Fork Battle Creek is 11.5 miles long and is rated as a class II-V (V+) section by American Whitewater.[98]

South Fork Battle Creek is stocked with hatchery trout at the intersection of South Fork and Cold Creek, located immediately upstream of the proposed diversion dam site. The area is described as a mix of forest and meadow, with primitive camping available (California DFW, 2017c).

3.3.5.2 Environmental Effects

Rugraw neither proposed, nor have any other entities recommended, specific measures for protection or enhancement of recreational use within the project area.

Our Analysis

Limited to no public recreation use occurs on proposed project lands. However, during periods of project construction, travelers going to nearby recreation sites may be temporarily impacted by increases in traffic along California State Route 36 (State Route 36), and other local roads used to access the project site. The increase in traffic would be caused by construction vehicle travel to the site, and the seasonal increase of recreation

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[98] The American Whitewater Scale of River Difficulty: Class I, Easy: Fast moving water with riffles and small waves; Class II, Novice: Straightforward rapids with wide, clear channels that are evident without scouting; Class III, Intermediate: Rapids with moderate, irregular waves that may be difficult to avoid and that can swamp an open canoe; Class IV, Advanced: Intense, powerful but predictable rapids requiring precise boat handling in turbulent water; Class V, Expert: Extremely long, obstructed or very violent rapids that expose a boater to added risk; Class VI, Extreme and Exploratory: These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability, and danger.

travelers going to the Battle Creek Campground, or other destinations in Lassen National Forest, and private recreational sites upstream of the project site. Project operation would regulate streamflow in the 2.4-mile-long bypassed reach between the proposed diversion dam and powerhouse, which could affect any angler usage of that reach, although Rugraw proposes a minimum flow to protect aquatic habitat and fisheries in the reach.

Traffic effects would be minor and would not affect other aspects of the traveler's recreational experience at a final destination. Water withdrawals for power generation would have minor effects on any private recreation (anglers) that may occur in the bypassed reach, which would also be provided with a minimum flow when the project is operating. However, the project would not typically operate from July through September each year (depending on actual rainfall), so would not affect recreation during the peak season for the recreational uses common in the project vicinity. There may be minor, negative recreational effects related to disturbances to river recreation at the intersection of South Fork Battle Creek and Cold Creek, which is regularly stocked with hatchery trout. However, if California DFW determines that the stocking location is adversely affected by the project, another stocking location could be chosen to avoid those effects.

The whitewater rafting reach located downstream of the project site should not be affected by construction or operation of the project. While construction activities could result in increases in turbidity in the South Fork, proposed erosion control measures would prevent any higher turbidity levels from extending further downstream from the immediate project site. Project operation should not affect the downstream boating reach because all diverted flows would be returned to the South Fork at the powerhouse. Although some flow fluctuations could occur at the powerhouse during start-up and shut-downs, those fluctuations would be short-term and minor and should not be evident well downstream of the powerhouse.

To investigate the potential for whitewater boating, and any effects of the project on that boating, Rugraw organized a site visit in 1999 with representatives of local recreational organizations, FERC, SPI, and California DFW. During this site visit, all parties agreed the opportunities for whitewater rafting were marginal at best in the immediate project area. Hazardous conditions, including insufficient water flow and the lack of public access, were the primary reasons for the lack of whitewater rafting opportunities. Rugraw subsequently conducted a feasibility study of whitewater rafting in the project reach (Dimick, 1999), which concluded that this reach seldom has sufficient water for whitewater kayaking, and is potentially only navigable by an expert kayaker capable of running "extreme whitewater" around log jams, boulder sieves, and braided channels. In response to a request from the Water Board, Rugraw submitted the whitewater boating study to American Whitewater and Shasta Paddlers on July 19, 2001, with a request for any questions or comments. No comments were received from either group. Under current conditions, there is limited potential for whitewater boating in the project reach, so the proposed project would have no effect on boating.

3.3.6 Land Use and Aesthetics

3.3.6.1 Affected Environment

Regional Land Use

Proposed project lands are entirely within Tehama County, California. Land use in the county is guided by the Tehama County General Plan 2008-2028, adopted on March 31, 2009. Within proposed project lands, land use is mostly designated as Timber, with smaller areas of Resource Lands, Upland Agriculture, and Public.

Land Use within the Proposed Project Boundary

Land uses near the project site are predominantly forestry, rural development, and open space. Within proposed project lands, land cover is mostly forested or shrub/scrub vegetation, with some areas of grassland, developed open space, and low and medium intensity development. Table 3-12 in section 3.3.3.1, *Terrestrial Resources*, *Vegetation*, provides land cover by acres. Principal landowners in the immediate vicinity of the project are as follows:

- **SPI**: In 1993, SPI bought much of the land of Diamond International Corporation, totaling approximately 233,000 acres within the region. This property is broken down into the northern and the southern tracts. The project site lies roughly in the center of the northern tract, which comprises approximately 70,000 acres.
- **Richard Montarbo**: In 1997, Richard Montarbo purchased approximately 600 acres in Sections 23 and 14 from Rugraw. Rugraw formerly used the southern portion of this land, nearest State Route 36, for cabin rentals (Lassen Lodge). This area is zoned R1-B(86) which permits development of single-family residential units on lots no smaller than 86,000 square feet (approximately 2 acres). The remainder of the property (Section 23 and the southwest quarter of Section 14) is designated Public and Resources Lands.
- **BLM**: BLM has jurisdiction and manages a portion of lands, approximately 181 acres, in Sections 19 and 20 (R2E, TS28N) classified "Vacant Public Domain" land and manages this land for multiple uses. This land is situated on the north side of South Fork Battle Creek, and, because of the steep terrain and limited access, is used as open space. BLM has determined this parcel is available for disposal due primarily to its inaccessibility. No proposed project facilities cross BLM-managed lands.

The Forest Service also manages a small portion adjacent to the project boundary, which is part of Lassen National Forest. Most of the National Forest property is located to the east of the project boundary at a distance of about 0.5 to 0.75 mile from the closest proposed project facility. One small National Forest parcel (37 acres) is located within 25 feet to the north of the proposed transmission line where the route crosses Ponderosa

Way. This parcel does not appear to have any specific management prescription under the existing Lassen Forest Plan, and an existing road, Ponderosa Way, crosses the property. The majority of the Forest Service land in the area is managed for multiple uses under a General Forest Zone designation. These uses include timber harvesting; fish and wildlife habitat; watershed protection; and recreational activities such as camping, hiking, and fishing.

Aesthetic Resources

The visual setting of the project vicinity is characterized by the geologic features of South Fork Battle Creek. The drainage topography is a combination of steep canyon walls and inner canyon volcanic deposits incised by South Fork Battle Creek. The project site is adjacent and immediately downstream of Cold Creek Butte, a volcanic feature that provides a visual backdrop on the eastern end of the project site.

The overall project vicinity can be characterized by five distinct landscape types as follows:

- **South-Facing Slopes**: These are typified by a varied vegetative mosaic composed of isolated groupings of montane forest habitats associated with side drainages entering South Fork Battle Creek from the north. Inclusions of chaparral, talus, and rock outcrop are also observable on these slopes, which are generally light in color, with gray/green vegetation and red/brown geology and soils. The visual texture is predominantly rounded, low-profile forms, punctuated by isolated conical forms of individual and clumps of trees. Views and vistas are generally unobstructed.
- **Coniferous North-Facing Slopes**: These slopes are characterized by relatively dense and homogenous vegetative cover. Timber management activities, including harvesting and road construction, have increased the number of openings, thereby providing numerous inclusions that offer vegetative diversity. This slope also contains a utility corridor and State Route 36 on the southern edge of the project vicinity. These slopes are predominantly green, with red/brown soils in areas associated with roads and timber management activities. The visual texture is uniform, at the stand level. Timber management activities provide variation in size and density throughout, and views and vistas may be limited, except in areas where timber management activities and established uses (roads, utilities) have resulted in large, continuous openings in the canopy.
- **Mixed Woodland North-Facing Valley Slopes**: These slopes consist of dense cover of low growing chaparral species, punctuated by taller hardwood and conifer species. To a lesser extent, timber management activities have occurred in this type of landscape, particularly in the form of roads and skid trails constructed to access conifer stands. These slopes vary between blue and green, depending on the type and density of

vegetation. Soils and rock outcrops are typically various shades of red and brown. The visual texture has a high degree of diversity in shape and form, with the interaction of vegetation of geologic features and vegetation. The views and vistas are highly variable, particularly in areas where timber management activities have occurred.

- **Creek Floodplain**: This area is composed of relatively gentle slopes, a colluvial stream channel, localized alluvial deposits, and riparian vegetation. This landscape has elements of riparian and upland vegetation, including chaparral, hardwoods, and conifers. It also has flowing water and localized aquatic vegetation that contributes to the character of the landscape. Anthropogenic activities, including the old abandoned Highway 36 corridor, and timber management activities, have contributed to its character. Features such as bridges and abutments, paved roads, and are superimposed on the natural features of the landscape. This landscape has a wide range of colors, ranging from the blue-green water features to the black remnants of the old highway. The visual texture is highly diverse, and includes the sinuous feature of the creek and the distinct lines of roads and bridges. The views and vistas are largely dependent on the level of anthropogenic activity occurring in a specific area.
- **Creek Canyon and Gorge**: This landscape is characterized by cliff walls and outcrops of exposed basaltic lava flows, waterfalls and cascades, large boulders and intermittent vegetation (riparian and upland). The landscape is highly diverse in association with the topographic features of volcanic terrain. Although numerous roads and trails have been constructed on or adjacent to the rim of the gorge, little evidence of anthropogenic activity is observable below the rim. Colors within this landscape are a contrast of dark grey/brown rock, green vegetation, and the colors of water. The visual texture is dominated by canyon walls, with vegetation and channel features. The inner gorge with vertical walls in excess of 100 feet combined with the sinuous stream channel severely constrains views and vistas below the rim.

3.3.6.2 Environmental Effects

Land Use

The project would be located on land owned or managed by SPI, Tehama County, and other private landowners. Rugraw has long-term or Grant Deed easements on the property where project facilities would be located.

The proposed new 60-kV transmission line would come within 300 feet of several rural homes and other buildings at the western end of the project site. However, in these locations the line generally parallels existing roadways.

To avoid and minimize effects on land use, Rugraw proposes to implement the following measures:

- Delineate roads and work areas prior to the start of construction, and restrict project activities to those designated areas;
- Use existing roads to the maximum possible extent, constructing new access roads only when no feasible alternative exists;
- Limit access roads to a one-lane width of 12 feet whenever possible;
- Restore vegetation directly removed or disturbed during project construction as appropriate in accordance with California forestry regulations and best practices;
- Consult with neighboring landowners prior to construction and maintain an ongoing public contact to address any questions and concerns.

Our Analysis

As described previously in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, project construction would result in the permanent removal of 68.79 acres of vegetation and temporary disturbance of an additional 11.37 acres. Although some permanent removal of vegetation for the construction of project facilities is unavoidable, Rugraw's proposals to limit ground disturbance and removal of vegetation, and to clearly delineate work area boundaries, would minimize permanent effects. Rugraw's proposal to map and quantify disturbances by vegetation type would provide a baseline for establishing targeted restoration goals and facilitate successful restoration of vegetation in areas of temporary disturbance.

The project is not expected to affect land uses upstream of the diversion dam along South Fork Battle Creek or downstream from the powerhouse site. The 25-foot and 45-foot easements required for the transmission line, pipeline, and penstock ROW would require vegetation management to ensure safe operation and reliability of the project. These easements would not be eligible for reforestation in the future.

Rugraw's proposal to use existing roads to the maximum possible extent, constructing new access roads only when no feasible alternative exists, as well as limiting access roads to a one-lane width of 12 feet whenever possible, would mitigate effects on land use within the project area and it should not result in a significant change to the rural land use setting. Maintaining ongoing public contact with neighboring landowners would minimize long-term effects on land use in the project area. The transmission line route would not represent a significant conflict with the Timber, Resource Lands, and Upland Agriculture designations; however, a County Land Use Permit would be required. Rugraw is in discussion with the County and is updating the land use permit application to meet all current information requests. Rugraw's proposed transmission line route within the town of Manton, which would follow a greater distance along Hazen Road before turning north along South Powerhouse Road, would require only about 500 feet of new ROW clearing with fewer effects on land use, and would also serve as a better fire break along Hazen Road, which would result in beneficial effects for the community.

Local landowners and Cal Fire expressed support for this route during the January 3, 2018, public meetings (meeting transcripts, eLibrary Accession Nos. 20180212-4001 and 4002).

If Rugraw applies each of the mitigation measures indicated above, no significant long-term effects on land use are anticipated. However, as stated above, a County Land Use Permit would be required.

Aesthetics

Construction of the project would require vegetation clearing and ground disturbance. Some interspersed BLM parcels are located in the project vicinity, but these sites are not open to the public. The majority of proposed project lands is in private ownership with limited public access, with all access roads to SPI land gated and locked. Access roads would be used by maintenance crews and vehicles for inspection and maintenance activities of project facilities and the transmission line.

Rugraw has incorporated the following project-wide visual mitigation measures into the project design to help mitigate the visual contrast of the transmission line in the landscape:

- Remove all paint or discoloring agents applied to rocks or vegetation prior to or during construction activities that indicate limits of survey or construction activity upon completion of construction activities.
- To reduce visual contrast in areas where over-story vegetation is removed for access, pole locations, or conductor clearance, feather specific sections of the clearing edges (trees thinned/removed from the edge of the ROW out or away from the ROW boundary) to give a natural appearance, where not in conflict with regulatory requirements (e.g., NERC, Western Electricity Coordinating Council, and Occupational Safety and Health Administration requirements).
- Use wood poles to support the transmission line to blend with surrounding vegetation and reduce contrast.
- Use helicopter construction in specific areas to reduce effects on the ground surface.

Our Analysis

Overall, because proposed project lands are composed of natural forested landscapes with few visible structures, new project-related structures would affect the natural scenery. The typical viewer groups associated with the project would be residential and recreational users and motorists. Manton, a small town with a population of 423, is the closest developed community adjacent to the project site (approximately 0.7 mile from the proposed project transmission line). The residents of Manton, most of whom are located on the western portion of the project site, would be the most affected viewer group by the visual disturbance because they are the only residents near, and closest to, the transmission line. The town of Mineral would be closest to the eastern part of the project site at the diversion dam, but proposed project facilities would not be visible to residents because the project site is within a deeply incised valley.

Construction activities would be evident to the public, and construction equipment would be present along South Powerhouse Road and Hazen Road. Construction effects would only likely occur in the span of a few months during the spring. Some portions of the transmission line would have the poles and conductors installed by helicopter, which would result in less visual effect because there would be less landscape disruption during the construction phase.

Short-term visual and noise effects would be caused by heavy equipment clearing and excavating land and by construction of each project facility and feature. Construction of the project would require vegetation clearing and ground disturbance, which would result in permanent and temporary impacts on aesthetics on proposed project lands. Temporary disturbances to aesthetics would occur from project facilities construction, ROW clearing, and the establishment of temporary multi-use work areas. However, these impacts would only last for the duration of construction. Additional temporary impacts on aesthetics would occur as a result of periodic project operation and maintenance. Permanent impacts on aesthetics would occur primarily as a result of the construction of the diversion dam, powerhouse, switchyard, and substation. Permanent conversion of forested habitat to herbaceous or shrub habitats along the pipeline/penstock, station service line, and 12-mile-long, 40-foot-wide transmission line ROW would also be considered a permanent impact on aesthetics.

Although using helicopters to aid construction in specific areas would reduce effects on the ground surface, and removing all paint or discoloring agents used prior to or during construction would also limit adverse effects on aesthetics, short-term effects on aesthetics would still occur. Visual effects would also result from inspection and maintenance activities producing traffic and dust on access roads; however, these effects would be temporary and minor.

Impacts on aesthetics adjacent to the diversion dam, powerhouse, switchyard, and substation are expected to be marginal because no developed recreation sites or specific recreational land use designations lie within proposed project lands or within 1 mile of proposed project facilities. Although land would be permanently disturbed and converted to other uses, impacts on aesthetics would be marginal due to the limited public access to these areas.

The transmission line on the western portion of the project site would be visible adjacent to the roadway for a distance of about 1.5 miles on South Powerhouse Road and Hazen Road. The new transmission line would be located on the south side of Hazen Road and the east side of South Powerhouse Road. The proposed transmission line route would be primarily along Hazen Road and South Powerhouse Road and only require approximately 500 feet of new ROW (the distance from South Powerhouse Road to the switchyard), resulting in minor impacts on aesthetics. Permanent vegetation clearing associated with the construction of the transmission line not directly adjacent to roadways could be undertaken to maintain a clear and safe distance of trees from the transmission line. However, as stated in the vegetation section (section 3.3.3.2, *Terrestrial Resources, Environmental Effects*), Rugraw's proposals to limit ground disturbances and removal of vegetation, and to clearly delineate work area boundaries, would minimize these effects. Because the distance from South Powerhouse Road to the proposed switchyard is only 500 feet, the impacts on aesthetics associated with vegetation clearing not along the roadways would be minor.

Some motorists along State Route 36 may be able to view the southeastern-most portion of the transmission line. These users are commuters, local road users, or tourists. Tourists are generally more aware of overall appearance from the road, whereas local residents traveling the same routes frequently may be acclimated to the general view, but are more likely to be aware of visual changes. Regardless of the type of highway user, views are usually of short duration, with less foreground emphasis.

Implementation of other mitigation measures (feathering the clearing edges to reduce visual effects and using wood poles to support the transmission lines to blend in with the surrounding vegetation) would further reduce effects on aesthetics from project operation. However, project components, primarily the transmission line, would still be visible to residents, recreational users, and motorists. Although long-term effects on aesthetics are anticipated, they are not expected to be significant because of the distance from commuter roads and the town of Manton and its residents.

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Section 106 of the National Historic Preservation Act

Section 106 of the NHPA requires the Commission to take into account the effects of licensing a hydropower project on any historic properties and allow the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment if any adverse effects on historic properties are identified within the project's APE.

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 EIS, we also use the term "cultural resources" to include properties that have not been evaluated for eligibility for listing in the National Register. In most cases, cultural resources less than 50 years old are not considered eligible for the National Register. Cultural resources need enough internal contextual integrity to be considered historic properties. For example, dilapidated structures or heavily disturbed archaeological sites may not have enough contextual integrity to be considered eligible. TCPs are a type of historic property eligible for 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).

Section 106 also requires that the Commission seek concurrence with the California SHPO on any finding involving effects or no effects on historic properties. If TCPs have been identified, section 106 also requires that the Commission consult with interested Native American tribes that might attach religious or cultural significance to such properties.

If existing or potential adverse effects have been identified on historic properties, Rugraw must develop an HPMP to seek to avoid, reduce, or mitigate the effects. Potential adverse effects that may be associated with a hydroelectric project include any project-related effects associated with project construction and the day-to-day operations and maintenance of the project after issuance of a license.

By letter dated May 8, 2013, the Commission designated Rugraw as the Commission's nonfederal representative for carrying out day-to-day consultation in regards to the proposed project licensing effort pursuant to section 106 of the NHPA; however, the Commission remains ultimately responsible for all findings and determinations regarding the effects of the project on any historic property, pursuant to section 106.

Area of Potential Effects

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by the issuance of an original license within a project's APE. The APE, which is determined in consultation with the California SHPO, is the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE for the proposed project includes land within the proposed project boundary, plus land outside the project boundary where project operations may affect the character or use of historic properties or TCPs.

Rugraw defined an initial APE for the proposed project in a letter sent to the California SHPO on June 23, 2013. In its letter, Rugraw requested the SHPO's concurrence with the APE boundaries. In a subsequent letter to the California SHPO filed on September 3, 2013, Rugraw requested concurrence on a revised APE (letter from J. Tompkins, Vice-President–Senior Project Manager, Rugraw, LLC, Redding, CA, to J. Tudor, Associate State Archaeologist, California Office of Historic Preservation, Sacramento, CA, dated August 29, 2013). In a response filed on December 18, 2013, the California SHPO stated that it did not object with this definition of the APE (letter from C. Roland-Nawi, SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, CA, to J. Tomkins, Vice-President–Senior Project Manager, Rugraw, LLC, Tiburon, CA, dated October 3, 2013).

Rugraw subsequently revised the project APE and its application defines both a direct and "vertical APE" for the proposed project. The direct APE has the following elements:

- Diversions and intake structure: 2 acres
- Powerhouse: 3.5 acres
- Transition structure: 1 acre
- Multipurpose areas: 3.2 acres
- 120 foot-long by 2.4 mile-long penstock pipeline
- Potential tower location: 2.9 acres
- 120 foot-wide by 12 mile-long transmission line
- 120-foot-long by 0.4-mile-long station service line
- Transmission line pulling areas

The direct APE also includes the entire boundary of archaeological sites within the proposed areas of direct impact. The vertical APE extends about 0 to 60 feet above and 1 to 20 feet below the ground surface (depending on the height and depth of project facilities).

In a letter to Rugraw filed on November 30, 2015, the California SHPO acknowledged this definition of the revised APE (letter from C. Roland-Nawi, SHPO, Office of Historic Preservation, Department of Parks and Recreation, Sacramento, CA, to J. Tomkins, Vice-President, Senior Project Manager, Rugraw, Inc., Tiburon, CA, dated April 1, 2014).

Because licensing of a hydroelectric project is a single section 106 undertaking, the Commission recognizes a single APE that would encompass land both directly and indirectly affected by the proposed project (FERC, 2016).[99] This single APE for the proposed project would include both the direct and vertical APEs.

Cultural History Overview

The following summary is modified from Rugraw's cultural resources report (Tetra Tech, 2015c).

Prehistoric Background

The prehistory of the southern Cascade foothills has been structured into a five-phase cultural sequence based on previous archaeological investigations. The Deadman Complex (4,500 before present [BP]–3,000 BP) represents the earliest identified cultural

[99] See discussion of APEs in FERC (2016, page 123).

complex, followed by the Kingsley Complex (3,000–1,500 BP), the Dry Creek Complex (1,500–500 BP), the Mill Creek Complex (AD 1,500–1845), and the Proto-Historic Period (AD 1845–1911; Ethnographic Yana). Each complex is primarily characterized by changes stone tool and other technologies. Over time, large-sized projectile points, such as those typical of the Deadman Complex, decreased in size as populations began to favor smaller points associated with bow and arrow technology and the hunting of smaller game. Changes in ground stone tools also reflect the processing of differing plant resources. The appearance of hopper mortars at archaeological sites associated with the Dry Creek Complex suggests that the processing of acorns at this time became increasingly important. Twined cordage and twined and coiled basketry, first associated with the Mill Creek Complex, also indicates the increased importance of resource storage. A complex trade network associated with all five complexes is indicated in the archaeological record by the recovery of large coastal *Haliotis* and *Olivella* shell beads. However, other bead materials vary over time and ornamental artifacts became more distinctive. Finally, sites typical of the early Deadman Complex have been identified in both open-air and rock shelter settings. While evidence of single- and multi-family residential dwellings are found at Kingsley Complex sites, large earth-covered ceremonial or communal structures are typical of Mill Creek Complex sites.

The Proto-Historic Period represents the time of historic contact with indigenous populations. Artifacts associated with this time period include tools and artifacts manufactured from Euro-American glass and metal refuse Euro-American trade goods such as glass and porcelain beads may also be found at Proto-Historic Period archaeological sites. Typical structures at this time include small pole-frame structures covered with brush, branches, animal skins, or other materials. Natural rock shelters and caves were also used.

Ethnography

The proposed project area is located within the ethnographic territory of the Hokan-speaking Yana and Yahi. The Southern Yana inhabited the land in the vicinity of the proposed Project and resided in village and campsites situated along foothill and mountain drainages. Yana and Yahi subsistence strategies included hunting deer and other game, salmon fishing, and the gathering of local plant resources including bulbs, greens, seeds, and pine nuts. Acorns were a main dietary staple and were collected and processed for immediate consumption or for long-term storage.

Domestic implements included baskets, cordage and ropes fashioned from plant materials, hopper mortars, unifacially used manos and slabs, and boulder metates, mahogany digging sticks, and juniper, hazel and mahogany bows. Bone and antler was used to manufacture a variety of tools and ornaments including wedges, awls, flakers, fish gorges and hooks, harpoon toggles, needles, beads, and bird bone whistles. Gaming pieces were often fashioned from incised rodent teeth. Lithic materials procured for stone tool manufacture consisted primarily of basalt, and andesite, but chalcedony, petrified wood, and obsidian were also used. Trade with neighboring tribes occurred for some of these raw materials although relations between tribal groups varied.

Much of the ethnographic information on the Yana and Yahi was provided by Ishi (1861–1916), who was made world famous by the anthropologist Alfred Kroeber. Ishi was considered, at the time, to be the last known Yana/Yahi survivor in California, living most of his life with his immediate family in the isolated foothills around Lassen Peak. After more than 40 years on the run and in hiding, and after losing all of his family members through violence and disease, Ishi was finally captured alone in 1911 on the outskirts of Oroville. When discovered, Ishi was about 50 years old, and for the next 5 years he collaborated with anthropologists at the University of California, becoming a valued research assistant and contributor of first-hand pre-contact knowledge unequaled in annals of American anthropology.

Historic Background

The earliest non-native exploration of the project area occurred in the 1830s by beaver trappers and fur traders. Ranching, logging, and agricultural pursuits were the primary economic endeavors in Tehama County during the late 1840s. Sawmills were established on Paynes Creek and Digger Creek in the late 1850s followed by homesteads and ranches in the 1860s. By 1870, the community of Paynes Creek was established about 11 miles east of the project APE, and by the late 1800s the settlement of Manton was established on Digger Creek. Between 1876 and 1907, the Sierra Flume and Lumber Company and the Sierra Lumber Company, which operated between 1875 and 1878 constructed several saw mills, lumber yards, and factories to process harvested timber. One of the important mills constructed by the Sierra Flume and Lumber Company was the New Champion Mill, built in 1876. Segments of the Last Chance Ditch (CA-TEH-1824H) may be associated with the New Champion Mill and pass through the project APE. Another important timber company in the area was the Blue Ridge Flume and Lumber Company, constructed in 1872. This company held 44 miles of flume that carried lumber from mills in the Manton area to the Sacramento River. The Blue Ridge Flume and Lumber Company was later purchased by the Sierra Flume and Lumber Company. In 1878, the Sierra Flume and Lumber Company was purchased by the Sierra Lumber Company, which in 1902 established the important Diamond Match Company.

A number of trails and roads were constructed in the area to support the lumber industry. One of these roads, State Route 36, was extended in 1913 to follow the alignment of the Old Country Wagon Road. In 1921, it was paved and currently passes by Lassen Lodge at Paynes Creek (CA-TEH-2500H). Over the years, the highway alignment shifted. Since its completion in 1937, it has seen a number of improvements. A former segment of the highway (CA-TEH-2499H) passes through the project APE.

A second important road in the region was Ponderosa Way (P-52-002474), also known as the Ponderosa Fire Break and Truck Trail. In the 1930s, the Civilian

Conservation Corps established camps in the Manton and Paynes Creek areas to house workers participating in federally funded forestry efforts. Ponderosa Way was constructed by the Civilian Conservation Corps as part of a 1929 CAL FIRE plan to create a continuous firebreak to protect National Forest land along the western edge of the Sierra Nevada. This road also passes through the project APE.

These roads opened the region to tourism and a number of wagon stops arose in the 1910s and 1920s. Some of the wagon stops provided lodging, summer cabins, postal services, merchandise, fuel, and other amenities to travelers passing through on their way to Lassen National Volcanic Park. Lassen Lodge (CA-TEH-2500H) is one such location. Some grew into small towns and communities and became vacation destinations.

Previous Cultural Resources Investigations

Prior to conducting cultural resources fieldwork for the proposed project, Rugraw conducted background archival research at the Northeast Information Center of the California Historical Resource Information System at California State University, Chico. This work included the review of current survey databases, overviews, site records, and information about documented cultural resources, landscapes, and ethnographic resources. Historic maps and historic aerial photographs that could assist in identification of historic roads, features, and other areas of potential significance were also reviewed. Finally, a number of historic land patents were also identified during the record search. These patents may provide additional historical information about property ownership and land use which could shed light on documented historic sites in the project area.

The records search indicated that 24 archaeological surveys have been previously conducted within or crossing about 45 percent of the project APE (Tetra Tech, 2014). These surveys were deemed inadequate for current purposes because they were conducted more than 7 years prior and did not meet current standards for archaeological investigations in the State of California.

The previous studies documented 17 archaeological resources within one mile of the current project APE; of these, six were identified within the project APE, including two prehistoric sites (CA-TEH-595, CA-TEH-1490), one multi-component site (CA-TEH-1358/H), and three historic-period sites (CA-TEH-1824H, CA-TEH-2041H, CA-TEH-2113H,). Additionally, the record search indicated that eight buildings, structures, and objects have been previously recorded within one mile of the project APE. None of these were identified within the project APE; however, an unrecorded segment of a documented historic road (P-52-002474, Ponderosa Way) was later found to be within the APE and was recorded during fieldwork for the current project.

A review of ethnographic literature and consultation with the California Native American Heritage Commission (NAHC) did not result in the identification of any known TCPs or sacred sites within the project APE. However, NAHC provided Rugraw with a list of Native American organizations and individuals who could have interests in the project study area.

Identified Resources

Prehistoric and Historic Archaeological Resources

Rugraw conducted an archaeological survey of all accessible land within the project APE in August 2013 and January 2014. The results of the studies are provided in *Cultural Resources Inventory: Lassen Lodge Hydroelectric Project, FERC License No. 12486, Tehema County, California* (Tetra Tech, 2014, amended 2015c). A total of 299.9 acres was surveyed and 11 archaeological sites were identified consisting of four prehistoric sites and seven historic-period sites (table 3-14). These include the six previously recorded sites and five newly documented sites. Six isolated finds were also observed (four historic finds and one prehistoric find).

Table 3-14. Prehistoric and historic archaeological resources within or adjacent to the Lassen Lodge Project APE (Source: Tetra Tech, 2015c).

Resource Number	Description	National Register Eligibility
CA-TEH-595	Recorded in 1962 as a prehistoric “village site;” 3 flakes were observed in 1982 and site was described as destroyed. No cultural materials observed during current survey.	Unknown
CA-THE-1358/H	Multicomponent site; lithic and groundstone scatter; tools, midden, potential burials. Historic refuse scatter, two ditches	Unevaluated, assumed eligible
CA-TEH-1490	Prehistoric lithic scatter, tools, groundstone	Unevaluated, assumed eligible
CA-TEH-1824H	Segment of historic Last Chance Ditch (water conveyance, circa 1901)	Ineligible
CA-TEH-2041H	Historic saw mill remains and associated features and refuse	Ineligible
CA-TEH-2113H	Historic cans and glass refuse scatter	Ineligible
CA-TEH-2495	Prehistoric obsidian and basalt lithic scatter	Unevaluated; assumed eligible

Resource Number	Description	National Register Eligibility
CA-TEH-2496H	Historic refuse scatter: cans, nails, stove fragments, white improved earthenware, glass	Ineligible
CA-TEH-2497	Prehistoric obsidian and basalt lithic scatter	Unevaluated; assumed eligible
CA-TEH-2498H	Historic can scatter	Ineligible
CA-TEH-2520H	Historic refuse scatter: cans, white improved earthenware	Ineligible

Rugraw recommended that all historic-period archaeological sites were ineligible for listing in the National Register (Tetra Tech, 2014). Prehistoric site CA-TEH-595 was initially recorded in 1962 and described as a "destroyed" prehistoric village site (Treganza, 1962, as cited by Tetra Tech, 2014). The site was visited again in 1982 (Chavez and Hupman, 1983, as cited by Tetra Tech, 2014). At that time, only three flakes were observed. No artifacts were observed during fieldwork undertaken for the current project. This site has not been formally evaluated for listing in the National Register. The remaining four prehistoric sites or sites with prehistoric components (CA-THE-1358/H, CA-TEH-1490, CA-TEH-2495, CA-TEH-2497) have also not been evaluated for listing of the National Register. However, in its cultural resources report (Tetra Tech, 2014), Rugraw stated that these sites will be assumed to be eligible for listing under National Register Criterion D for their potential to provide information important to understanding prehistory. Isolated finds are generally not eligible for listing in the National Register. By letter dated April 2, 2014, the California SHPO concurred with all of Rugraw's eligibility recommendations for archaeological resources identified within the project APE.

Architectural Resources (Buildings, Structures, and Objects)

Rugraw conducted an architectural inventory of architectural resources (buildings, structures, and objects) of land within the project APE (Tetra Tech, 2014). This study identified one previously recorded feature (P-52-002474, historic Ponderosa Way) and seven new resources (table 3-15). All are historic roads or road segments except for a former wagon stop now known as Lassen Lodge (CA-TEH-2500H). Lassen Lodge consists of a series of structures, including a gas station, a lodge and three cabins, and other structures. Rugraw did not have property owner permission to access the lodge property. According to Rugraw's consultant (Tetra Tech, 2015c), on October 7, 2013, the California SHPO agreed that, for the purposes of the current project recordation and evaluation, only those features visible from the State Route 36 public ROW would suffice (personal communication from K. Forest, State Historian II, Office of Historic Preservation, Sacramento, CA, with J. Mates, Tetra Tech, Seattle, WA, October 7, 2013. Not filed).

Table 3-15. Architectural resources (buildings, structures, objects) within or adjacent to the Lassen Lodge Project APE (Source: Tetra Tech, 2015c).

Resource Number	**Description**	**National Register Eligibility**
CA-TEH-2499H	Former segment of State Route 36 (SPO Road 120 A 7)	Eligible
CA-TEH-2500H	Lassen Lodge	Ineligible
CA-TEH-2501H	South Powerhouse Road	Ineligible
CA-TEH-2502H	Manton School Road	Ineligible
CA-TEH-2503H	Hazen Road	Ineligible
CA-TEH-2504H	Unnamed dirt road	Ineligible
CA-THE-20505H	Unnamed dirt road	Ineligible
P-25-002474	Ponderosa Way (historic road)	Eligible

Rugraw recommended that only CA-TEH-2499H (former segment of State Route 36) and P-25-002474 (Ponderosa Way) would be eligible for listing in the National Register (Tetra Tech, 2014). As mentioned above, State Route 36 was originally constructed in the 1860s as an unpaved wagon road; in the 20th century, the portion of the road in the project area was constructed and paved allowing for the development of local resort businesses and transportation of agricultural products. Ponderosa Way was crucial for the protection of timber land threatened by wildfires. In its cultural resources report, Rugraw recommended that both roads no longer contain information potential, but they are both eligible for listing in the National Register under National Register criterion A for their association with events significant to local history. All six other architectural resources were recommended as ineligible for listing. In its April 1, 2014, letter, the California SHPO concurred with these recommendations. The SHPO also agreed that Rugraw had provided sufficient justification that the entire landscape surrounding the Lassen Lodge (CA-TEH-2500H) including the valley below the lodge do not contribute to the potential National Register eligibility of the lodge itself.

Traditional Cultural Properties

NAHC was contacted on October 31, 2007, to determine if the agency was aware of any sacred land in the vicinity of the proposed project (Tetra Tech, 2015c). As mentioned previously, NAHC had no knowledge of sacred sites in the area but provided Rugraw's cultural resources consultant with a list of Native American contacts. Letters were sent to these individuals and organizations in November 2007; these letters were followed up with phone calls. No comments were received. NAHC was contacted a second time in December 2012 to request an updated search of the sacred lands file and an updated list of Native American contacts. Although NAHC again responded that it was not aware of any sacred sites within the project area, the list of Native American contacts had expanded. The individuals and organizations on the list were contacted on April 30, 2013, and asked to provide any information they might have regarding potential Native American resources within the study area. A response was received from a representative of the Redding Rancheria who delegated consultation to a representative of the Maidu-Pit River-Atsugewi. Rugraw's cultural resources contractor invited this representative to attend field trips to the project area. These trips occurred on October 22, 2013, and December 2, 2013. Several of the archaeological sites within the project APE were visited. The attending tribal representative stated that the entire area is highly sensitive for prehistoric resources but that she was not aware of any ethnographic or sacred sites within the project APE.

No other Native American organizations or individuals provided information related to ethnographic sites or TCPs in the vicinity of the proposed project.

3.3.7.2 Environmental Effects

Project-related Effects on Cultural Resources

Project-related effects on cultural resources within the APE are likely to occur from project construction, operation and maintenance, use and maintenance of project roads, recreation, vandalism, and mitigation measures associated with other project environmental resources. Project effects are considered to be 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.

Rugraw has identified project effects on eligible or unevaluated resources that may occur as a result of project construction, maintenance, and operation (Rugraw, 2015). In the short term, construction activities associated with the proposed project may result in direct impacts on archaeological sites and historic structures in the project APE. Over the license term, other activities such as road maintenance and use could also affect these resources.

Prehistoric and Historic Archaeological and Architectural Resources

Within the project APE, the California SHPO determined that six historic-era archaeological sites and six architectural resources are ineligible for listing in the National Register. Under section 106, no further assessment of effects or continued management of these resources is required.

Five of the archaeological sites are prehistoric in nature. One of these sites (CA-TEH-595) is likely to have been destroyed by prior activities, and Rugraw stated that there likely would be no effects on the site from project-related activity (Tetra Tech, 2014). In its April 1, 2014, letter, the California SHPO concurred. The four remaining sites were not evaluated for listing in the National Register but are assumed to be eligible (CA-TEH-1358/H, CA-TEH-1490, CA-TEH-2495, and CA-TEH-2497).

Site CA-TEH-1358/H is bisected by paved Ponderosa Way and two other unpaved county roads. As a result, it has been affected by road construction and maintenance. Other activities such as logging, historic ditch construction, cattle grazing, fire, recreational use, deposition of modern refuse, and use of heavy machinery have also affected the site. Site CA-TEH-1490 is bisected by one unpaved road and has been affected by road construction. It has also been affected by fire, fire suppression activities, and prior test excavations (Hamusek, 1988, as cited by Tetra Tech, 2015c). In its April 1, 2014, letter, the California SHPO determined that these two sites would be adversely affected by use of the existing roads that traverse these sites for construction, operation, and maintenance purposes.

CA-TEH-2495 has been previously affected by fire, cattle grazing, recreational use (nearby gun club), and erosion. The site is located within the alignment of the proposed transmission line. CA-TEH-2497 is bisected by a paved SPI road and has been affected by past road construction and maintenance. It has also been affected by logging activities and pedestrian traffic. In its April 1, 2014, letter, the California SHPO determined that project-related impacts on these two sites can be avoided.

Two architectural resources (CA-TEH-2499H [segment of State Route 36], P-25-002474 [Ponderosa Way]) were also determined to be eligible for listing in the National Register. Rugraw stated that project construction and/or operation and maintenance activities would not include alteration, demolition, or destruction of these roads and that they would continue to be used in the same way that they are currently utilized. As such, Rugraw (Tetra Tech, 2014) recommended that the proposed project would not affect their historic integrity. In its April 1, 2014, letter, the California SHPO concurred. The SHPO also concurred that the proposed transmission line would not be visible from Lassen Lodge (CA-TEH-2500H) thereby resulting in no potential effects on this structure.

A representative of the Redding Rancheria expressed concern regarding potential project-related effects on all prehistoric archaeological sites identified within the APE and recommended that all of these sites be monitored during construction activities. The representative also stated that the remaining segment of Last Chance Ditch (CA-TEH-1824H) and the historic saw mill remains (CA-THE-2041H) should be preserved. In its April 1, 2014, letter, the California SHPO determined that these two resources are not eligible for listing in the National Register and concurred with Rugraw's recommendation that no treatment measures were necessary.

Management of Historic Properties

On November 30, 2015, Rugraw filed an HPMP to address current and future project-related effects on eligible or potentially eligible cultural resources within the APE with its final license application. The HPMP was prepared in accordance with the Advisory Council and Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects* (2002).

In its HPMP, Rugraw proposes several general management measures for historic properties, including but not limited to: (1) the appointment of a Cultural Resources Coordinator to oversee implementation of the HPMP over the license term; (2) an employee education program; (3) a plan for monitoring eligible or potentially eligible resources during construction and throughout the license term; (4) a plan for maintenance of project roads, including historic roads; (5) a plan to protect historic properties during road maintenance and rehabilitation; (6) plans for additional cultural resources inventories, site evaluations, and data recovery excavations (as needed); (7) an inadvertent discovery plan; (8) procedures for the treatment of human remains that may be identified during project-related activities; and (9) requirements for annual cultural resources reporting to the Commission, California SHPO, and participating Native American tribes. Additionally, the HPMP contains a list of activities that would be exempt from section 106 consideration.

The HPMP also discusses specific project effects on all resources and provides measures to avoid, lessen, or mitigate adverse effects on those that are eligible or potentially eligible for listing in the National Register. For project-related effects as a result of using roads that bisect sites CA-TEH-1358/H and CA-TEH-1490 during project construction, in its HPMP, Rugraw proposes to develop a "capping" plan in consultation with the California SHPO, Commission, Native American tribes, and others, as appropriate. Sites CA-TEH-2495 and CA-TEH-2496 would be fenced for avoidance and monitored during construction. If effects on any of these sites as a result of construction or future project operation and maintenance activities cannot be avoided, Rugraw would formally evaluate each site for its National Register eligibility. If determined to be eligible, appropriate mitigation would be determined in consultation with the California SHPO, Commission, Native American tribes, and others, as appropriate.

In April 2014, Rugraw provided a draft of the HPMP to the California SHPO for review and received comments on August 1, 2014 (email from J. Tudor, Associate State Archaeologist, California Office of Historic Preservation, Sacramento, CA, to J, Farrell, Tetra Tech, Seattle, WA, filed November 30, 2015). Most of the SHPO's comments were addressed in the HPMP prior to its submittal to the Commission. Appendix C of the HPMP provides the California SHPO's comments and the extent to which they were addressed in the revised document.

On May 8, 2018, Commission staff issued a draft PA with the associated HPMP for comment and review and received additional comments (filed on June 6, 2018), from the California SHPO.[100] In all, the California SHPO made 18 comments and recommendations on the HPMP including that: (1) the HPMP does not provide a clear process on any of the items included in the document involving the section 106 process, and that another section should be added that accounts for a consultation process for all situations; (2) a process for amending the APE should be provided in section 1.2.1; (3) more level of specificity and process is needed in Section 1.4 involving specific actions for managing historic properties; (4) the specific stipulation involving the dispute resolution process in the associated PA should be referenced in section 1.7.2; (5) a process for consultation involving post-review discoveries and inadvertent effects should to be included in Section 1.8; (6) there should be consistency between the role of the cultural resources coordinator and cultural resources specialist, beginning in section 4.1 and throughout the HPMP, and that the cultural resources specialist needs to meet Secretary of the Interior professional standards; (7) a process for additional consultation should be added in section 4.3 to insure that potential project effects are avoided involving potential redesigning of the project, and that "effects" should be used in place of "impacts" for closer adherence to section 106 nomenclature ; (8) an actual monitoring plan should be included in the HPMP as referenced in section 4.5; (9) more consistency and specificity is needed in section 4.6.1 involving project-related road maintenance activities; (10) a consultation process for road widening activities should be added in section 4.6.2; (11) a consultation process for archaeological site evaluations and data recover be provided in section 4.6.4 and provide more explanation why only one tribal monitor would be sufficient for such site excavation activities; (12) section 4.7 should specifically reference the parameters involving emergency situations as pointed out in section 106 under such circumstances; (13) section 5.1 should provide the capping plans for the several targeted archaeological sites, including the consultation process involving such procedures; (14) treatment measures in section 5.2 involving buildings, structures, and objects, should be reassessed especially in light of comments made on section 4.6.1 above; (15) additional consultation steps involving all of the consulting parties should be added in section 5.3 dealing with changes to specific treatment measures; (16) more detail is needed in in inadvertent discovery plan associated with appendix B, specifying who will be consulted with in the instance of a particular discovery and who will be contacted, and updating the list of emergency contacts in Table 1 and clarifying agency affiliation vs agency in cases dealing with the California SHPO; (17) there should be a consultation process detailing how the HPMP will be revised to address operation and maintenance activities in light of inadvertent discoveries; and (18) Volume 2 of the HPMP be made a part of the document for review and comment.

Our Analysis

Overall, Rugraw's HPMP provides measures that are consistent with most of the Advisory Council and Commission's 2002 guidelines. However, finalizing the HPMP to

[100] The California SHPO also commented on the draft PA, which we will address when we issue the final PA.

incorporate the California SHPO comments above would improve the document *for full compliance under section 106.* We also add the following comment below, which would clarify and enhance other aspects of the HPMP and should also be incorporated into a final HPMP.

The summary page of the HPMP (Tetra Tech, 2015c) states that the HPMP was developed in consultation with representatives of the Maidu-Pit River-Atsugewi, the Redding Rancheria, and the Greenville Rancheria. However, appendix D of the HPMP contains a matrix of Rugraw's tribal consultation efforts before June 2014, indicating that copies of the HPMP were provided to tribal organizations in April 2014 and that no comments were received. Section 1.6 of the HPMP states that a copy of the HPMP was submitted with the license application to the participating tribes, the U.S. Army Corps of Engineers, and others as appropriate for review. Appendix D of the HPMP should be updated to contain copies of any post-2014 correspondence received from the tribes with regard to the identification of cultural resources and development of the HPMP. If no comments were received, a statement to that effect should be included.

A new section after section 1.4 should be added to the HPMP that clearly outlines the roles and responsibilities of each of the consulting parties.[101]

In section 4.2 of the HPMP, Rugraw proposes to provide an interpretive aspect for its employees (and others) to foster a better understanding of the importance of the project region to Native Americans, but does not specify this further in section 4.2.1. Installation of interpretive signs at select areas, possibly at one or more of the key viewing areas, would adhere to the Advisory Council and Commission's 2002 guidelines and ensure that the visiting public is also made aware of the importance of the project region to Native Americans, its rich cultural history, and the importance of protecting cultural resources.

As pointed out by the California SHPO above, section 4.5 of the HPMP calls for the development of a monitoring plan, but no specific monitoring plan is provided in the HPMP. Additionally, sections 4.6.5 and section 5.1 of the HPMP specifies annual monitoring of eligible or unevaluated cultural resources (excluding site CA-TEH-595 which would be monitored every 5 years). However, the monitoring plan discussed in section 4.5 appears to pertain to construction monitoring only, and no description of annual monitoring is provided. An annual monitoring plan would specify those individuals who would participate in the monitoring, how the monitoring would be conducted, and how the results would be disseminated to consulting parties; results could be included in Rugraw's annual cultural resources report. Inclusion in the HPMP of these details, along with a specific monitoring plan would ensure that the California SHPO, Commission, Native American tribes, and other parties are regularly informed of

[101] This was also pointed out by the California SHPO in their June 7, 2018 letter, relating to the PA.

the condition of significant cultural resources within the project APE, both during construction and over the license term.

It is not clear why the sections of the HPMP pertaining to additional cultural resources inventories (4.6.3), archaeological site evaluation and data recovery excavation (4.6.4), and long-term historic property monitoring (4.6.5) are included in the HPMP as subsections of the main Road Maintenance and Rehabilitation section (4.6). These sections would also apply over the license term to resources and land in areas where no roads are present (e.g., CA-TEH-2495) and should be made separate sections within the General Treatment Measures section. As pointed out by the California SHPO above, other aspects of section 4.6 should be modified as well.

Although section 5.3 of the HPMP acknowledges that future changes to specific site treatment may be required and that consultation at such times with the Commission, California SHPO, Native American Tribes, and others, as appropriate, would be necessary, the HPMP should also include provisions for periodic review and revision of the HPMP (typically every 5 years) with the consulting parties over the license term. This review could be commensurate with the preparation of every fifth annual report.

3.3.8 Socioeconomic Resources

3.3.8.1 Affected Environment

Population and Households

The project would be located between Paynes Creek and Mineral, California, in northeastern Tehama County. The county is largely rural and lies approximately 100 miles north of Sacramento.

According to 2011-2015, 5-year American Community Survey estimates, the population of Tehama County was 63,152 in 2015 (U.S. Census Bureau, 2015a). The county population in 2000 was approximately 56,039, and has grown at a 0.8 percent combined annual growth rate over the past 15 years. A total of 70.1 percent of the county population was white alone in 2015, compared to 38.7 percent of the population at the state level (U.S. Census Bureau, 2015b).

The three closest towns to the project site, Manton, Mineral, and Paynes Creek, had populations of 423, 199, and 70, respectively, in 2015. The two closest cities, Red Bluff and Redding (Shasta County), had populations of 14,065 and 91,063, respectively (U.S. Census Bureau, 2015a). In Tehama County, there were 27,220 total housing units in 2015, with a vacancy rate of 12.9 percent (U.S. Census Bureau, 2015c)

The median age in Tehama County was 40.5 years in 2015, approximately 5 years older than the state median of 35.8 years (U.S. Census Bureau, 2015b). Median household income in Tehama County was $41,001 in 2015; per capita income was $21,263; and 19.8 percent of the population in Tehama County had incomes that fell below the federal poverty level. For comparison, the state of California’s poverty rate was 16.3 percent in the same year. In 2015, the median household income at the state level was approximately 51 percent higher than the county, at $61,818. State per capita income in 2015 was $30,318, approximately 43 percent higher than Tehama County (U.S. Census Bureau, 2015d).

Employment and Income

In 2016, Tehama County was highly specialized in agriculture, forestry, fishing and hunting relative to the state, with 1,926 employees in the sector. Using the state as a reference area, employment in that sector at the county level had a location quotient of 4.74, indicating that the county had more than four times as many employees in this sector than was true at the state level. The largest sector by total employment was health care and social assistance, which accounted for more than 19 percent of all employment at 2,558 employees in 2016. Other sectors in the county with high levels of employment include retail trade, manufacturing, and transportation and warehousing (U.S. Bureau of Labor Statistics, 2016). The unemployment rate in the county was 7.1 percent in 2015, compared to 6.2 percent at the state level (U.S. Census Bureau, 2015d).

Total wages in Tehama County equaled approximately $534 million in 2016. The largest sector, by total annual wages, was health care and social assistance, which accounted for 17.7 percent of all wages. Other important sectors include manufacturing at 16.8 percent, and transportation and warehousing at 14.1 percent (U.S. Bureau of Labor Statistics, 2016).

Recreation and Visitation

According to Visit California, visitor spending in Tehama County supported $130 million in direct spending, and supported 1,610 jobs in 2016. Total tax revenue generated from visitor spending was $10 million (Visit California, 2017).

Agriculture and Irrigation

Farm-related income was estimated at $13.8 million in 2012 in Tehama County, of which forest products (including sales of standing timber) accounted for approximately 6.1 percent at $847,000 (USDA-NASS, 2014). According to the California State Board of Equalization, $9.7 million dollars' worth of timber was harvested in Tehama County in 2016, the eighth-highest value out of the 58 counties in California (California State Board of Equalization, 2017).

3.3.8.2 Environmental Effects

Project Construction and Operation

During the construction period, the project would employ approximately 30 people during the peak of activity. Average annual payroll during construction would be approximately $75,000 per person, assuming a pay scale typical for union employment; an average work force of 25 persons; and a typical distribution of supervisory, skilled, and unskilled labor. Over a 12- to 18-month construction period, this average monthly payroll would yield a total payroll of approximately $900,000 to $1,250,000. Estimated local and payroll taxes during the construction period would equal approximately $130,000 to $200,000.

Following construction, three full-time jobs are expected to be maintained for the operational life of the project. These jobs would result in minimal increase in payroll and other local taxes (including hotel taxes, gas taxes, and user fees), as well as an estimated $120,000 in annual property tax revenue for Tehama County (based on current design).

Our Analysis

Some additional direct and indirect economic benefits may occur from purchase of local construction materials; additional household spending in the area by full-time and construction personnel would result in small induced economic benefits. The cities of Red Bluff and Redding are within commuting distance of the project, and a large portion of the skilled work force likely would commute from those areas. The housing vacancy rate, 12.9 percent in 2015, suggests adequate housing is available (U.S. Census Bureau, 2015c). No residences or businesses would be displaced by project construction, and the labor force within commuting distance is expected to be adequate to meet project needs.

There may be increased traffic on State Route 36 as a result of the increase in the number of commuting workers, and from transportation of equipment and supplies. Increased traffic, activity, noise, dust, and general disturbance would occur in the construction areas of the proposed diversion works, the penstock route, the powerhouse, and along the transmission line ROW.

All construction activities would occur on private property or Tehama County land, with none planned on state or federal lands. The planned construction would not remove any public land from current recreational use. Downstream, there are limited uses of the river for angling, rafting, and kayaking. The planned timing of water withdrawals and proposed erosion control measures are expected to minimize effects on those users, and any project-related effects are expected to have a negligible effect on the regional economy. The small size of the expected workforce, both during construction and operations, is not likely to significantly affect recreationally based economic activity in the region. Generally, because of the small size of the project and its remote location, effects on county recreational users are expected to be negligible.

Construction and operation of the project would occur entirely on private property or Tehama County land and not result in permanent removal of land from agricultural use (either for grazing or for timber). Because of the small number of additional employees supported during both construction and operations, the project would have minimal effects on agricultural uses in the area. The project would not be used to provide water for general use or irrigation and have no effect on irrigation in Tehama County.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Lassen Lodge Project would not be constructed. The physical, biological, or cultural resources of the area would not change, and no electrical generation from the project would occur. The power that would have been developed from a renewable resource would have to be replaced from nonrenewable fuels. Existing fish and wildlife habitat and usage along about 2.5 miles of South Fork Battle Creek and 12 miles of the transmission line corridor would be preserved, and existing aquatic habitat in South Fork Battle Creek would remain available for anadromous species if the BCSSRP is successful in removing downstream barriers to anadromy in South Fork Battle Creek.

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4.0 DEVELOPMENTAL ANALYSIS

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

In this section, we look at the Lassen Lodge Project's use of South Fork Battle Creek for hydropower purposes to see what effect various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[102] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a 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 project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA 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.

Table 4-1 summarizes the assumptions and economic information we use in our analysis. This information was provided by Rugraw in its license application or assumed by staff where noted. We find that the values provided by Rugraw are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; estimated future capital investment required to maintain and extend the life of plant equipment and facilities; licensing costs; normal operation and maintenance cost; and Commission fees.

[102] 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.

Table 4-1. Parameters for economic analysis of the Lassen Lodge Project (Source: Rugraw, as modified by staff).

Economic Parameter	Value	Source
Proposed capacity	5.0 MW[a]	Rugraw
Proposed average annual generation	24,936 MWh[b]	Rugraw
Construction cost	$13,500,000[c]	Rugraw
Annual operation and maintenance cost	$210,000/year[d]	Rugraw
Cost to prepare license application	$3,900,000[e]	Rugraw
Period of economic analysis	30 years	Staff
Cost of capital (long-term interest rate)	8 percent	Staff
Federal tax rate	35 percent	Staff
Local tax rate	3 percent	Staff
Annual power value ($/MWh)	$30.35[f]	Staff

[a] Rugraw, November 2015, Initial Statement, page IS-2.

[b] In the final amended license application, Rugraw states that the project would be shut down at a flow of about 450 cfs, but in a letter filed on June 29, 2018, Rugraw clarifies that the project would begin its shutdown procedure at 418 cfs (letter from Charlie Kuffner, Rugraw, LLC, to Savannah Downey, California State Water Resources Control Board, dated June 28, 2018). This change would slightly reduce the annual generation as proposed from 25,000 MWh to 24,936 MWh.

[c] Rugraw, March 31, 2017, response to Commission's additional information request dated February 24, 2017.

[d] Rugraw, March 31, 2017, response to Commission's additional information request dated February 24, 2017, reports $210,000/year in 2017 dollars excluding the cost of environmental mitigation measures. Costs include operation staff ($90,000), annual ROW expense ($25,000), annual utilities and operational equipment expense ($20,000), annual maintenance reserve ($50,000), and annual interconnection operator operation and maintenance fees ($25,000).

[e] Rugraw, March 31, 2017, response to Commission's additional information request dated February 24, 2017.

[f] The energy rate used is based on the Energy Information Administration's Annual Energy Outlook for 2017 (EIA, 2017).

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 summarizes the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and project cost for each of the action alternatives considered in the this EA: Rugraw's proposal and the staff alternative.

Table 4-2. Summary of the annual cost of alternative power and annual project costs for alternatives for the Lassen Lodge Project (Source: staff).

	Rugraw's Proposal[a]	**Staff Alternative**	**Staff Alternative with Mandatory Conditions**
Installed capacity (MW)	5	5	5
Annual generation (MWh)	24,936	24,936	24,936
Annual cost of alternative power	$756,810	$756,810	$756,810
($/MWh)	30.35	30.35	30.35
Annual project cost	$2,199,350	$2,169,890	$2,187,780
($/MWh)	88.20	87.02	87.74
Difference between cost of alternative power and project cost	($1,442,540)	($1,413,080)	($1,430,970)
($/MWh)	(57.85)	(56.67)	(57.39)

[a] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the project cost is greater than the cost of alternative power.

4.2.1 Applicant's Proposal

Under Rugraw's proposal, the Lassen Lodge Project would have an installed capacity of 5.0 MW and generate an average of 24,936 MWh of electricity annually. The average annual cost of alternative power would be $756,810, or $30.35/MWh. In total, the average annual project cost would be $2,199,350, or about $88.20/MWh. Overall, the project would produce power at a cost that is $1,442,540, or $57.85/MWh, more than the cost of alternative power. The applicant may be able to negotiate a contract in the power market providing a higher energy value than the EIA energy rate we used. Under our Mead analysis, if the Commission issues a license, the applicant then must decide based upon the market whether to pursue the project.

4.2.2 Staff Alternative

The staff alternative includes the same developmental components as Rugraw's proposals and, therefore, would have the same capacity and energy values described above for Rugraw's proposals. For the Lassen Lodge Project, table 4-3 shows the staff-recommended additions, deletions, and modifications to each applicant's proposed environmental protection and enhancement measures, and the estimated cost of each.

For the Lassen Lodge Project, based on an installed capacity of 5.0 MW and an average annual generation of 24,936 MWh, the cost of alternative power would be $756,810, or $30.35/MWh. The average annual project cost would be $2,169,890, or about $87.02/MWh. Overall, the project would produce power at a cost that is $1,430,970, or $57.39/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative with Mandatory Conditions

The staff alternative with mandatory conditions includes the same developmental components as Rugraw's proposal and, therefore, would have the same capacity and energy value described above for Rugraw's proposal. This alternative also includes five preliminary water quality certificate conditions recommended by the Water Board that are not included in the staff alternative. For the Lassen Lodge Project, table 4-3 shows the staff-recommended and mandatory condition additions, deletions, and modifications to each applicant's proposed environmental protection and enhancement measures, and the estimated cost of each.

For the Lassen Lodge Project, based on an installed capacity of 5.0 MW and an average annual generation of 24,936 MWh, the cost of alternative power would be $756,810, or $30.35/MWh. The average annual project cost would be $2,187,780, or about $87.74/MWh. Overall, the project would produce power at a cost that is $1,430,970, or $57.39/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 gives the cost of each of the environmental enhancement measures considered in our analysis. Environmental measures with no added cost are not included in table 4-3. 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. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of operating the Lassen Lodge Project (Source: staff).

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
Geology and Soils				
1. Stockpile natural topsoils and replace, regrade, and revegetate disturbed areas with native vegetation after construction of project facilities.	Rugraw, staff	$15,000	$0	$1,150
2. Restore disturbed areas with native vegetation using seed mixes recommended by California DFW.	Staff	$0[d]	$0	$0
3. Develop an SWPPP that will describe the erosion and sedimentation control practices planned for implementation during project construction.	Rugraw	$260,000	$0	$20,000
4. Modify the proposed SWPPP to include measures for controlling runoff from the construction sites, preventing material from contacting or entering surface waters, and as recommended by the Water	Staff	$290,000[e]	$0	$22,310

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
Board, using washed riprap, rocks, and gravel for construction adjacent to or in the watercourses (Water Board preliminary condition 19).				
5. Store spoils from project construction in areas that limit erosion of spoil material and prevent runoff into aquatic habitats.	Rugraw, staff	$25,000	$0	$1,920
6. Surface permanent roads with gravel to a depth and quantity sufficient to maintain a stable road surface.	Rugraw, staff	$100,000	$0	$7,690
7. Install cofferdams, silt fences, or other structures to isolate in-water work areas.	Rugraw, staff	$10,000	$0	$770
8. Implement control measures for erosion, excessive sedimentation, and turbidity at the commencement of, and throughout, any ground-clearing activities, excavation, or other project activities that could result in erosion and sedimentation discharges to project waters	Water Board, staff	$0[d]	$0	$0

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
(Water Board preliminary condition 18).				
9. Develop a construction plan that incorporates the specific measures proposed for construction, and file the plan with the Commission for approval.	Staff	$15,000[f]	$0	$1,150
Aquatic Resources				
10. Develop a DSMP to annually sluice sediments from the project's reservoir during annual high flows (greater than 400 cfs) or when flows are greater than 108 cfs if sluicing is deemed necessary.	Rugraw	$0	$10,000	$6,500
11. Develop a DSMP that includes requirements to: (1) sluice sediment; (2) remove woody debris impinged on or behind the dam, and place it downstream back into the active channel; and (3) monitor nine channel metrics (NMFS and Interior recommendation 6).	NMFS, Interior	$0	$90,000[f]	$58,500

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
12. Modify the proposed DSMP to include consultation with the Water Board and California DFW in low-flow years to determine if the sluicing of sediments should occur at flows less than 400 cfs, monitoring turbidity to document any project-caused exceedance of the Basin Pan's objectives, and periodically surveying the project impoundment for sediment and woody material deposition.	Staff	$10,000[g]	$11,580[g]	$8,300
13. Maintain upstream and downstream fish passage during construction (California DFW recommendation 4).	Rugraw, California DFW, staff	$10,000	$0	$770
14. Provide a fish screen on the intake and downstream fish passage at the project diversion works (California DFW recommendation 4).	Rugraw, California DFW, staff	$0[h]	$5,000	$3,250
15. Provide upstream fish passage at the project diversion works (California DFW recommendation 4).	Rugraw, California DFW	$300,000[i]	$5,000[i]	$26,330

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
16. Coordinate with California DFW on the design of the downstream fish passageway and fish screen at the diversion (California DFW recommendation 4).	Rugraw, California DFW, staff	$0	$0[d]	$0
17. Design the upstream fish ladder according to design standards listed in California DFW recommendation 7 (California DFW recommendation 4).	Rugraw, California DFW	$0	$0[d]	$0
18. Implement a minimum instream bypass flow of 13 cfs, or inflow, whichever is less, and do not begin operations until flows reach 18 cfs (California DFW recommendation 1).	Rugraw, California DFW, staff	$0	$10,000	$6,500
19. Implement a minimum instream bypass flow of 35 cfs, or the natural flow, if less, (NMFS and Interior 10(j) recommendation 1).	NMFS, Interior	$0	$184,800[j]	$120,120
20. Implement a minimum instream bypass flow of 35 cfs from November 1 to	NMFS (Alternative 1)	$0	$151,630[k]	$98,560

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
March 1, 30 cfs from March 2 to May 31, and 25 cfs from June 1 to October 31 (NMFS alternative recommendation 1).				
21. Implement a minimum instream bypass flow of 8 cfs, or the natural flow if less.	Rugraw (alternative)	$0	-$55,840[f] (compared to the proposed minimum flow—represents gained energy 1,840 MWh)	-$31,270
22. Monitor streamflow on upstream side of the diversion structure, in the bypassed reach just above the powerhouse tailrace, and below Ponderosa Way Bridge (California DFW recommendation 2).	Rugraw	$50,000	$20,000	$16,850
23. Monitor streamflow at a gage located downstream of the diversion dam and fish ladder (California DFW recommendation 1).	California DFW	$10,000[f]	$10,000[f]	$7,270
24. Monitor streamflow at seven locations: (1) just upstream of the diversion dam; (2) at the intake header box; (3) just upstream of Angel Falls; (4) upstream of	NMFS, Interior	$90,000[f]	$30,000[f]	$26,420

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
Spring #4, just downstream of Angel Falls; (5) at the powerhouse discharge; (6) just downstream of the powerhouse (or just upstream of Panther Grade); and (7) just downstream of Panther Grade (NMFS and Interior 10(j) recommendation 3).				
25. Conduct real-time stream gage monitoring at the following locations: (1) within the project impoundment, (2) just downstream of the diversion dam, and (3) in the bypassed reach just upstream of the Spring #4 influence.	Staff	$20,000[f]	$15,000[f]	$11,290
26. Develop a streamflow monitoring component of an operation compliance monitoring and reporting plan that includes the staff-recommended gaging in item 25 above.	Staff	$10,000[l]	$10,000[l]	$7,270
27. Provide a ramping rate of change that will not exceed 0.1 foot of stage change per	Rugraw, California DFW	$0	$5,000	$3,250

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
hour (California DFW recommendation 2).				
28. Provide a ramping rate of change that will not exceed 1 inch of stage change per hour (NMFS and Interior 10(j) recommendation 1).	NMFS, Interior, staff	$0	$5,000[m]	$3,250
29. Develop a flow gage monitoring plan (NMFS and Interior 10(j) recommendation 3).	NMFS, Interior	$10,000[f]	$0	$770
30. Conduct snorkel surveys for anadromous fish upstream of Panther Grade within a month of each 400 cfs or greater flow event and when Chinook salmon and steelhead have passed upstream of Coleman, Inskip, and South Diversion dams.	Rugraw	$25,000	$4,790[n]	$5,040
31. Develop an annual SMP with seasonal monitoring (NMFS and Interior 10(j) recommendation 4).	NMFS, Interior	$25,000[f]	$25,000[f]	$18,170

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
32. Conduct genetic sampling of rainbow trout fry, and, if anadromous steelhead are detected in the bypassed reach, evaluate potential impediments to habitat connectivity to steelhead within the bypassed reach and implement adaptive management to provide habitat connectivity as appropriate address the impediments.	Rugraw	$0	$1,490[o]	$970
33. Monitor fish behavior at the project's tailrace, and modify the tailrace if fish attraction is observed.	Rugraw, staff	$0	$3,000	$1,950
34. Develop a water temperature monitoring plan.	Rugraw, California DFW, NMFS, Interior	$10,000[f]	$0	$770
35. Develop water temperature monitoring component of an operation compliance monitoring and reporting plan.	Staff	$10,000[f]	$0	$770
36. Monitor water temperature at six monitoring stations.	Rugraw	$40,500[p]	33,550[p]	$24,920

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
37. Develop a water temperature monitoring plan with three monitoring locations and DO monitoring, with at least five years of monitoring at the diversion intake, just upstream of Spring #4, and at the powerhouse discharge.	Water Board	$25,000[q]	$11,810[q]	$10,370
38. Monitor water temperature at six monitoring stations (California DFW recommendation 3).	California DFW	$40,500[r]	$33,500[r]	$24,920
39. Monitor water temperature at seven monitoring gages (Interior and NMFS 10(j) recommendation 2).	NMFS, Interior	$45,900[s]	$35,080[s]	$26,330
40. Conduct real-time water temperature monitoring at the diversion dam intake and just upstream of the influence of Spring #4.	Staff	$15,000[t]	$12,200[t]	$9,080
41. Develop an operation compliance monitoring and reporting plan that specifies monitoring equipment and methods, and provisions for	Staff	$0[u]	$0[u]	$0

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
annual operation and compliance reports, to document compliance with any license requirements for flow, ramping rates, and water temperature.				
42. Discontinue project operations when the average daily stream temperature exceeds 20˚C as measured within the bypassed reach.	Rugraw, California DFW	$0	$15,000	$9,750
43. Induce project shut-down or reduction when 7DADM temperature exceeds 20°C.	Water Board	$0	$15,000[v]	$9,750
44. Induce project shut-down or reduction when 7DADM temperature exceeds 18ºC for migration/over-summering, 15.5ºC for rearing/holding, and 13ºC for spawning (FWS 10(j) recommendation 2, modified).	Interior	$0	$25,000[w]	$16,250
45. Induce project shut-down or reduction when 7DADM temperature exceeds 18ºC for migration/over-summering, 16ºC for rearing, and 13ºC for	NMFS	$0	$25,000[w]	$16,250

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
spawning (NMFS 10(j) recommendation 2).				
46. Induce project shut-down or reduce operations when the average daily stream temperature exceeds 20°C, and when the water temperature just upstream of Spring #4 is higher than the water temperature at the diversion intake.	Staff	$0	$15,000[v]	$9,750
47. Develop a water quality monitoring plan to monitor water quality, including turbidity, during project construction, operation, and maintenance (Water Board preliminary condition 10).	Water Board, staff	$10,000[x]	$890[x]	$1,350
48. Perform water quality monitoring: (1) when performing any in-water work; (2) if project activities result or have the potential to result in a discharge to surface waters; or (3) when project-related activities result in the creation of a visible plume in surface	Water Board, staff	$0[d]	$0[d]	$0

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
waters (Water Board preliminary condition 6).				
49. Develop a BMI monitoring plan (NMFS and Interior 10(j) recommendation 5).	NMFS, Interior	$15,000[y]	$7,690[y]	$6,150
50. Develop a drought plan (Water Board preliminary condition 4).	Water Board	$25,000[f]	$0	$1,920
51. Develop an aquatic invasive species monitoring plan; including monitoring and corrective action steps (Water Board preliminary condition 8).	Water Board, staff	$10,000[f]	$5,000[f]	$4,020
52. Develop a pesticide use plan (Water Board preliminary condition 9).	Water Board	$10,000[f]	$0	$770
53. Develop a fish habitat assessment plan, in consultation with Water Board staff and other relevant resource agencies (Water Board preliminary condition 12).	Water Board	$25,000[z]	$2,910[z]	$3,820
54. Develop a fish population monitoring plan (Water Board preliminary condition 11).	Water Board	$25,000[f]	$4,820[f]	$5,060

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
Terrestrial Resources				
55. Conduct monitoring during construction to ensure that measures to protect biological resources are implemented appropriately.	Rugraw, staff	$25,000	$0	$1,920
56. Provide environmental training to construction staff regarding laws, regulations, and BMPs to protect threatened and endangered species and special-status plant species and their habitats.	Rugraw, staff	$5,000	$0	$390
57. Delineate the limits of construction, work areas, and multipurpose areas with flagging, fencing, and/or stakes, and prohibit ground disturbance outside of these limits.	Rugraw, staff	$5,000	$0	$390
58. Reclaim temporarily disturbed stream and riparian habitat through restoration of preconstruction conditions and riparian plantings and/or seeding, where applicable, with seed mixes	Rugraw, staff	$10,000	$0	$770

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
recommended by California DFW.				
59. Conduct preconstruction inspections for sensitive and federally listed plants in all areas where surveys have not previously been conducted, and implement specified protection measures as necessary.	Rugraw, staff	$10,000	$0	$770
60. Conduct preconstruction inspections for slender Orcutt grass, elderberry and vernal pool habitat in areas of proposed disturbance not previously surveyed in 2013 and adjust the transmission line design to avoid any areas where these species or habitats are found.	Staff	$5,000[f]	$0	$390
61. Revise the Noxious Weed Management and Revegetation Plan, which includes measures to ensure weeds and non-native invasive vegetation do not establish at onsite disposal areas during project construction, and include	Rugraw, staff	$5,000	$0	$390

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
provisions for riparian plantings along disturbed portions of South Fork Battle Creek to provide overhanging vegetation and if revegetation success criteria are not met after 2 years, continue reseeding and monitoring until criteria are met.				
62. Modify the Noxious Weed Management and Revegetation Plan to include provisions for preconstruction treatment of existing non-native invasive weed populations on project lands, additional reseeding and monitoring if restoration success criteria are not met by the end of the 2-year monitoring period, and measures to protect rare plant species from control measures targeting noxious weed species (consistent with Water Board preliminary condition 14).	Water Board, staff	$0	$1,000[f]	$650
63. Map and quantify, by vegetation type, the	Rugraw, staff	$5,000	$0	$390

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
vegetation to be removed as a result of project construction.				
64. Conduct preconstruction surveys for migratory birds within 100 feet of the project (disturbance area) immediately prior to construction if disturbance will occur during the nesting season (typically April 15 to July 31).	Rugraw, staff	$5,000	$0	$390
65. Establish a 100-foot buffer around active nests of bird species protected under the Migratory Bird Treaty Act.	Rugraw, staff	$2,500	$0	$190
66. Conduct preconstruction pedestrian or aerial nest surveys in suitable habitat within 1 mile of the project disturbance area during the appropriate nesting time periods needed to identify raptor nest locations and establish the status of nests.	Rugraw, staff	$5,000	$0	$390
67. Provide an appropriate buffer to active raptor nests during project construction.	Rugraw, staff	$2,500	$0	$190

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
68. Modify the proposed measure for restricting construction activities around active raptor nests to include consultation with California DFW in determining the appropriate buffer distances.	Staff	$0[d]	$0	$0
69. Design and construct the transmission line in compliance with APLIC guidance to reduce effects on avian species (APLIC, 2006; 2012) (Interior 10(j) recommendation 7).	Rugraw, Interior	$12,500	$0	$960
70. Design and construct the transmission line to reduce impacts on avian species.	Staff	$12,500[f]	$0	$960
71. Develop an avian protection plan that incorporates Rugraw's transmission line design and considers FWS's Avian Protection Plan Guidelines to reduce the risk of avian interactions with the proposed transmission line, and implement the plan throughout the term of the	Interior, staff	$10,000[f]	$1,250[f]	$1,580

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
license (Interior 10(j) recommendation 7).				
72. Develop a bald eagle and raptor management plan that considers FWS's National Bald Eagle Management Guidelines and includes the use of species-specific distance buffers, landscape buffers, seasonal restrictions, and additional recommendations to benefit raptors (Interior 10(j) recommendation 7).	Interior, staff	$10,000[f]	$1,250[f]	$1,580
Threatened and Endangered Species				
73. Develop a sensitive amphibian protection plan for CRLF and FLYF and protect their breeding habitat during construction (Interior 10(j) recommendation 8).	Rugraw, Interior	$10,000	$0	$770

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
74. Conduct preconstruction surveys for juvenile and adult FYLF immediately prior to construction when in-water work will occur during the breeding season (typically mid-March to August).	Rugraw	$10,000	$0	$770
75. Relocate larval, juvenile, and adult FYLF found within the project reach or 500 feet downstream, outside the project construction area.	Rugraw	$1,000	$0	$80
76. Develop an amphibian monitoring plan with preconstruction monitoring for CRLF, FYLF, and Cascades frog, specifically: egg masses, tadpoles, and adult amphibians on South Fork Battle Creek (Water Board preliminary condition 13).	Water Board	$10,000[f]	$890[f]	$1,350
77. Develop a special status amphibian protection plan that includes the following provisions to protect FYLF, Cascades frog, and CRLF	Staff	$10,000[f]	$1,070[f]	$1,470

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
during construction: (1) conduct preconstruction surveys for all life stages during the breeding season; (2) avoid construction activities in riparian areas when egg masses are present; (3) develop a protocol for handling FYLF and Cascades frog during relocation activities; (4) identify specific areas for relocation (notify California DFW if relocation of FYLF or Cascades frogs is necessary), (5) stop work and notify FWS within 24 hours if CRLF are observed during preconstruction surveys or during construction; and (6) relocate larval, juvenile, and adult FYLF and Cascades frogs prior to construction activities to an area sufficiently upstream to prevent them from re-entering the construction area.				

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
78. Include annual monitoring for CRLF, FYLF, and Cascades frog, specifically: egg masses, tadpoles, and adult amphibians on South Fork Battle Creek during project operations in the amphibian monitoring plan (Water Board preliminary condition 13).	Water Board	$0	$9,110[f]	$5,920
79. Develop a FYLF monitoring plan (California DFW 10(j) recommendation 2B).	California DFW	$10,000[f]	$0	$770
80. Ensure the project does not result in a base flow recession rate greater than 1 foot in 3 weeks, starting at the end of the spring snowmelt flow pulse.	Interior	$0	$1,520[aa]	$990
81. Consult annually with resource agencies to review current lists of rare, threatened, and endangered species and special-status plant and wildlife species to identify species that have the potential to be adversely impacted by the project and develop protection measures	Water Board	$10,000[f]	$0	$770

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
as needed (Water Board preliminary condition 5).				
Land Use and Aesthetics				
82. Restore vegetation directly removed or disturbed during project construction, including along temporary access roads, as appropriate and in accordance with California forestry regulations and best practices.	Rugraw, staff	$17,500	$0	$1,350
Cultural Resources				
83. Implement the HPMP filed on November 30, 2015.	Rugraw	$20,000	$2,000	$2,840
84. Revise the HPMP filed on November 30, 2015, to include: (1) copies of any post-2014 tribal correspondence and consultation related to the identification of cultural resources and development of the HPMP to document full compliance with section 106; (2) a cultural resources interpretive element, such as installation of interpretive signs at key viewing areas);	Staff	$25,000[bb]	$5,000[bb]	$5,170

Enhancement/Mitigation Measures	Entities	Capital Cost (2017$)[a, c]	Annual Cost (2017$)[b, c]	Levelized Annual Cost (2017$)
(3) a detailed plan for annual monitoring of cultural resources within the APE that are eligible for listing in the National Register or have yet been evaluated that are eligible for listing in the National Register or have not yet been evaluated; (4) provisions for periodic review and revision of the HPMP; and (5) editorial corrections as specified in section 5.1.2 of this EIS.				

[a] Costs were provided by Rugraw in its March 31, 2017, filing 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] Staff estimates there would be no additional cost to implement this measure.

[e] Staff estimates the cost of prewashing riprap, rocks and gravel would be approximately $30,000 above the proposed cost of the SWPPP.

[f] Staff estimate.

[g] Staff estimate; annual cost includes $10,000 per year for debris management, $1,600 in years 1, 4, and 7 for cross-section surveys and $500 in years 2-30 for turbidity monitoring.

[h] Rugraw included the capital cost for this measure in the overall construction cost with no breakdown; we estimate the cost of the fish screen and downstream passage to be $800,000 out of the total construction cost of $13,500,000.

[i] Rugraw did not provide an estimate; staff provided an estimate for the capital cost to construct the upstream fish passage facilities and an annual cost to operate and maintain the facilities.

[j] Staff estimate loss of 6,089 MWh.

[k] Staff estimate loss of 4,996 MWh.

[l] Staff estimate; capital cost includes $10,000 for development of the plan; annual cost includes $10,000 per year for flow monitoring.

[m] Staff estimate; assumed to be the same as cost provided by the application for comparable measure.

[n] Staff estimate; annual cost includes $10,000 every 2 years starting in year 2.

[o] Staff estimate; annual cost includes $10,000 in years 5, 10, 15, and 20.

[p] Staff estimate; capital cost: $10,000 each for WT station at (1) Old Highway 36 bridge, (2) upstream of powerhouse tailrace, (3) at powerhouse tailrace, (4) downstream of powerhouse tailrace, cost for diversion dam station assumed included in construction cost, and $500 for data logger upstream of the Ponderosa Way bridge; annual cost: $25,000 for service of 5 stations, $2,200 to service logger year 2, $1,600 to service logger years 3-30, $200/yr. (average) to replace loggers every 3 years, and $10,000 for annual reporting and consultation.

[q] Staff estimate; capital cost: $10,000 to develop plan, $15,000 for WT station upstream of Spring #4, $10,000 for WT station at powerhouse discharge, cost for diversion dam station assumed included in construction cost; annual cost: $15,000 for service of 3 stations, $8,700 for DO monitoring, $6,000 to install and service multi-parameter water quality loggers, and $4,300 for annual reporting and consultation.

[r] Staff estimate; capital cost: $15,000 for WT station upstream of Spring #4, $10,000 each for WT stations (1) upstream of Angel Falls and (2) at powerhouse tailrace, $5,000 for temperature monitoring in the penstock, cost for diversion dam station assumed included in construction cost, and $500 for a data logger upstream of Panther Grade; annual cost: $25,000 for service of 5 stations, $2,200 to service loggers in year 2, $1,600 to service loggers in years 3-30, $200/yr. (average) to replace loggers every 3 years, and $10,000 for annual reporting and consultation.

[s] Staff estimate; capital cost: $15,000 for WT station upstream of Spring #4, $10,000 each for WT station (1) upstream of Angel Falls, (2) at powerhouse tailrace, (3) just downstream of the powerhouse or upstream of Panther Grade, cost for diversion dam station assumed included in construction cost, and $450 each for data loggers at the intake header box and upstream of the Ponderosa Way bridge; annual cost: $25,000 for service of 5 stations, $3,700 to install and service loggers in year 2, $3,200 to service loggers in years 3-30, $300/yr. (average) to replace loggers every 3 years, and $10,000 for annual reporting and consultation.

t Staff estimate; capital cost: $15,000 for WT station upstream of Spring #4, cost for diversion dam station assumed included in construction cost; annual cost: $10,000 for service of 2 stations, and $3,400 for annual reporting and consultation.

u To avoid double-counting the cost for the operation compliance monitoring and reporting plan we provide a cost of $0 in the table. However, the sum of its components (i.e., development of the streamflow-monitoring component, development of the water-temperature monitoring component, real-time stream gage monitoring, and real-time water temperature monitoring) has a levelized annual cost of $28,410.

v Staff estimate; assumed same energy loss as for the Rugraw proposal.

w Staff expects the lost energy for this measure to be greater than for the Rugraw proposal because of the more restrictive temperature criteria.

x Staff estimate; annual cost includes $10,000 in year 1.

y Staff estimate; annual cost includes $15,000 in years 1-4, 8, 12, 16, 20, 24, and 28.

z Staff estimate; annual cost includes $15,000 in years 1, 5, and 10.

aa Staff estimated the lost energy cost to implement the measure.

bb Staff estimate; assumes an additional $5,000 to the capital cost for HPMP revisions and installation of signage and an additional $3,000 to the annual cost for additional annual monitoring beyond the cost estimated by Rugraw.

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 recreational opportunities; and the preservation of other aspects of environmental quality. 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. This section contains the basis for, and a summary of, our recommendations for licensing the Lassen Lodge Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency comments filed on the project and our review of the environmental and economic effects of the proposed project and project alternatives, we selected the staff alternative as the preferred alternative. The staff alternative includes elements of Rugraw's proposal with some modifications and additional staff-recommended measures. We recommend this alternative because: (1) issuing an original license for the project would allow Rugraw to operate the Lassen Lodge Project as a dependable source of electrical energy; (2) the 5 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of the staff alternative would exceed those of the no-action alternative; and (4) the proposed and recommended measures would protect and enhance fish and wildlife resources.

In the following section, we make recommendations as to which environmental measures proposed by Rugraw or recommended by agencies should be included in any license issued for the project.

5.1.1 Measures Proposed by Rugraw

Based on our environmental analysis of Rugraw's proposal discussed in section 3 and the costs discussed in section 4, we recommend including the following environmental measures proposed by Rugraw in any license issued for the project. Our recommended modifications to Rugraw's proposed measures are shown in ***bold italics***, and parts of measures that we do not recommend are shown in ~~strikeout~~.

Project Construction

- Limit land disturbance and vegetation clearing to those areas needed for construction. Delineate the limits of construction, work areas, and multipurpose areas with flagging, fencing, and/or stakes to prevent land-disturbing activities outside of construction areas.

- Stockpile natural topsoils and replace, regrade, and revegetate disturbed areas, in accordance with California forestry regulations and best practices, with native vegetation. Restore disturbed stream and riparian habitat to preconstruction conditions and with riparian plantings and/or seeding, where applicable, ***with seed mixes recommended by California DFW***~~, with approved seed mixes~~.
- Develop an SWPPP with measures to prevent storm-induced erosion and sedimentation during ground-disturbing construction activities, including:
    - Store spoils from project construction in areas that limit erosion of spoil material and prevent runoff into aquatic habitats.
    - Install cofferdams, silt fences, or other structures to isolate in-water work areas ***and, consistent with the Water Board's preliminary condition 19, only use washed riprap, rocks, and gravel adjacent to or in watercourses.***
- Use existing roads to the maximum possible extent, constructing new access roads only when necessary; limit access roads to a width of 12 feet whenever possible; and surface permanent roads with gravel to a depth and quantity sufficient to maintain a stable road surface and minimize erosion and dust.
- Conduct in-water work activities between July 1 and October 15 when streamflows are low to protect water quality and aquatic resources.
- Maintain upstream and downstream fish passage at the project during construction by constructing the diversion structure in phases or by providing a temporary diversion culvert to allow fish to pass the site.
- Conduct ~~biological~~ monitoring during construction to ensure that measures to protect biological resources are implemented appropriately, ***using staff trained in the identification of special-status species and their habitats***.
- Provide environmental training to construction staff ~~regarding laws, regulations~~, and ***implement*** BMPs to protect threatened and endangered species and special-status plant species and their habitats.
- Conduct preconstruction ~~surveys in~~ ***inspections of*** all areas of suitable habitat for threatened and endangered and special-status plant species where surveys have not previously been conducted, and implement specified protection measures as necessary.
- Avoid streams, wetlands, and pond habitats to the extent possible during construction, and use existing stream and wetland crossings where possible.

Incorporate this and other construction-specific measures into a construction plan for Commission approval.

- Implement the Noxious Weed Management and Revegetation Plan (filed on November 30, 2015), which includes measures to ensure weeds and non-native invasive vegetation do not reestablish at onsite disposal areas during project construction, with modifications to include provisions for riparian plantings along disturbed portions of South Fork Battle Creek to provide overhanging vegetation, ***monitoring of restoration success and criteria for additional reseeding if by the end of a 2-year monitoring period the criteria are not met, preconstruction treatment of existing non-native invasive plant populations on project lands, and measures to protect rare plant species from control measures targeting noxious weed species.***
- Map, evaluate, and quantify, by vegetation type, the vegetation that would be removed as a result of project construction.
- Conduct preconstruction surveys for migratory bird nests within 100 feet of any areas that will be disturbed during the typical nesting season of April 15 to July 31 to identify nest locations and their status.
- Restrict construction activities within 100 feet of any active migratory bird nests found during the preconstruction surveys.
- Conduct preconstruction raptor nest surveys in suitable habitat within 1 mile of any areas that will be disturbed during the appropriate nesting time periods (January through August) to identify nest locations and their status.
- Determine ***in consultation with California DFW*** and apply an appropriate buffer for restricting construction activities around any active raptor nests found during preconstruction.
- Avoid ground-disturbing activity on or near talus slopes to protect Sierra Nevada red fox and American pika.
- Avoid construction activity within or near potential bat roosting habitat, including rock crevices, cliffs, and snags.
- Conduct surveys for ~~juvenile and adult~~ ***all life stages (egg masses, larvae, juveniles, and adults) of*** FYLF ***and Cascades frog*** immediately prior to construction when in-water work would occur and relocate juvenile and adult frogs found within the project reach and up to 500 feet downstream, outside the project construction area. ***Incorporate these measures into the staff-recommended special-status amphibian protection plan discussed below.***
- Avoid construction activities in riparian areas during the time that egg masses of FYLF are present (typically mid-April through mid-May);

postpone construction around the immediate area where egg masses of FYLF, ***Cascades frog, and CRLF*** are found until the eggs have hatched; avoid collection of rocks from in-water environments and minimize disturbance to pools and shallow runs between March 1 and August 31 to protect FYLF and their habitat. ***Incorporate these measures into the staff-recommended special-status amphibian protection plan discussed below***.

- Develop a CRLF protection plan to allow for CRLF to become reestablished in the project area and to be protected from manageable threats during construction***. Incorporate the plan into the staff-recommended special-status amphibian protection plan discussed below***.
- Reduce visual contrast where over-story vegetation is removed by thinning and removing trees from the edge of the ROW to give a natural appearance, where possible.
- Use wood poles to support the project transmission line to blend with surrounding vegetation.

Project Operation

- Operate the project in a run-of-river mode, ~~maintaining the water surface elevation within +/- 0.5 inch of the normal pool elevation~~ ***where outflow from the project reservoir approximates inflow on a near-instantaneous basis.***
- Provide a ramping rate that will not exceed ~~0.1 foot~~***1 inch*** of stage change per hour as measured ~~by a stream gage to be located within the bypassed reach between the diversion structure and the Old State Highway Route 36 Bridge~~ ***at the staff-recommended monitoring gage located just downstream of the diversion dam***.
- Discontinue project operation when the average daily stream temperature ***measured upstream of Spring #4 influence*** exceeds 20°C ***and is higher than the stream temperature***~~,~~ measured ***at the dam***~~in the bypassed reach upstream of Angel Falls~~.
- Develop a DSMP for the sluicing of sediment and debris at the project that would include: annual sluicing of sediments from the project's reservoir when natural flow at the diversion site exceeds 400 cfs; or in years where natural flows never reach 400 cfs, the sediment deposits in the reservoir would be evaluated to determine if sluicing is needed; ***that the Water Board and California DFW be consulted to determine if the sluicing of sediments should occur*** ~~If so, the sluicing would occur at~~ ***when*** flows ***are less than 400 cfs***~~greater than 108 cfs (minimum instream flow of 13 cfs plus turbine design flow of 95 cfs~~***; monitoring turbidity to document any project-caused exceedance of the Basin Plan's turbidity objectives; and***

periodic surveys of the project impoundment to document sediment and woody material deposition.

- Maintain an MIF of 13 cfs or inflow, whichever is less, ***as measured just upstream of Spring #4 influence***, in the bypassed reach to protect aquatic resources.
- Construct ~~an upstream and~~ a downstream fish passageway and fish screen structure at the project diversion works to ensure fish are able pass ***downstream over*** the diversion dam, and design the facilities in coordination with California DFW incorporating the NMFS Southwest Region Fish Screening Criteria for Anadromous Salmonids and NMFS Northwest Region Anadromous Salmonid Passage Facility Design.
- Monitor fish behavior at the project's tailrace and modify the tailrace if fish attraction is observed.
- Design and construct the transmission line to protect avian species (APLIC, 2006; 2012) ***and incorporate this measure into the avian protection plan discussed below.***
- ***Finalize*** the HPMP filed on November 30, 2015, ***to include both California SHPO and staff comments and recommendations. Revisions to the HPMP would include: (1) modifying sections 1.2, 1.4, 1.7, 1.8, 4.1, 4.3, 4.5, 4.6, 4.7, 5.1, 5.2, 5.3, and appendix B of the document for a more clearer and concise management approach for historic properties that may be affected by the proposed project; (2) copies of any post-2014 tribal correspondence and consultation related to the identification of cultural resources and development of the HPMP to document full compliance with section 106; (3) a cultural resources interpretive element, such as installation of public interpretive signs at key viewing areas; (4) a detailed monitoring plan for cultural resources within the APE that are eligible for listing in the National Register or have not yet been evaluated; (5) provisions for periodic review and revision of the HPMP; (6) editorial corrections as specified in section 5.1.2 of this EIS; and (7) inclusion of Volume II into the final HPMP.***

5.1.2 Additional Measures Recommended by Staff

In addition to Rugraw's proposed measures and the staff modifications listed above, we recommend including the following staff-recommended measures in any license issued for the Lassen Lodge Project:

Project Construction

- Develop a plan for monitoring turbidity and pH and documenting observations of oily sheens and turbidity plumes during project construction.
- Conduct preconstruction inspections for slender Orcutt grass, elderberry, and vernal pool habitat in areas of proposed disturbance not previously surveyed in 2013, and adjust the transmission line design to avoid any areas where these species or habitats are found.
- Develop a special-status amphibian protection plan in consultation with California DFW and FWS that includes the following provisions to protect FYLF, Cascades frog, and CRLF: (1) conduct preconstruction surveys for all life stages during the breeding season; (2) stop work and notify FWS within 24 hours if CRLF are observed during preconstruction surveys or during construction; (3) avoid construction activities in riparian areas when egg masses are present; (4) develop protocols for handling FYLF and Cascades frogs during relocation activities; (5) identify specific areas for relocation (notify California DFW if relocation of FYLF or Cascades frogs is necessary); and (6) relocate larval, juvenile, and adult FYLF and Cascades frogs prior to construction activities to an area sufficiently upstream to prevent them from re-entering the construction area.

Project Operation

- Develop a project operation compliance monitoring and reporting plan to support and document compliance with run-of-river project operation, MIF requirements, ramping rates, base flow recession rates, and water temperature protection measures and that specifies: (1) real-time water temperature monitoring at the project's dam and just upstream of Spring #4 influence; (2) real-time monitoring of water surface elevation just downstream of the diversion dam and streamflow just upstream of Spring #4 influence; (3) water surface elevation monitoring in the reservoir; (4) non-compliance event reporting; and (5) annual compliance reports.
- Develop an aquatic invasive species monitoring plan in consultation with the resource agencies that incorporates measures to help prevent the introduction and/or spread of aquatic nuisance species (flora and fauna) into the proposed project area, including construction BMPs, to prevent the spread of aquatic nuisance species (e.g., bullfrog), and protocols to decontaminate equipment that could spread chytrid fungus.

- Develop an avian protection plan that incorporates Rugraw's proposed transmission line design and considers FWS's Avian Protection Plan Guidelines and APLIC Guidelines to reduce the risk of avian interactions with the proposed transmission line, and implement the plan throughout the term of the license.
- Develop a bald eagle and raptor management plan that considers FWS's National Bald Eagle Management Guidelines and includes the use of species-specific distance buffers, landscape buffers, seasonal restrictions, and additional recommendations to benefit raptors.
- Develop a plan to protect FYLF from spring base flow recession rates that could dewater egg masses.

The following section presents the basis for our recommended measures and our recommended modifications to the proposed measures.

Erosion Control and Sedimentation

Rugraw proposes to develop an SWPPP that outlines measures to prevent erosion and sedimentation during project construction. Consistent with Rugraw's proposal, the Water Board recommends control measures for erosion, excessive sedimentation, and turbidity at the commencement of, and throughout, any ground-clearing activities, excavation, or other project activities that could result in erosion and sedimentation discharges to project waters (preliminary condition 18). In addition, the Water Board recommends the use of washed riprap, rock, and gravel placed within or adjacent to any watercourses (preliminary condition 19) and monitoring of water quality for turbidity during construction (preliminary condition 6).

As discussed in section 3.3.1.2, *Geology and Soil Resources, Environmental Effects*, developing the proposed SWPPP with the additional measures recommended by the Water Board would minimize the amount of erosion and sediment transport to South Fork Battle Creek from project construction. Use of washed riprap, rock, and gravel would prevent fines from rock crusher operations from entering South Fork Battle Creek. Monitoring the functionality of erosion and sediment control structures, especially around rainfall events and disturbance activities, would help to identify any necessary maintenance, repair, or improvement/replacement of erosion and sediment control structures. We estimate that incorporating the Water Board's preliminary conditions 6 and 19 into the proposed SWPPP would only increase the cost of the proposed SWPPP by $2,310 and would be warranted to protect aquatic resources during construction.

Construction Plan

In addition to the erosion and sedimentation control measures developed as part of the SWPPP, Rugraw also proposes several construction measures for protection of environmental resources, including the timing of construction; delineation of construction areas using fencing and/or flagging; using existing roads to the maximum extent possible, and constructing any new access roads to a width of no more than 12 feet; maintaining upstream and downstream fish passage at the project during construction; avoiding streams, wetlands, and pond habitats to the extent possible during construction and use of existing stream and wetland crossings where possible; and providing environmental training to construction staff regarding laws, regulations, and BMPs to protect threatened and endangered species and special-status plant species and their habitats. These are reasonable measures to implement during construction, and to ensure that these measures are implemented and coordinated, should be included in a construction plan to be filed for Commission approval prior to the start of ground-disturbing activities. This construction plan should also be closely coordinated with the SWPPP. We estimate that preparation of a construction plan would have a levelized annual cost of $1,150 and would be worth the cost.

Debris and Sediment Management Plan

Rugraw proposes to develop a DSMP that includes annual sluicing of sediment from the project reservoir into the bypassed reach when flows are 400 cfs or greater. However, if inflow does not reach 400 cfs in a given year, Rugraw would evaluate the sediment deposits behind the diversion to determine the need to sluice at lower flows.[103] Rugraw also notes that it plans to pass large woody material by lowering the three 8-foot wide pneumatic gates. If woody material arrives at the dam that is too large to pass downstream in this manner, Rugraw could consult with FWS and California DFW to identify a safe method to handle the associated material.

NMFS and Interior recommend that Rugraw develop a DSMP that includes a monitoring component to measure the sediment retention upstream of the sluice gates, LWM and sediment distribution downstream of the diversion, and the riparian response to new conditions resulting from the proposed project. Specifically, the monitoring would measure the following channel metrics: (1) reach-wide parameters (e.g., total length and gradient, average width and depth); (2) wetted width of each riffle; (3) water velocity; (4) relative substrate composition (i.e., fines, gravel, cobble, boulder, and bedrock); (5) pebble count; (6) substrate consolidation and percent embeddedness; (7) canopy cover; (8) canopy height; and (9) diameter of canopy trees.

As discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, the periodic downstream transport of small and large woody material would reduce operational effects on downstream aquatic habitat, and the annual sluicing of sediment would help to maintain sediment supply to the bypassed reach and reduce the potential of clogging project facilities. Sediment sluicing may have a negative effect on turbidity and sedimentation downstream, especially at flows less than 400 cfs. However, this effect

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[103] Rugraw's *Baseline Hydrologic Analyses for South Fork Battle Creek* (2014) determined that the maximum daily flow of 380 cfs (as measured upstream of Angel Falls) would typically occur every 2 years.

would likely be offset by the greater habitat benefits of passing sediment and woody debris downstream of the dam; therefore, we recommend that Rugraw first consult with the Water Board each time it determines a need to sluice sediments when inflow is less than 400 cfs and conduct turbidity monitoring upstream and downstream of the impoundment during, and if appropriate, immediately following the sluicing events, to document whether and how long the project causes turbidity to exceed the Basin Plan's objectives. Evaluation of these results and consultation with the Water Board would provide insight into whether the DSMP should be revised to reduce negative effects on turbidity levels and potentially fish in the bypassed reach.

We expect that the proposed sediment sluicing and passage of woody debris past the proposed diversion dam would generally be successful in maintaining downstream aquatic habitat. However, attempting to flush sediments out of the dam's impoundment during low-flow years could be ineffective and result in accumulation of sediments in the impoundment. Revising the DSMP to include periodic monitoring of the impoundment for the accumulation of sediment and woody debris would provide a way to determine the effectiveness of the sluicing program and identify the need for any modification to it. These modifications could include revising the sluicing schedule and using mechanical assistance for removing coarser-grained material from the impoundment. A conceptual approach for accomplishing this goal would be to establish one to three cross-sections in the area to be impounded prior to filling the impoundment, and then monitor these cross-sections about three times in the first decade of project operation to determine whether long-term accumulation of sediment and/or woody material is occurring in the impoundment. Therefore, there is no basis for requiring the detailed monitoring program recommended by the agencies to verify the effects of the proposed project on sediment and woody debris movement, which would have a substantial cost (levelized annual cost of $58,500) and minimal benefits.

We recommend that Rugraw modify the DSMP to include: (1) monitoring of turbidity associated with sediment sluicing events to document any project-caused exceedance of the Basin Plan's turbidity objectives, and (2) periodic monitoring of the project impoundment to determine whether long-term accumulation of sediment and/or woody material is occurring. We estimate that implementation of the DSMP with the staff-recommended modifications would have a levelized annual cost of $7,270 and that the benefits to aquatic resources would warrant the cost.

Ramping Rate

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, project operations could result in fluctuations in flow and water levels within the bypassed reach. Consistent with California DFW's preliminary recommendation (10(j) recommendation 2), Rugraw proposes to implement a ramping rate of 0.1-foot/hour as measured by a stream gage to be located within the bypassed reach between the diversion structure and the Old State Highway Route 36 Bridge. Interior and NMFS, however, recommend a

1-inch/hour ramping rate (10(j) recommendation 1) as measured between Angel Falls and Spring #4.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, our analysis found that fluctuations in flow and water levels (ramping events) in the project's bypassed reach would be relatively infrequent. However, any rapid changes in streamflow associated with project start-ups or shut-downs could adversely affect downstream aquatic resources. As noted in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the proposed and recommended ramping rate restrictions (0.1-foot/hour and 1 inch/hour) would eliminate any sudden changes in flow and protect aquatic resources. The draft EIS concluded that the less conservative 0.1-foot/hour (1.2-inch/hour) restriction would be protective of fish and other aquatic biota in the bypassed reach and may be easier to comply with from an operational perspective. However, while both ramping rates are very close, a 1-inch/hour ramping rate would provide additional protection for fish and other aquatic organisms.

Further, as demonstrated in table 4-3, we estimate there would be no difference in cost between the 0.1-foot/hour and the 1-inch/hour ramping rates. Therefore, the agency-recommended 1-inch/hour ramping would provide additional protection for aquatic resources at no additional cost. As a result, we recommend Rugraw implement a 1-inch/hour ramping rate during project shut-down and start-up, and when changing operation.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, the broader and shallower channel configuration of the bypassed reach upstream of Angel Falls would likely have a higher potential for stranding fish than the narrow confined stream channel found downstream of Angel Falls; as a result, we do not support Interior's and NMFS's recommendation for monitoring compliance with ramping rates between Angel Falls and Spring #4. Instead, and consistent with California DFW's recommendation and Rugraw's proposal, we recommend ramping-rate compliance be monitored real-time immediately downstream of the diversion dam. Details regarding the exact monitoring protocols—location, equipment and station design, methods, and compliance reporting—should be included in the project operation compliance monitoring and reporting plan discussed below. We estimate our recommended ramping rate of 1-inch/hour and associated monitoring would have a levelized annual cost of $3,250 and be worth the cost for protection of aquatic habitat and biota.

Temperature Thresholds and Monitoring

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, project operation has the potential to increase water temperatures in the bypassed reach. To avoid any potential adverse effects on aquatic resources in the bypassed reach, Rugraw proposes, and California DFW recommends (10(j) recommendation 3), to cease operation when water temperature in the bypassed reach exceeds an average daily temperature of 20ºC. To protect resident rainbow trout, the Water Board (preliminary condition filed in its comments on the draft EIS) recommends ceasing project operation when water temperature in the bypassed reach hits a threshold of 20ºC 7DADM. Interior and NMFS (10(j) recommendation 2) also request curtailing project operation as needed to prevent temperature exceedance for spring-run and winter-run Chinook salmon in the bypassed reach downstream of Angel Falls (table 5-1).

Table 5-1. Temperature thresholds (7DADM) for Chinook salmon life stages in the bypassed reach that would require curtailment of project operations, as recommended by Interior and NMFS (Source: staff).

Life Stage	Interior	NMFS
Spawning	13°C	13°C
Holding and rearing	15.5°C[a]	16°C
Migration and summer holding	18°C	18°C

[a] FWS modified its previously recommended 16°C criterion during the March 15, 2018, section 10(j) meeting, where it indicated that it was now recommending 15.5ºC from March 2 to May 31 for spring-run and winter-run Chinook salmon holding and rearing and the same 7DADMs as NMFS for the rest of the year.

Associated with these recommendations for project shut-down in accordance with exceedance of temperature thresholds, Rugraw proposes and California DFW (10(j) recommendation 4), Interior, and NMFS (10(j) recommendation 2) recommend development of a water temperature monitoring plan. In the draft EIS, we found that implementing a temperature threshold would provide little, if any, benefit to aquatic resources, nor would there be a need for a water temperature monitoring plan. However, subsequent to the issuance of the draft EIS, Rugraw filed water temperature and flow data for 2015–2017 (Rugraw, 2018). These data, as discussed in *Water Temperature* in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* indicate that a project-induced flow reduction could result in increases in water temperature within the bypassed reach between the diversion dam and Spring #4 under some river conditions.

Although Rugraw, California DFW, and the Water Board agree on a project shut-down threshold of 20°C for the protection of resident salmonids (rainbow trout), Rugraw and California DFW specify the use of average daily temperature while the Water Board specifies 7DADM. The NMFS and FWS variable seasonal criteria target the protection of anadromous salmonids, which do not occur in the project reach.

As discussed in section 3.3.2.2, *Aquatic Resources, Water Temperature,* application of an average daily temperature criterion would enable more precise control of project-induced temperature increases based on real-time daily averages instead of using 7-day averages of only the daily maximum temperatures. In addition, we note that operating the project with a 13-cfs MIF is expected to cool the reach between the dam and Spring #4 during some periods when average daily temperatures exceed 20°C at the dam. Subsequently, to ensure that project shut-downs only occur as a result of project-related warming effects, we recommend that the project cease operation only when the average daily water temperature recorded just upstream of Spring #4's influence is at or above 20°C and is greater than the average daily water temperature recorded at the diversion dam. We conclude that applying an average daily temperature criterion of 20°C in this way would adequately protect resident salmonids from adverse project-related temperature effects.

Compliance with our recommendation for limiting project-related warming effects would require real-time water temperature monitoring at the diversion dam and at a point just upstream of Spring #4's influence. We recognize that temperature monitoring at the other locations proposed by Rugraw and recommended by the agencies would be useful for the BCSSRP. However, temperature monitoring at these stations would not enable determining when the project should be shut-down or fulfill other project compliance purposes. Details regarding the exact monitoring protocols: location, equipment and station design, methods, and compliance reporting, should be included in the project operation compliance monitoring and reporting plan discussed below. However, we note the importance of installing the temperature sensors in locations that would remain submerged and not be buried by sediments, and the benefits of co-locating them with water level and flow gages.

We estimate that addressing water temperature monitoring in the project operation compliance monitoring and reporting plan and real-time temperature monitoring at two stations would have a levelized annual cost of $9,850,[104] and would be worth the cost for protection of aquatic habitat. In contrast, the more extensive but unnecessary water temperature monitoring programs recommended by California DFW (six stations) and Interior/NMFS (seven stations), which we are not recommending, would have levelized annual costs of $25,690 and $27,100, respectively.

Based on temperature modeling and the synthetic flow record developed for the project, we estimate that our recommended temperature threshold would result in a levelized annual cost of $19,600, which includes our estimate for lost generation ($9,750) and temperature monitoring at two stations ($9,850). In contrast, Interior and NMFS recommended temperature thresholds and monitoring approach would result in a levelized annual cost of $43,350, for lost generation ($16,250) and monitoring at seven locations ($27,100). The California DFW recommended program would have a levelized annual cost of $35,440, for lost generation ($9,750) and monitoring at six locations ($25,690).

[104] $9,850 is the sum of the $770 for developing the water temperature monitoring component of an operation compliance monitoring and reporting plan and $9,080 for water temperature monitoring.

Streamflow Monitoring

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, operation of the project has the potential to affect streamflows within the project reach of South Fork Battle Creek. Rugraw proposes and resource agencies recommend alternative monitoring programs to ensure compliance with any streamflow requirements included in a license. Rugraw proposes to monitor streamflow at three locations.[105] Interior and NMFS recommend the development of a flow gage monitoring plan (10(j) recommendation 3) that would specify monitoring at seven locations.[106] California DFW recommends monitoring flow (10(j) recommendation 1) at a single location downstream of the diversion dam and fishway.

In its August 31, 2016, response to resource agency comments, Rugraw agreed to develop the flow gage monitoring plan recommended by Interior and NMFS and did not dispute including seven monitoring gages as recommended by those agencies. Rugraw commented, however, that one site recommended by NMFS and Interior,[107] immediately downstream of Angel Falls, would not be accessible for maintaining a gage, and instead proposed an alternative location just upstream of the powerhouse tailrace and downstream of Spring #4.[108]

As discussed above, we recommend the project operate in a run-of-river mode and provide a MIF in the project's bypassed reach. In section 3.3.2.2, *Aquatic Resources, Environmental Effects*, we found that a run-of-river mode of operation would have negligible effects on streamflow downstream of the powerhouse discharge. Subsequently, monitoring flow at the powerhouse discharge, downstream of the powerhouse, and downstream of Panther Grade, as recommended by NMFS and Interior,

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[105] Rugraw proposes to monitor streamflow at three locations: (1) just upstream of the diversion dam; (2) just upstream of the powerhouse tailrace; and (3) downstream of Ponderosa Bridge.

[106] The agencies' recommended locations for the flow gages are as follows: (1) just upstream of the diversion dam; (2) at the intake's header box; (3) upstream of Angel Falls; (4) upstream of powerhouse Spring #4; (5) at the powerhouse discharge; (6) downstream of the powerhouse; and (7) downstream of Panther Grade.

[107] Rugraw indicates that the NMFS and Interior recommended site referred to as "Upstream of Powerhouse Spring Number 4, just downstream of Angel Falls (between Angel Falls and Powerhouse Spring No. 4)" was not accessible, but makes no such comment for California DFW's recommended station upstream of powerhouse Spring #4.

[108] The proposed and recommended locations of the flow gages by Rugraw and the resource agencies range from upstream of the diversion dam at RM 23.0 to RM 18.5, 2.1 miles downstream of the proposed powerhouse and are fully discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*.

would not serve to monitor compliance with license conditions. While, we recognize that project maintenance may occasionally require the penstock to be dewatered and subsequently refilled, resulting in some manipulation of flows downstream of the tailrace, this would happen rarely during a license term; [109] and refilling the penstock would only use flows that are not needed to meet minimum flow requirements. Our recommended 1-inch/hour ramping rate requirements would also apply.[110]

However, to inform project operations and compliance with our recommended run-of-river mode of operation we do recommend Rugraw monitor: (1) the water surface elevation of the project's impoundment, to support compliance with run-of-river project operation;[111] and (2) streamflow just upstream of Spring #4's influence, the location expected to have the lowest flow in the bypassed reach during the seasonal low-flow period and subsequently our recommended compliance point for our recommended MIF(s).[112] To ensure monitoring is conducted at a sufficient resolution for project operation to be responsive to changes in flows, we recommend real-time monitoring at 15-minute intervals.

Although Rugraw does not support a monitoring location upstream of Spring #4 due to access concerns, its proposed alternative location would be downstream of Spring #4's influence and therefore is not an appropriate compliance point for monitoring MIFs.

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[109] Normal project operations would not require dewatering the penstock, even for periods of extended shut-downs. Hydro operators typically do not dewater a penstock unless required for specific maintenance or repairs, which are typically uncommon during the life of a project.

[110] Completely refilling the pipeline-penstock system would take less than 1 hour with a diversion rate of more than 38 cfs, and as long as 37 hours at a minimum diversion rate of only 1 cfs. Because of the rare frequency of needing to refill the system, the short period required for refill at moderate streamflows, and the small change in streamflow when an extended refill period is needed (at 1 cfs), we conclude that any effects on flow levels and habitat would be minor.

[111] We note that Rugraw is proposing to maintain the water surface elevation of the reservoir to within +/-0.5 inch, as part of its run-of-river operation. However, maintaining that level of precision in a reservoir (even a small reservoir) may be beyond the capabilities of currently available monitoring and flow regulation equipment. Subsequently, maintaining a stable impoundment within a 3-inch +/- elevation range would indicate compliance with run-of-river operation.

[112] Flow monitoring in the bypassed reach indicates that surface water is sometimes lost to groundwater between the proposed dam location and inflow from Spring #4.

Monitoring water surface elevation and streamflow at the two staff-recommended locations in addition to the water surface elevation immediately downstream of the diversion dam to inform project ramping (as discussed above), would fully capture project-induced effects on flow in South Fork Battle Creek, and, as such, any additional or different monitoring locations proposed by Rugraw or recommended by the agencies would not be necessary to monitor compliance with our recommended streamflow measures. During discussions at the March 15, 2018 section 10(j) meeting, both NMFS and Interior in fact came to agreement with the three staff-recommended monitoring locations. We estimate that our recommended streamflow compliance monitoring with gages in the project's impoundment, just downstream of the dam, and just upstream of Spring #4 would have a levelized annual cost of $18,560,[113] and that the benefits to aquatic resources would outweigh the cost. In contrast, the annualized levelized cost for streamflow monitoring as recommended by California DFW would be $7,270, and Interior and NMFS would be $26,420, and are not needed to monitor compliance with license conditions.

To ensure the streamflow monitoring is effective and consistent with Interior's and NMFS's recommended flow gage monitoring plan, we recommend that Rugraw articulate specific monitoring locations, equipment and station design, and methods for monitoring streamflow and project operations into our recommended operation compliance monitoring and reporting plan discussed below.

Water Quality Monitoring Plan

The Water Board recommends that Rugraw monitor water quality, with an emphasis on turbidity, when performing any in-water work, if project activities could have a discharge to surface waters, and when project-related activities result in the creation of a visible plume in surface waters (preliminary condition 6); develop a water quality monitoring plan, install and operate equipment at multiple water quality monitoring locations as determined by Rugraw and relevant resource agencies; and make data publicly available (preliminary condition 10).[114] The Water Board includes a list of other potential water quality parameters to be monitored in preliminary condition 10: BMI, turbidity, flow, water surface level, pH, temperature, alkalinity, minerals, and/ or conductivity.

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[113] $18,560 is the sum of the $7,270 for developing the streamflow monitoring component of an operation compliance monitoring and reporting plan, and $11,290 for real-time streamflow and water level monitoring.

[114] In its comments on the draft EIS, the Water Board clarifies that its recommended water quality monitoring is for monitoring during project construction, operation, and maintenance activities (i.e., during all activities with the potential to adversely affect water quality).

As described in sections 3.3.1.2, *Geology and Soil Resources, Environmental Effects*, and 3.3.2.2, *Aquatic Resources, Environmental Effects,* implementation of our recommended measures to control erosion, stormwater runoff, and in-water work periods and methods would minimize elevated turbidity and pH. However, monitoring for pH, turbidity and oily sheens during project construction would ensure that any adverse effects on water quality in South Fork Battle Creek would be identified, and allow for remediation, as needed. Therefore, we recommend that Rugraw conduct water quality monitoring during construction, and estimate that this monitoring would be conducted at no additional cost and would benefit aquatic resources.

However, the Water Board clarified that the water quality monitoring plan would also apply to the operation and maintenance of the project. We previously discussed that sediment sluicing could result in turbidity plumes and that turbidity monitoring should be conducted whenever sluicing occurs, as part of the DSMP. Project operations would typically not cause turbidity plumes but some maintenance activities (such as road repairs) could. The project is also not expected to affect mineral content, conductivity, or alkalinity; therefore, we do not recommend monitoring these parameters.

Development of a water quality monitoring plan would provide a means of determining the effectiveness of mitigation measures aimed at maintaining water quality during the proposed construction and maintenance of the project, and sediment sluicing events. Including all water quality monitoring requirements for these phases of the project within one plan would be the most efficient way to implement these requirements. The plan should include a number of techniques for detecting water quality effects, from visual observations to water quality sampling for specific contaminants. For example, reporting observations of oily sheens and turbidity plumes on surface waters would document potential fuel and oil spills and major erosion events. These observations combined with monitoring data could be used to determine what caused them and facilitate initiation of appropriate responses, including clean-up actions. The water quality monitoring plan should specify the methods, quality assurance measures, and reporting schedules. We recommend preparation of a water quality monitoring plan for construction and maintenance of the project, including sediment sluicing events, which would have a levelized annual cost of $1,350, and would be worth the cost for protection of water quality during these phases of the project.

Aquatic Invasive Species Monitoring Plan

To address the potential infestation and/or spread of invasive aquatic plant or animal species in the proposed project area, the Water Board recommends Rugraw develop an aquatic invasive species monitoring plan in consultation with relevant resource agencies (preliminary condition 8). The plan would: (1) identify potential sources related to, or conditions associated with, the proposed project that have the potential to transport or spread aquatic non-native invasive species; (2) identify BMPs to reduce and/or minimize the transportation or spread of aquatic non-native invasive species; and (3) include monitoring and corrective action steps to address potential spread of invasive species. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* although project construction and operation could cause the introduction of aquatic invasive species, early detection and rapid response efforts are the most effective and cost-efficient responses to invasive species that become introduced and established. Therefore, we recommend that Rugraw develop an aquatic invasive species monitoring plan. The plan should incorporate measures to help prevent the introduction and/or spread of aquatic nuisance species into the proposed project area.

As discussed in section 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*, there is potential for bullfrog to become established in the project impoundment. Colonization of bullfrog in the project area would increase risk of predation on state and federally listed amphibians including FYLF, Cascades frog, and CRLF. Incorporating measures in the aquatic invasive species monitoring plan for bullfrog surveys of the project impoundment and control measures to be implemented if bullfrogs are observed would reduce potential effects on listed frog species. Bullfrogs, known carriers of the aquatic chytrid fungus that causes high mortality in other amphibian species, could introduce the fungus to the project area. Additionally, equipment used in the water during treatment of invasive weeds, including boots, waders, and tools, have the potential to carry chytrid fungus and invasive weed propagules to other waterbodies. Therefore, to prevent the potential spread of chytrid fungus and invasive weed species, the plan should also include protocols for decontaminating equipment using agency-approved methods. Coupled with annual reporting, these measures should adequately monitor and help prevent the introduction or spread of aquatic invasive species within the proposed project area. We estimate the aquatic invasive species monitoring plan would have a levelized annual cost of $4,020 and that the benefits to aquatic resources would warrant the cost.

Special-status Amphibian Protection Plan

Rugraw proposes to avoid construction activities in riparian areas during the period when FYLF egg masses are typically present (mid-April through mid-May). Rugraw also proposes to conduct preconstruction surveys for juveniles and adults immediately prior to in-water work during the FYLF breeding season (mid-March through August) and relocate any that are found to areas outside of potential disturbance.

Water Board preliminary condition 13 would require Rugraw to develop an amphibian monitoring plan that includes annual monitoring for all life stages of CRLF, FYLF, and Cascades frogs, specifically egg masses, tadpoles, and adult amphibians on South Fork Battle Creek. California DFW (10(j) recommendation 2) similarly recommends FYLF monitoring between March and October. The recommended plan would also include annual reports that present monitoring data and analyze and evaluate frog populations and recommend actions based on population changes observed during monitoring.

Interior recommends that Rugraw prepare a sensitive amphibian protection plan for FYLF and CRLF and allow the establishment CRLF in the project area, provide protection from manageable threats, and control of bullfrogs, which are an aquatic invasive species that prey upon CRLF. Rugraw supports this measure, but contends there is no evidence bullfrogs caused the reduction in CRLF populations in the project area.

As discussed in sections 3.3.2.2, *Aquatic Resources, Environmental Effects*, 3.3.3.2, *Terrestrial Resources, Environmental Effects*, and 3.3.4.2, *Threatened and Endangered Species, Environmental Effects*, project construction could affect habitat for FYLF, Cascades frog, and CRLF. Protection measures are needed during construction to prevent effects on breeding FYLF. We note that Rugraw's proposed measures do not address potential effects on larval frogs. We also note that, because larval frogs have potential to move back downstream into the construction zone, consultation with California DFW would be needed to identify a suitable habitat a safe distance upstream of the project area for the placement of relocated FYLF. Although they are unlikely to occur in the project area, Rugraw's proposal does not include preconstruction surveys and relocation of juvenile and adult Cascades frogs or surveys for CRLF. To prevent take of CRLF, Rugraw should stop work and notify FWS if any CRLF are observed in the construction area. To prevent stress and injury to FYLF, Rugraw should consult with California DFW prior to construction to develop protocols for relocating FYLF if they are observed in the construction area. We anticipate the recommended protocols would provide proper handling techniques to prevent stress to individuals, and limit the potential for take associated with moving individuals out of harm's way during construction activities.

To facilitate consultation and compliance, we recommend Rugraw prepare a special-status amphibian protection plan that incorporates all measures related to the protection of FYLF, Cascades frog, and CRLF. The special-status amphibian protection plan would be developed in consultation with FWS and California DFW, and include: (1) conducting preconstruction surveys for all life stages during the breeding season; (2) avoiding construction activities in riparian areas when egg masses are present; (3) developing protocols for handling FYLF and Cascades frog during relocation activities; (4) identifying specific areas for relocation (notify California DFW if relocation of FYLF or Cascades frogs is necessary); (5) stopping work and notifying FWS within 24 hours if CRLF are observed during preconstruction surveys or during construction; and (6) relocating larval, juvenile, and adult FYLF and Cascades frogs prior to construction activities to an area sufficiently upstream to prevent them from re-entering the construction area. Although we find that the project impoundment could provide suitable breeding habitat for bullfrog, and thus impede potential reestablishment of CRLF, measures to monitor and control bullfrogs in the impoundment area are already included in our recommended aquatic invasive species monitoring plan discussed previously. Therefore, we do not recommend including any bullfrog control measures in the special-status amphibian protection plan. We estimate development of the special-status amphibian protection plan would have a levelized annual cost of $1,470, and the benefits to amphibian resources would justify this cost.

Base Flow Recession Rate to Protect Foothill Yellow-legged Frog

Following issuance of the draft EIS, FWS revised its 10(j) recommendations to provide that base flow recession rates following the spring snowmelt flood pulse should not exceed a 1-foot drop in stage over a 3-week period to protect FYLF. FYLF eggs masses are typically deposited in water depths ranging from 0.7 to 1.6 feet and require up to 3 weeks to hatch. FWS states that its recommendation is intended to reduce the potential for egg masses to be dewatered while incubating. Although our analysis presented in section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, and appendix C indicates that project operation would typically provide stable MIFs that would prevent stage reductions that could affect FYLF egg masses, the project may result in base flow recession rates in the bypassed reach that exceed the recommended rate roughly once every 7 years. Although these occasional flow recessions that result in desiccation of egg masses would not likely eliminate an entire year class from the population, they could greatly reduce reproductive success in the bypassed reach and subsequently negatively influence the breeding population in following years, limiting second-generation production. Therefore, we recommend Rugraw, in consultation with FWS and California DFW, develop a plan to protect FYLF from spring base flow recession rates that could dewater egg masses. Such a plan should include: (1) a protocol for distinguishing base flow recessions from storm pulse recessions; (2) measures to avoid a greater than 1-foot reduction in base flow over a 3-week period; and (3) annual reporting that provides the stage record from May 1 through July 31, and identifies periods where operations were modified, if necessary, to protect FYLF egg masses, or demonstrates that base flow stage reductions did not exceed the 1 foot per 3-week threshold. Implementation of such a plan would protect FYLF from project-related effects on reproduction success and would be worth our estimated levelized annual cost of $2,080.

Project Operation Compliance Monitoring and Reporting Plan

As discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects*, and section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, project operation would alter the existing flow regime in the project's bypassed reach of South Fork Battle Creek. As recommended by staff, and discussed previously in this section, the project would: (1) operate in run-of-river mode; (2) provide an MIF of 13 cfs; (3) implement a ramping rate restriction of 1-inch/hour; (4) discontinue project operations when the project causes average daily water temperature in the bypassed reach to exceed 20°C; and (5) monitor base flow recession rates and adjust minimum flows to ensure base flow recessions do not result in a drop in stage of more than 1 foot over a 3-week period during the FYLF breeding season. Subsequently, we recommend that Rugraw develop an operation compliance monitoring and reporting plan in consultation with NMFS, FWS, California DFW, and the Water Board to document compliance with project operational requirements listed above. The operations component of the plan would incorporate all staff-recommended flow and water temperature monitoring data requirements and specify the operational protocols for compliance with each. The monitoring component of the plan would articulate specific monitoring locations, equipment and station design, and methods. The reporting component of the plan would: (1) specify that the licensee notify the NMFS, FWS, California DFW, and the Water Board within 24 hours, and the Commission within 10-days of a non-compliance event; and (2) include a provision for annual operation and compliance reports, which would document compliance with all license requirements for flow, ramping rates, and water temperature. The annual reports would also track and report other operational events such as project shut-down and start-up due to available flow, the turbidity monitoring results during sluicing operations, and results of the periodic monitoring of sediment and/or woody material accumulation in the project reservoir.

We estimate that the levelized annual cost of the plan would be equal to the sum of its parts discussed above, $28,800,[115] and that the benefits to aquatic resources would warrant the cost.

Noxious Weed and Revegetation Management Plan

Construction of the project would temporarily disturb 11.37 acres of vegetation. During operation, vegetation maintenance would occur within the project transmission corridor. These activities have the potential to create suitable habitat for new populations of noxious weeds. To address this, Rugraw proposes to implement its Noxious Weed and Revegetation Management Plan (filed on November 30, 2015) that includes numerous measures to prevent transportation of noxious weeds to the project site; monitoring and control measures for new weed populations that occur within the project boundary; and success criteria. However, the plan does not provide for additional actions if success criteria are not met, as recommended by Interior, nor does it include the Water Board's recommendations to treat existing noxious weed populations in the project boundary (preliminary condition 14) or provide for the protection of sensitive plants during treatment of weeds (preliminary condition 14).

As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, treating existing populations would reduce seed sources that could spread to areas of project disturbance. Additionally, while the proposed plan includes appropriate methods for measuring success of revegetation and weed treatments, there is no discussion of what would occur if criteria are not met. Modifying the plan to include additional seeding and weed treatment, as Interior recommends, would ensure the activities are not discontinued

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[115] Although table 4-3 lists the estimated cost of the operation and compliance monitoring plan as $0 to avoid double-counting the cost of each component of the plan, the sum of its components (i.e., staff-recommended development of the plan's streamflow-monitoring component, development of the plan's water-temperature monitoring component, real-time stream gage monitoring, and real-time water temperature monitoring) has a levelized annual cost of $28,410.

prematurely, but are implemented until goals are achieved and vegetation resources are restored. Finally, modifying the plan to include measures that would protect sensitive plants during application of weed treatments would reduce potential for accidental trampling, mechanical damage, or herbicide damage to sensitive species.

Therefore, we recommend modifying Rugraw's Noxious Weed and Revegetation Management Plan to include provisions for treatment of existing non-native invasive plant populations in the project boundary, additional reseeding and monitoring if restoration success criteria of less than 10 percent cover of noxious weeds are not met by the end of the 2-year monitoring period, and measures to protect sensitive plant species from treatment would provide additional benefit to vegetation resources. We estimate these modifications would have a levelized annual cost of $650 and that the benefits to vegetation resources would warrant the cost.

Avian Protection Plan

Rugraw proposes to construct the project transmission line in accordance with APLIC recommendations. Interior recommends that Rugraw develop an avian protection plan that describes the protective measures that would be implemented to protect all avian species from adverse effects of power transmission line construction and operation (10(j) recommendation 7). As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, the APLIC manuals provide a variety of potential measures for minimizing potential for transmission lines to electrocute birds or cause injury associated with collisions. However, these manuals do not necessarily identify specific measures to be used in specific situations. Requiring Rugraw to develop a plan specifying which measures it proposes to implement would allow agencies to comment on whether the proposed measures are suitable for this specific project. Therefore, we recommend that prior to the construction of the transmission line Rugraw prepare, in consultation with California DFW and Interior, an avian protection plan describing what measures it would use to minimize effects of transmission lines on birds and describing how APLIC guidelines (APLIC, 2006, 2012) were considered in the development of the plan. We estimate the plan would have a levelized annual cost of $1,580 and that the benefits to wildlife resources would warrant the cost.

Bald Eagle and Raptor Management Plan

Rugraw proposes to conduct preconstruction surveys for raptors, including bald eagles, and implement appropriate protection buffers as needed during project construction. Interior recommends that Rugraw prepare a bald eagle management plan that would identify specific measures for protecting bald eagles from effects during project operations including, but not limited to, maintenance activities. As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, the National Bald Eagle Management Guidelines (FWS, 2007) recommend a variety of buffer distances to eagle nests depending on the intensity of disturbance activity, the location of the disturbance relative to nests, and the extent to which individual birds may be accustomed to noise disturbance and human activity. Other raptor species vary in sensitivity to disturbance and may require different buffer distances than bald eagles. Consultation with California DFW and FWS to prepare a bald eagle and raptor management plan would ensure any buffer distances proposed for the protection of raptors would be appropriate to the specific project conditions and species in consideration. Therefore, we find Rugraw should prepare a bald eagle and raptor management plan that specifies the project-specific buffers to be applied and describes how FWS guidelines were considered in identifying the buffers. We estimate the plan would have a levelized annual cost of $1,580 and that the benefits to bald eagles and other raptors would warrant the cost.

Historic Properties Management Plan

Rugraw proposes to implement the HPMP filed with its application that provides for the management of cultural resources and historic properties within the proposed project APE. Both the California SHPO and Commission staff commented on the HPMP and recommend additional modifications to it. Our analysis in section 3.3.7.2, *Cultural Resources, Environmental Effects*, indicates that, while the HPMP includes many of the standard requirements of an HPMP, some measures contained within the HPMP still require some clarification and/or more detail. In addition, there are other measures that should be included in the HPMP to ensure that the operation and maintenance of the project would not adversely affect historic properties over the term of any new license. As such, we recommend implementation of Rugraw's HPMP with the following revisions: (1) modifying sections 1.2, 1.4, 1.7, 1.8, 4.1, 4.3, 4.5, 4.6, 4.7, 5.1, 5.2, 5.3 and appendix B of the document for a more clear and concise management approach for historic properties that may be affected by the proposed project; (2) inclusion of copies of all post-2014 tribal correspondence and consultation to document full compliance with section 106; (3) inclusion of a cultural resources interpretive element (e.g., installation of public interpretive signs at key viewing areas); (4) inclusion of a detailed monitoring plan for cultural resources that are eligible or potentially eligible for listing in the National Register, including filing of an annual monitoring report, or a plan to include these measures in the construction monitoring plan specified in section 4.5 of the HPMP; (5) provisions for periodic review and revision of the HPMP; (6) editorial corrections;[116] and

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[116] Several small errors were identified in the HPMP and should be corrected in the revised HPMP: (1) sections 5.1 and 5.2 of the HPMP describe each site, building, structure, and object recorded in the project APE. In these sections, the descriptions of "*Treatment Measures During Project-related Construction*," "*Treatment Measures During Project-related O&M,*" and "*Long-Term Monitoring Frequency*" for some non-road resources (CA-TEH-1824H [ditch]; CA-TEH-2041H [historic sawmill]; CA-THE-2113H [historic can and refuse scatter]; CA-TEH-2496H [historic refuse scatter]; CA-THE-2498H [historic refuse scatter]; CA-TEH-2520H [historic refuse scatter]; and CA-TEH-2500H [Lassen Lodge]) are described as: "None: road is not NRHP eligible." Please re-check, and if not a road, then change the description of the resource to what it actually represents; (2) include stand-alone sections for additional cultural resources

(7) inclusion of Volume II into the HPMP that consists of all individual cultural resource site record forms. We estimate that the levelized annual cost to revise and implement the HPMP for the project would be $5,170 and conclude the benefits of cultural resource protection justify the cost.

5.1.3 Other Measures Not Recommended by Staff

In addition to those measures discussed in the previous section for which staff recommended alternatives or modifications, staff finds that some of the measures recommended by Rugraw or other interested parties would not contribute to the best comprehensive use of South Fork Battle Creek 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.

Pesticide Use Plan

The Water Board recommends that Rugraw develop a pesticide use plan (preliminary condition 9) if pesticide use related to the project has the potential to affect water quality. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, using pesticides to control pests near project buildings, roads, and other physical structures presents a risk of contaminating surface waters in the project area, and developing a pesticide use plan would provide a comprehensive source documenting how Rugraw would manage these risks to protect water quality, ESA- or CESA-listed species, and/or associated habitat in or downstream of application areas. We initially recommended a pesticide use plan as part of the staff alternative in the draft EIS, but after further review, we note that the Commission does not regulate pesticide use, which is already regulated at the state and local level. Pesticide management by California's Department of Pesticide Regulation and the Tehama County Agricultural Commissioner would adequately protect the water quality of surface and ground waters, endangered species, and other wildlife. We therefore, do not recommend a pesticide use plan.

Dissolved Oxygen Monitoring

In comments on the draft EIS, the Water Board recommends monitoring of temperature and DO for a minimum of 5 years at the diversion intake, just upstream of Spring #4, and below the bypassed reach; and meeting with the resource agencies to

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inventories (section 4.6.3), archaeological site evaluation and data recovery excavation (section 4.6.4), and long-term historic property monitoring (section 4.6.5) rather than subsections of Road Maintenance and Rehabilitation (section 4.6); (3) "Atsugewi" is incorrectly spelled as "Astugewi" in the document and should be corrected, accordingly, and (4) appendix D of the HPMP is difficult to read because of its extremely small font size. Use of a larger font or different format for the table would ensure legibility.

determine if the project is having a significant impact on water temperature and identify appropriate mitigative actions.

Although project operation may increase water temperature slightly during some periods (see section 3.3.2.2, *Aquatic Resources, Water Temperature*), these temperature changes are not expected to have a measurable effect on DO concentrations, because they would have minimal effect on the saturation of oxygen in water. For example, increasing the temperature from 18ºC to 19ºC would decrease DO at saturation by 0.2 milligram per liter (USGS, 2018). Monitoring DO during project operation is not recommended.[117]

BMI Monitoring Plan

NMFS and Interior recommend (10(j) recommendation 5) that Rugraw develop a BMI monitoring plan that includes surveys at least 1 year prior to construction and in years 1 through 4 and every 4 years thereafter through the term of the license. Interior further stipulates that, if key BMI population parameters decrease by more than 50 percent, Rugraw would prepare a riparian restoration plan and mitigation plan targeted at increasing BMI production. In response to the NMFS and Interior recommendations, Rugraw agreed to conduct a baseline BMI survey in the proposed bypassed reach prior to project construction.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* operation of the proposed project would alter the existing flow, water temperature, water quality, and sediment transport characteristics of South Fork Battle Creek, which in turn could affect distribution, abundance, and composition of BMI. However, it is anticipated that Rugraw's proposed mitigation measures including run-of-river operation, minimum flows, ramping rates, BMPs during construction, and sediment and woody debris passage at the dam, would adequately protect aquatic habitat and BMI in the project-affected reach. While continued sampling of BMI, as recommended by the resource agencies, would enable any general trends to be documented, we cannot envision a scenario where project construction and operation, with protection and enhancement measures that would be included in any new license, would result in a different conclusion as to the overall project effects on the resource beyond that already evaluated in this EIS. Further, general monitoring of BMI would not necessarily isolate any project-specific effects on the resources. Consequently, we find that the monitoring data would provide minimal benefits from a project-specific perspective. We estimate that BMI monitoring would have a levelized annual cost of $6,150, and would not be worth the cost to implement.

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[117] We also note the project would have little influence on DO at the diversion intake, and the other two DO monitoring stations recommended by the Water Board are located downstream of Angel Falls, which would act to aerate any bypassed reach flow from the dam to near saturation.

Fish Habitat Assessment Plan

To monitor the effects of the proposed project on aquatic habitat, the Water Board recommends that Rugraw develop a fish habitat assessment plan (preliminary condition 12) at a levelized annual cost of $3,820. The fish habitat assessment plan would be prepared in consultation with Water Board staff and other relevant resource agencies and include monitoring of habitat features (such as water temperature, stream depth, flow velocities, water quality, sediment transport, etc.) associated with resident fish populations and ESA- and CESA-listed fish species potentially found within the project area.

As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* operation of the proposed project would alter the existing flow, water temperature, water quality, and sediment transport characteristics of South Fork Battle Creek, which in turn could affect the distribution and abundance of resident rainbow trout, BMI, and potentially Chinook salmon and steelhead, if introduced to the reach. Although long-term monitoring of aquatic habitat conditions in the project's proposed bypassed reach, as recommended by the Water Board, could allow Rugraw and resource agencies to evaluate any changes in aquatic habitat over time and determine if required mitigative measures are effective at meeting resource objectives, we cannot envision a scenario where project construction and operation, with protection and enhancement measures that would be included in any new license, would result in a different conclusion as to the overall project effects on the resource beyond that already evaluated in this EIS. Further, general monitoring of fish habitat would not necessarily isolate any project-specific effects on the resources. Consequently, we find that any monitoring data would provide minimal benefits from a project-specific perspective. Measures proposed by Rugraw and recommended by staff should adequately protect aquatic habitat in the project-affected reach of South Fork Battle Creek. Therefore, we are not recommending the fish habitat assessment plan.

Minimum Instream Flows of 35, 30, 25 and 8 cfs

We do not recommend NMFS's and Interior's 35-cfs minimum flow recommendation because it was developed based on results of a PHABSIM study performed in the bypassed reach that predicted the usable habitat for steelhead and spring-run Chinook salmon juveniles and fry (Interior, 2018). At present, neither steelhead trout nor spring-run Chinook salmon occur in the proposed bypassed reach. Panther Grade at RM 18.9 would prevent these species from entering the project reach in all but the most extreme high flow conditions, assuming that fish are provided access upstream of Coleman, Inskip, and South Diversion dams.[118] Setting the minimum flow at 35 cfs to provide maximum habitat for a non-extant fish assemblage is questionable,

[118] In its comments on the draft EIS, Interior states that the expected completion date for removal of barriers to fish migration is 2023.

particularly in light of potential effects on power generation. However, if anadromous salmonids gain access to the project reach, the project would not be operating during Chinook salmon spawning season. During steelhead spawning, the recommended 13-cfs MIF would support a spawning capacity that would produce a number of steelhead parr that would far exceed the steelhead rearing capacity of the reach, and a 35-cfs instream flow would exceed that capacity many times over.

Following issuance of our draft EIS, NMFS recommended staff analyze an additional MIF alternative that varies by season for the following steelhead and Chinook life stages:

- 35 cfs for steelhead/Chinook spawning, November 1 to March 1;
- 30 cfs for steelhead/Chinook rearing, March 2 to May 31; and
- 25 cfs for steelhead over-summer, June 1 to October 31.

NMFS, however, did not provide any basis for these alternative flows, other than that they would be targeted to specific seasonal life stages for steelhead and Chinook. Our analysis of these alternative flows in section 3.3.2.2, *Aquatic Resources, Effects of Flow Regulation on Aquatic Habitat*, found that they would provide near maximum habitat value for juvenile and fry rearing and over summer holding, although the cited PHABSIM study did not provide WUA data for spawning. However, as noted for the year-round 35-cfs flow, implementing this variable flow regime would provide maximum habitat value for a non-extant fish assemblage, which we do not recommend.

In its February 2, 2018, comments on the draft EIS, Rugraw suggested that Commission staff analyze an 8-cfs minimum flow, and states it is also willing to consider seasonal minimum flows ranging from 8 to 13 cfs depending on the number of anadromous fish in the reach, along with 30-cfs pulse flows if more than 12 adult anadromous fish are identified in the project reach. However, Rugraw did not specify, that it was changing its original flow proposal of 13 cfs.

We analyzed an 8-cfs minimum flow by also reviewing Interior's PHABSIM analysis, which did not evaluate an 8-cfs minimum flow alternative but did include WUA calculations for both 5 and 10 cfs. Extrapolating between the WUA available at 5 and 10 cfs, the amount of available habitat for Chinook and steelhead at 8 cfs would be substantially less than that realized under the 13-cfs, 35-cfs, and 35/30/25-cfs minimum flow regimes. At 8 cfs the amount of WUA would be reduced by about 30 to 51 percent from that available at 13-cfs minimum flow and would be even further reduced at the agency-recommended flows. An 8-cfs minimum flow would also increase the amount of time the project would operate during the spring and fall, resulting in reduced habitat connectivity for resident rainbow trout. This reduction in habitat connectivity would be the same as for the 13-cfs minimum flow (from 9 to 25 percent of the time depending on season). Depending on their frequency, Rugraw's 30-cfs pulse flow alternative could help to maintain habitat connectivity if more than 12 adult anadromous fish are identified in the project reach and possibly stimulate the downstream migration of juveniles to more suitable habitats. However, because of the substantial reduction in habitat area at a minimum flow of 8 cfs, we are not recommending that flow.

In the absence of anadromous fish, rearing capacity is also the most limiting factor for resident rainbow trout in the bypassed reach. This rearing capacity is determined by the limited volume of habitat during the low flow season, when the project would not be operating and thus would not affect the rearing capacity of rainbow trout. According to Cramer et al. (2015), the parr equivalent capacity for rainbow trout spawning is slightly less than that for steelhead, but still far greater than needed to fully seed the available rearing habitat, even for spawning at 13 cfs. Although spawning capacity would increase at flows above 13 cfs, the increased number of offspring would be forced to migrate in search of vacant rearing habitat downstream. However, this would appear to be of negligible benefit, because similar stream morphology downstream from the project indicates that spawning capacity likely exceeds rearing capacity throughout South Fork Battle Creek. The levelized annual cost for a 13-cfs minimum flow would be $6,500, the levelized annual cost of a 35-cfs minimum flow would be $120,120, and the levelized annual cost for NMFS's alternative 35/30/25-cfs minimum flow would be $98,560. Both of the higher minimum flow alternatives would have major effects on project economics without providing substantial additional fishery habitat benefits. Therefore, we do not recommend a 35-cfs or alternative 35/30/25-cfs minimum flow for the bypassed reach. The 8-cfs minimum flow alternative would increase energy production by 1,840 MWh (levelized value of $36,300) compared to project operation under the proposed minimum flow of 13 cfs, but because of the limited protection of aquatic habitat, we are not recommending this flow.

Salmonid Monitoring Plan

Rugraw proposes to conduct snorkel surveys for anadromous fish upstream of Panther Grade within a month of each 400 cfs or greater flow event.[119] Rugraw also proposes to conduct genetic tissue sampling of steelhead/rainbow trout within the bypassed reach. Interior and NMFS recommend long-term monitoring of both resident and anadromous fish, and Water Board preliminary condition 11 specifies "monitoring all fish species within and downstream of the Project area." As discussed in section 3.3.2.2, *Aquatic Resources*, *Environmental Effects,* although Rugraw's proposal to conduct genetic sampling for steelhead and snorkel surveys could provide general fisheries management information on the distribution of resident and anadromous salmonids in the bypassed reach, this information would be unrelated to a specific project effect (i.e., the presence of anadromous fish at the project would depend upon, among other non-project-

[119] As noted in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* Rugraw believes that Panther Grade is a barrier to upstream fish migration when flows are less than approximately 400 cfs; however, fish passage has not been assessed at this site over the full range of natural flows experienced during the Chinook and steelhead migration period.

related factors, successful fish passage at downstream dams and over Panther Grade). Therefore, there is no project-specific basis for requiring Rugraw to monitor for any future presence of anadromous fish at the project as a condition of any license issued. For resident salmonids, we have already evaluated the potential project effects and benefits and costs of mitigation measures in this EIS. We have further concluded that our recommended environmental measures would adequately protect resident fish within the bypassed reach. Therefore, there is no project-specific need for the monitoring data. For these reasons, we do not recommend Rugraw's proposed general monitoring or the resource agencies' recommended long-term general monitoring of resident and anadromous salmonids in the bypassed reach, including Water Board preliminary condition 11. We estimate that Rugraw's proposed monitoring program would have a levelized annual cost of $5,040, and the Interior and NMFS recommended monitoring program would have a levelized annual cost of $18,170. We assume that the cost for preliminary condition 11 would be similar to the Interior and NMFS program. None would be worth the cost for the minimal project-specific benefit from the information that would be obtained by any fish monitoring program.

Streambed and Riparian Area Restoration

Interior recommends that, if water is not available to comply with the 7DADM criteria specified in its temperature threshold recommendation discussed above, or if water temperature above the project's influence exceeds the criteria, Rugraw should restore streambed and riparian areas to provide additional shading to reduce instream water temperatures (10(j) recommendation 2). As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, it is conceivable that streambed and/or riparian restoration projects could contribute to reducing warming in the creek and/or increasing water availability. However, our water temperature analysis indicates that the project would have minor effects on water temperature in South Fork Battle Creek, and under some conditions would act to cool temperatures in the creek. There would still be the potential for warmer water temperatures in waters entering the project area from upstream anthropogenic effects, but Rugraw should not be required to address effects upstream of the project that do not have a project nexus and are beyond its control. In addition, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, we are now recommending water temperature monitoring and cessation of project operation if average daily water temperatures in the bypassed reach exceed 20°C, and it is documented (by monitoring) that project operation is causing an increase in water temperature in the bypassed reach.

Upstream Fish Passage at the Diversion Dam

Rugraw proposes and California DFW recommends (10(j) recommendation 4) the design and construction of upstream fish passage facilities at the project diversion in coordination with California DFW, and incorporating NMFS Northwest Region Anadromous Salmonid Passage Facility Design, to ensure fish are able to pass over the diversion dam after completion of the project. Although installation of the proposed upstream fish passage facilities would likely provide safe, timely, and effective upstream passage for resident rainbow trout, this measure would only benefit resident trout residing in the 0.7-mile-long reach of South Fork Battle Creek between Angel Falls and the diversion dam.[120] Given the limited extent of the reach (0.7 mile) and the limited amount of summer rearing habitat for rainbow trout located there, as well as the lack of anadromous species, we find that the benefit of providing upstream fish passage at the project's diversion dam to be outweighed by the estimated capital cost of $300,000 (levelized annual cost of $23,080). As we previously described, reseeding of the stream with trout occurs naturally from upstream and does not depend on the ability of trout downstream to migrate upstream over passage barriers. If anadromous salmonids gain access to the bypassed reach in the future, they would not require passage at the diversion dam because the impassable Angel Falls would prevent fish from reaching the dam. Any upstream passage facility at the dam would likely only be used by a limited number of resident fish that would not require upstream passage to complete their life history. Therefore, we do not recommend Rugraw's proposal or California DFW's recommendation for the design and construction of upstream fish passage facilities at the diversion dam.

Drought Plan

The Water Board recommends implementation of a drought plan to outline project operation, including flows, during a drought and/or multiple critically dry years (preliminary condition 4) at a levelized annual cost of $1,920. The drought plan would also include a measure for requesting WQC variances during drought conditions. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, developing a drought plan to maintain flows and water levels during drought conditions would not be required to protect water quality for aquatic species. The proposed project would operate in a run-of-river mode with a proposed minimum bypassed reach flow, operate as a non-consumptive use of water for power generation (i.e., all of the diverted flow would be returned to South Fork Battle Creek), and would not store flow in a reservoir. The project as proposed would not exacerbate drought conditions in downstream stream reaches. Therefore, we do not recommend that Rugraw develop a drought plan as outlined in the Water Board's preliminary condition 4.

Amphibian Monitoring Plan

The Water Board (as part of preliminary condition 13), California DFW (10(j) recommendation 2), and Interior (10(j) recommendation 8) recommend general post-construction monitoring for FYLF, Cascades frog, and CRLF. Rugraw is in agreement with these recommendations. However, as discussed in sections 3.3.3.2, *Terrestrial Resources, Environmental Effects*, and 3.3.4.2, *Endangered Species, Environmental*

[120] Angel Falls, located at RM 22.3, is a natural barrier to upstream fish passage.

Effects, the recommended measures do not indicate how monitoring would be used to identify project-related effects, what level of effects would be considered adverse, or what mitigation would be implemented. Monitoring alone would not provide project-related protection, habitat enhancement, or mitigation, so any benefits of this measure cannot be analyzed. Further, because the project would not create artificial high flows in summer, would not remove channel-forming winter and spring flood flows, and would only create a small impoundment, we find the project avoids the primary mechanisms through which hydroelectric projects typically affect sensitive frogs. We find the benefits of the monitoring efforts are not worth the estimated levelized annual cost of $1,350. Therefore, we do not recommend including monitoring of sensitive frogs as part of the license.

Consultation and Review

Water Board preliminary condition 5 would require Rugraw to consult annually with relevant resource agencies to review current lists of rare, threatened, and endangered species and special-status plant and wildlife species to identify species that have the potential to be adversely impacted by the project. Species-specific study plans would be developed or updated, in consultation with relevant resource agencies, whenever new potential impacts or newly listed species are identified. Rugraw agrees to implement this measure.

While we agree that consultation prior to new construction and non-routine maintenance would protect federally listed species and their habitats over the term of the license, the Commission includes in its licenses a standard license article providing such protection to both listed and non-listed species. This license article contains a fish and wildlife reopener provision that could be used to require changes to project facilities, operation, or maintenance upon the Commission's motion, or as recommended by the appropriate state or federal fish and wildlife agencies, after notice and opportunity for hearing.[121] This standard reopener provision 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 any license issued for the project. We recognize, however, that these annual review and consultation measures are included in the preliminary WQC conditions and would be required as mandatory conditions of any license issued for the project if they also are included in the final WQC. These consultations would have a levelized cost of $770.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Project construction would disturb soils in the project area, resulting in temporary adverse effects on soil resources. Rugraw's proposed erosion control measures, SWPPP, and proposed construction plans provide a comprehensive set of measures to avoid or

[121] Typically, this would be standard article 15 in any license issued for the project.

minimize construction effects on soil erosion, sedimentation, and water pollution during construction. Even with implementation of these plans, there would still be temporary increases in sediment and turbidity levels that would cause short-term effects on aquatic biota in South Fork Battle Creek.

Construction of the diversion dam would create a small headpond of about 0.4 acre with negligible storage. Although this small impoundment would replace existing stream habitat, this new impoundment would be similar to other pools within South Fork Battle Creek and overall would not have a substantial effect on stream habitat in the creek. The proposed diversion dam would block the upstream movement of resident trout, although only 0.7 miles of stream occurs below the proposed dam site and the next downstream barrier to upstream fish movement, Angel Falls.

Project operation would cause some flow fluctuations in the bypassed reach. Reducing flows in the bypassed reach could reduce transport of gravel and fine sediment within South Fork Battle Creek. Rugraw's proposal to sluice gravels and fines at the diversion dam, however, would ensure suitable spawning and rearing habitat is available to salmonids and minimize any adverse effects downstream of the dam.

Project construction would result in the permanent loss or alteration of about 69 acres of vegetated wildlife habitat, including about 31 acres of Sierran mixed conifer, 5 acres of annual grassland, 3 acres of blue oak woodland, 4 acres of blue oak-foothill pine-interior live oak, and about 7 acres of mixed and montane chaparral. Roughly 11 acres of temporary vegetation disturbance would also occur during project construction. The use of construction equipment could introduce invasive plant species and provide opportunities for them to colonize areas where land has been disturbed during project construction. However, revegetating the disturbed areas and ensuring the successful establishment of native vegetation would help to control the introduction and spread of invasive plant species.

Wildlife would be disturbed by noise and human presence during the construction period and, to a lesser extent, project operation and maintenance. The overhead transmission line could result in bird collisions, which could cause direct injury or mortality of individual animals. Designing the overhead line consistent with practices outlined by APLIC, including marking to increase visibility, would minimize this potential to the greatest extent practicable. Existing recreational access to the project area, while generally minor and limited to private recreation, would be periodically interrupted during the construction period.

5.3 RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by 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 April 25, 2016, notice soliciting comments, recommendations, terms and conditions and prescriptions, California DFW, NMFS, and Interior, collectively, filed 27 recommendations under section 10(j) of the FPA.[122] We found 21 of the 27 recommendations to be within the scope of 10(j). Of the 21 recommendations within the scope of 10(j), we determined that 2 may be completely inconsistent, and 9 are partially inconsistent with the purpose and requirements of the FPA or other applicable law. Table 5-2 (at the end of the following discussion) 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 and section 5.1, *Comprehensive Development and Recommended Alternative*, of this document.

We sent letters to California DFW, NMFS, and Interior on December 5, 2017, informing them of our preliminary determination of inconsistencies for their recommendations, and requesting concurrence, comments, or alternative recommendations. By letters filed February 2, 2018, and February 14, 2018, Interior and NMFS 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, Commission staff conducted a 10(j) meeting with Interior and NMFS on March 15, 2018, in Sacramento, California.[123] In addition to addressing the section 10(j) recommendations, this meeting (which was publically noticed and open to all interested parties) also served as a forum to

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[122] As table 5-2 shows, California DFW filed 10 recommendations on June 16, 2016; NMFS filed 7 recommendations on June 21, 2016; and Interior filed 11 recommendations on June 24, 2016. In addition, Interior provided two new recommendations during the section 10(j) meeting on March 15, 2018. Six of the recommendations filed by NMFS and Interior are identical, but because we divide three of those recommendations into their two components, resulting in a total of nine identical NMFS and Interior recommendations, we refer to the overall number of recommendations from all the agencies as 27 (10+[7-6]+[11-6]+2+9).

[123] The section 10(j) meeting was also attended by the Water Board, Reclamation, and Rugraw and its representatives (a transcript of the meeting was filed to the record on March 15, 2018).

discuss the recommendations we found to be outside the scope of section 10(j).[124] Subsequently, each of the recommendations in table 5-1 of the draft EIS (now table 5-2 in this final EIS) were discussed during the meeting. Following is a summary of the meeting discussions and other section 10(j) process filings for each of the recommendations filed by Interior and NMFS 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. Our findings for recommendations within the scope of 10(j) but inconsistent with the comprehensive planning standard of section 10(a) of the FPA, including the equal consideration provision of section 4(e) of the FPA, are based on our determination that the costs of the measures outweigh the expected benefits.

Upstream Fish Passage

In the draft EIS, we did not adopt California DFW's recommendation to design and construct upstream fish passage facilities at the project diversion under the staff alternative. As discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, our analysis finds that, although installation of the proposed upstream fish passage facilities would likely provide safe, timely, and effective upstream passage for resident rainbow trout, the benefits of this measure would be limited, providing passage for only the resident trout occurring within the short, 0.7-mile-long reach of South Fork Battle Creek between Angel Falls and the diversion dam.[125]

Following review of the agencies' response 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 continue to find that the limited benefits of providing upstream fish passage at the project's diversion dam would be outweighed by the relatively substantial levelized annual cost of $26,330. Therefore, we find that providing such upstream fish passage is not warranted pursuant to sections 4(e) and 10(a) of the FPA.

As a result, the inconsistencies between the 10(j) recommendation for upstream fish passage at the diversion dam and sections 4(e) and 10(a) of the FPA remain unresolved.

Minimum Instream Flow of 35 cfs

In the draft EIS, we did not adopt the Interior and NMFS recommendations for a MIF of 35 cfs in the project bypassed reach under the staff alternative. As discussed in

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[124] Interior's two new recommendations made during the section 10(j) meeting on March 15, 2018, include (1) changing its recommended water temperature threshold for cessation of project operations from 16°C for holding and rearing of Chinook salmon to 15.5°C (which is discussed herein), and (2) recommending a base flow recession rate for protection of FYLF (which is discussed in section 5.1.2, *Additional Measures Recommended by Staff*).

[125] Angel Falls, located at RM 22.3, is a natural barrier to upstream fish passage.

section 5.1.3, *Other Measures Not Recommended by Staff*, of the draft EIS, our analysis concludes that the applicant's proposed and California DFW/staff-recommended 13-cfs minimum flow would support the existing rainbow trout resident fishery and a steelhead spawning capacity that would produce a number of steelhead parr that would far exceed the steelhead rearing capacity of the reach. Although the draft EIS recognizes that Interior's and NMFS's flow recommendations are intended for the benefit of federally listed steelhead and Chinook juvenile and fry rearing life stages, and would provide near maximum habitat value for these species and life stages, it also notes that these anadromous fish are not present in the project area.

Following review of the agencies' response 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 continue to find that the limited benefits of providing the Interior and NMFS 35-cfs minimum flow recommendations would be outweighed by the substantial estimated effect on project economics (levelized annual cost of $120,120) and is not warranted pursuant to sections 4(e) and 10(a) of the FPA.

As a result, the inconsistencies between the agency 10(j) recommendations for a MIF of 35 cfs in the project bypassed reach and sections 4(e) and 10(a) of the FPA remain unresolved.

Flow Gage Monitoring Plan

In the draft EIS, we did not adopt the Interior and NMFS recommendations for the development of a flow gage monitoring plan that would specify monitoring at seven locations, under the staff alternative.[126] Although we conclude that flow gaging and monitoring is needed, we find that three rather than seven monitoring stations are sufficient to document compliance with license conditions. As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, project operation would have negligible effects on streamflow downstream of the powerhouse discharge because the project would be operated in a run-of-river mode, where outflow from the project would approximate inflow to the project on a near instantaneous basis. Consequently, monitoring flow at the three locations downstream of the powerhouse discharge as recommended by Interior and NMFS would not be needed to monitor project compliance with a license condition, nor would the additional stations just upstream of the diversion dam; at the intake's header box; and upstream of Angel Falls.

During the section 10(j) meeting, we explained the basis for the staff-recommended flow monitoring locations, and meeting participants concluded that the following three monitoring locations recommended by Commission staff would be sufficient: (1) the water surface elevation of the project's impoundment, to support

[126] California DFW also recommended monitoring flow at a single location downstream of the diversion dam and fishway.

compliance with run-of-river project operation; (2) the water surface elevation just downstream of the diversion dam, to represent habitat with high likelihood of fish stranding, for compliance with the ramping rate restriction; and (3) streamflow just upstream of Spring #4's influence to monitor compliance with the minimum flow requirement (a transcript of the meeting was filed on the record on March 15, 2018; see page 146 of the transcript, lines 1 through 9). Thus, we conclude that Interior and NMFS now recommend the three gaging locations under the staff alternative, thereby resolving the inconsistency.

Ramping Rate

We identified two inconsistencies with the ramping rate recommendations for the project: (1) the actual ramping rate, and (2) the location for measuring the ramping rate. In the draft EIS, we recommended Rugraw's proposed and California DFW's and Water Board's recommended ramping rate of 0.1-foot/hour (equivalent to 1.2 inches/hour) rather than Interior's and NMFS's slightly smaller ramping rate of 1-inch/hour. In the draft EIS, staff concluded that the 0.1-foot/hour rate restriction would be adequate to protect fish and other aquatic biota in the bypassed reach, which is a relatively high gradient and confined channel. We also concluded that 0.1-foot/hour may be easier to comply with from an operational perspective, because it is a larger ramping rate and may require less precise instrumentation.

During the section 10(j) meeting, we discussed our recommended ramping rate with the resource agencies and in re-considering our draft EIS analysis, concluded that both ramping rates are similar in magnitude (i.e., 1.2 inches/hour versus 1 inch/hour), would provide similar protection to aquatic resources (although 1 inch/hour would be slightly more protective), and would have the same cost. In deference to Interior's and NMFS's recommendation for a 1-inch/hour ramping rate, which would also satisfy the California DFW- and Water Board-recommended 0.1-foot/hour ramping rate, we now adopt a 1-inch/hour ramping rate, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*. Thus, the inconsistency related to the magnitude of the ramping rate is resolved.

The second inconsistency associated with the ramping rate was the location for measuring and determining compliance with the ramping rate. The agencies recommended a single measurement point for ramping, with Interior and NMFS recommending a point downstream of the diversion dam between Angel Falls and Spring #4.[127] We recommended in the draft EIS that compliance with the ramping rate can be best monitored by recording water surface elevation at a single location immediately downstream of the diversion dam, at a location that fully reflects project effects, is within a wider stream channel where flow fluctuations would have a more dramatic effect on available habitat, and is without influence of any inflows from springs or other water

[127] California DFW recommended a point between the diversion structure and ABS but did not participate in the section 10(j) meeting discussions.

sources within the reach. As we discussed above under *Flow Gage Monitoring Plan*, during discussions at the section 10(j) meeting, Interior and NMFS now adopt the staff recommendation to monitor water surface elevation at a single point just downstream of the diversion dam, to represent habitat with high likelihood of fish stranding, for compliance with the ramping rate restriction (see the section 10(j) meeting transcript page 144, lines 12 through 21, and page 146, lines 1 through 9). Therefore, the inconsistency related to the point of measurement for the ramping rate is resolved.

Water Temperature Monitoring

In the draft EIS, we found that implementing a temperature threshold for cessation of project operations would provide little, if any, benefit to aquatic resources, because the limiting factor for resident salmonid populations in the bypassed reach is the amount of available habitat during the low flow season, when the project would not be operating, and temperature modeling showed that project inflow temperatures exceeding 20ºC would cool in the bypassed reach under project operation. Therefore, pursuant to section 313(b) of the FPA, we did not adopt, under the staff alternative in the draft EIS, recommendations from Interior and NMFS to monitor water temperature and curtail project operations as needed to prevent a temperature exceedance for spring-run and winter-run Chinook salmon in the bypassed reach downstream of Angel Falls (13°C for spawning, 15.5° or 16°C for holding and rearing, Interior and NMFS, respectively, and 18°C for migration and summer holding).[128] Similarly, we did not adopt California DFW's recommendation to monitor water temperatures and cease project operations when water temperature in the bypassed reach exceeds an average daily temperature of 20ºC.

Subsequent to issuance of the draft EIS and prior to the 10(j) meeting, Rugraw filed 2015–2017 water temperature and flow data (Rugraw, 2018). In discussions at the section 10(j) meeting, we stated that we would evaluate the new temperature information and further consider the need for water temperature monitoring in the project reach and the need for thresholds for project shut-down.

Our re-analysis of the water temperature issue, using the 2015–2017 water temperature and flow data, and as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, found that a project-induced flow reduction could result in increases in water temperature within the bypassed reach between the diversion dam and Spring #4 under certain river conditions. Our review of the substantial new evidence resulted in modifying our recommendation to include real-time temperature monitoring within the bypassed reach just upstream of Spring #4 and just upstream of the diversion dam, consistent with two of the several monitoring locations recommended by California DFW, NMFS, and Interior. Also as a result of our review, we now recommend that the project cease operation when the average daily water temperature recorded immediately

[128] Interior initially recommended a threshold temperature of 16°C for holding and rearing, but modified their recommendation to 15.5°C during the section 10(j) meeting.

upstream of Spring #4 is at or above 20°C and greater than the average daily water temperature recorded at the diversion dam, consistent with California DFW's recommendation. We estimate that real-time temperature monitoring and our recommended temperature threshold would result in a levelized annual cost of $19,600, which includes our estimate for lost generation ($9,750) and temperature monitoring at two stations ($9,850), and would be worth the cost for protection of aquatic resources. Therefore, while the inconsistency with water temperature monitoring locations remains unresolved (see table 5-2), the inconsistency related to water temperature monitoring in general is resolved.

As previously described, another inconsistency was the threshold temperature for inducing project shut-down. The agencies recommend several different temperature criteria.[129] The California DFW criterion is intended to protect resident salmonids (rainbow trout). Interior's and NMFS's variable seasonal criteria target the protection of anadromous salmonids, which they say will eventually be restored to upper South Fork Battle Creek and the project bypassed reach. However, the Interior and NMFS recommendations are inconsistent with the substantial evidence standard of section 313(b) of the FPA, based on a lack of evidence to support the reasonableness of the recommendations, because anadromous salmonids do not now occur in the bypassed reach, and the project would not materially affect water temperatures downstream of the project's tailrace. Thus, we adopt the California DFW criterion for project shut-down intended to protect resident salmonids, and the inconsistencies with Interior's and NMFS's 10(j) recommendations for threshold temperatures remain unresolved.

Debris and Sediment Management Plan

In the draft EIS, we recommended Rugraw develop a DSMP and that Rugraw first consult with the Water Board and California DFW each time it determines a need to sluice sediments when inflow is less than 400 cfs. We determined, however, that NMFS's and Interior's recommendations for a detailed monitoring program for nine different channel metrics[130] downstream of the diversion dam would not be required to determine the success of the sluicing and debris management measures of the DSMP. We concluded that proposed sediment sluicing and passage of woody debris past the proposed diversion dam would be successful in maintaining downstream aquatic habitat,

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[129] These criteria are: 7DADM of 13°C for spawning, 15.5° or 16°C for holding and rearing (Interior and NMFS, respectively), and 18°C for migration and summer holding, for Interior and NMFS; and average daily temperature of 20ºC for California DFW.

[130] These would include: (1) reach-wide parameters (e.g., total length and gradient, average width and depth); (2) wetted width of each riffle; (3) water velocity; (4) relative substrate composition (i.e., fines, gravel, cobble, boulder, and bedrock); (5) pebble count; (6) substrate consolidation and percent embeddedness; (7) canopy cover; (8) canopy height; and (9) diameter of canopy trees.

and the additional monitoring of nine channel metrics included in the Interior and NMFS recommendations was not warranted because the cost of this additional monitoring outweighs the expected benefits (levelized annual cost of $58,500); and therefore, are inconsistent with the comprehensive planning standard of section 10(a) of the FPA, including the equal consideration provision of section 4(e) of the FPA.

During discussions at the section 10(j) meeting, the agencies expressed concern about the effects of sediment sluicing, and the possible need for turbidity monitoring upstream and downstream of the impoundment during, and if appropriate, immediately following the sluicing event(s); the effectiveness of flushing sediment and woody material out of the impoundment; the need for passing large woody material (greater than 30 feet long) past the dam (not cutting it into 6-foot lengths); and whether long-term accumulation of sediment and/or woody material would occur in the impoundment.

As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, based on information provided by agency representatives on their experience with sediment and woody material passage at hydro projects, we now recommend, consistent with the agencies' recommendations, that the DSMP include (1) monitoring of turbidity associated with sediment sluicing events to document any project-caused exceedance of the Basin Plan's turbidity objectives, and (2) periodic monitoring of the project impoundment to determine whether long-term accumulation of sediment and/or woody material is occurring. We conclude that revising the DSMP to include monitoring of sediments and woody material accumulated in the impoundment (with a levelized annual cost of $7,270) would be a more cost-effective way to determine the effectiveness of the sediment and woody material sluicing program, and whether sediment and larger woody material is successfully being passed downstream, compared to the agency-recommended study of the nine channel metrics previously discussed (levelized annual cost of $58,500). At the section 10(j) meeting, Interior and NMFS also concurred that with periodic monitoring of sediment and woody material in the impoundment, additional detailed monitoring downstream of the diversion dam would not be required (see the section 10(j) meeting transcript, discussion beginning on page 220, line 20). Staff also committed to assessing potential project effects on riparian vegetation and canopy cover, which is included in section 3.3.3.2, *Terrestrial Resources, Effects of Project Construction and Operation on Vegetation*, of the final EIS. Therefore, we conclude that our preliminary determination of inconsistency associated with detailed monitoring downstream of the diversion dam is resolved.

Sections 5.1.2, *Additional Measures Recommended by Staff*, and 5.1.3, *Other Measures Not Recommended by Staff*, provide additional details on 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 reflects initial and modified section 10(j) recommendations made at the meeting and any agreements reached.

Table 5-2. Fish and wildlife agency recommendations for the Lassen Lodge Project (Source: staff).

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
1. Maintain upstream and downstream fish passage during construction.	California DFW (Recommendation 4)	Yes	$770	Yes
2. Provide downstream fish passage at project diversion works.	California DFW (Recommendation 4)	Yes	$3,250	Yes
3. Provide upstream fish passage during project operation.	California DFW (Recommendation 4)	Yes	$26,330	No (see section 5.1.3)[a]
4. Coordinate with California DFW on the design of the fish screen at the diversion.	California DFW (Recommendation 4)	No, not a specific measure to protect, mitigate, or enhance fish and wildlife resources	$0	Yes
5. Design the upstream fishway according to California DFW design standards.	California DFW (Recommendation 4)	No, compliance with agency standards is not a specific fish and wildlife measure	$0	No (see section 5.1.3)[a]

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
6. Implement a minimum instream bypass flow of 13 cfs, or inflow, whichever is less, at all times, and do not begin operation until flows reach 18 cfs.	California DFW (Recommendation 1)	Yes	$6,500	Yes
7. Implement a minimum instream bypass flow of 35 cfs, or the natural flow, if less, at all times.	NMFS and Interior (Recommendation 1)	Yes	$120,120	No (see section 5.1.3)[a]
8. Monitor streamflow at the diversion structure.	California DFW (Recommendation 1)	Yes	$7,270	Yes, but we recommend real-time streamflow monitoring at one location upstream of Spring #4, and water surface elevation upstream and downstream of the dam (see section 5.1.2)
9. Develop a flow gage monitoring plan.	NMFS and Interior (Recommendation 3).	Yes	$770	Yes

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
10. Monitor streamflow at seven locations.	NMFS and Interior (Recommendation 3).	Yes	$26,420	Yes, but we recommend real-time streamflow monitoring at one location upstream of Spring #4, and water surface elevation upstream and downstream of the dam (see section 5.1.2)
11. Provide a ramping rate of change that will not exceed 1 inch of stage change per hour.	NMFS and Interior (Recommendation 1)	Yes	$3,250	Yes
12. Provide a ramping rate of change that will not exceed 0.1 foot of stage change per hour.	California DFW (Recommendation 2)	Yes	$3,250	Yes, but we recommend a more restrictive 1-inch/hour ramping rate
13. Develop a SMP that includes quarterly snorkel surveys for anadromous and resident salmonids for the duration of the license term.	NMFS and Interior (Recommendation 4)	No, general presence/ absence fish monitoring is not a specific fish and wildlife measure	$18,170	No (see section 5.1.3)[a]

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
14. Develop a water temperature monitoring plan	California DFW (Recommendation 3), NMFS and Interior (Recommendation 2)	Yes	$770	Yes
15. Monitor water temperature at six monitoring stations.	California DFW (Recommendation 3)	Yes	$24,920	Yes, except the staff-recommended alternative includes monitoring at only two stations
16. Monitor water temperature at seven monitoring stations.	NMFS and Interior (Recommendation 2)	Yes	$26,330	Yes, except the staff-recommended alternative includes monitoring at only two stations
17. Shut down project or reduce generation when temperature exceeds 20ºC.	California DFW (Recommendation 3)	Yes	$15,000	Yes, but we recommend project shut-down or reduced generation only when project-induced temperatures exceed 20°C (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
18. Implement a project shut-down or reduction when temperature exceeds 7DADM criteria of 13ºC for salmonid spawning, 15.5ºC for salmonid rearing, and 18ºC at other times.	Interior (Revised Recommendation 2)	Yes	$13,000	Yes, but we recommend project shut-down or reduced generation only when project-induced temperatures exceed 20°C (see section 5.1.2)
19. Implement a project shut-down or reduction when temperature exceeds 7DADM criteria of 13ºC for salmonid spawning, 16ºC for salmonid rearing, and 18ºC at other times.	NMFS (Recommendation 2)	Yes	$16,250	Yes, but we recommend project shut-down or reduced generation only when project-induced temperatures exceed 20°C (see section 5.1.2)
20. Develop a BMI monitoring plan to monitor BMI once prior to project construction, during the first 4 years of project operation, and every 4 years thereafter for the term of the license.	NMFS and Interior (Recommendation 5)	No, general monitoring without triggers for mitigation is not a specific fish and wildlife measure	$6,150	No (see section 5.1.3)[a]

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
21. Develop a DSMP that includes requirements to: (1) sluice sediment; (2) remove woody debris impinged on or behind the dam, and place it downstream back into the active channel; and (3) monitor nine channel metrics.	NMFS and Interior (Recommendation 6)	Yes	$58,500	Yes, with modification for additional agency consultations, turbidity monitoring, and impoundment monitoring instead of the nine channel metrics recommended by NMFS and Interior
22. Design and construct the transmission line in compliance with APLIC guidance to reduce effects on avian species.	Interior (Recommendation 7)	No, compliance with agency guidelines is not a specific fish and wildlife measure	$960	Yes, but we recommend the transmission line be designed consistent with APLIC guidance
23. Develop a bald eagle management plan.	Interior (Recommendation 7)	Yes	$1,580	Yes
24. Develop an avian protection plan.	Interior (Recommendation 7)	Yes	$1,580	Yes
25. Develop a CRLF and FYLF protection plan and protect their breeding habitat during construction.	Interior (Recommendation 8)	Yes	$770	Yes, included in our recommended special-status amphibian protection plan (see section 5.1.2)

Recommendation	Agency	Within the Scope of Section 10(j)	Levelized Annual Cost	Adopted?
26. Ensure the project does not result in a base flow recession rate greater than 1 foot in 3 weeks, starting at the end of the spring snowmelt flow pulse.	Interior (Recommendation 9)	Yes	$2,080	Yes (see section 5.1.2)
27. Develop an FYLF monitoring plan.	California DFW (Recommendation 2)	No, general monitoring without triggers for mitigation is not a specific fish and wildlife measure	$770	No (see section 5.1.3)[a]

[a] Findings that recommendations found to be within the scope of section 10(j) are inconsistent with the comprehensive planning standard of section 10(a) of the FPA, including the equal consideration provision of section 4(e) of the FPA, are based on staff's determination that the costs of the measures outweigh the expected benefits.

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 16 comprehensive plans that are applicable to the Lassen Lodge Project, located in California and no inconsistencies were found:

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California Department of Fish and Game. U.S. Fish and Wildlife Service. National Marine Fisheries Service. Bureau of Reclamation. 1988. Cooperative agreement 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.

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APPENDIX A—COMMENTS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

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COMMENTS ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE LASSEN LODGE PROJECT

Lassen Lodge Project—FERC Project No. 12496-002–California

The Federal Energy Regulatory Commission (Commission or FERC) issued its draft environmental impact statement (EIS) for the licensing of the Lassen Lodge Hydroelectric Project (project) on December 4, 2017. Comments were due by February 2, 2018. In addition, Commission staff conducted two public meetings in Red Bluff, California, on January 3, 2018, 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.[131]

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 modified the final EIS. We group the comment summaries and responses by topic for convenience. Although we do not summarize comments that point out minor revisions to the draft EIS in this appendix, we have made those revisions in the final EIS. We do not summarize comments that reiterate a stakeholder position or recommendation previously provided. The following entities filed comments on the draft EIS:

Commenting Entity	Filing Date
National Marine Fisheries Service	January 31, 2018
U.S. Department of the Interior	February 2, 2018
California Department of Fish and Wildlife	February 2, 2018
California State Water Resources Control Board	February 2, 2018
American Whitewater, California Sportfishing Protection Alliance, and Trout Unlimited	February 2, 2018
Rugraw, LLC	February 2, 2018
U.S. Environmental Protection Agency	February 2, 2018

[131] *See* draft EIS meeting transcripts, eLibrary Accession Nos. 20180212-4001 and 20180212-4002.

Commenting Entity	Filing Date
Richard Montarbo	February 3, 2018
Central Valley Regional Water Quality Control Board	February 6, 2018

GENERAL

Comment G1: The U.S. Environmental Protection Agency (EPA) comments that it rates the preferred alternative as lack of objections (LO).[132] EPA provides this rating with the understanding that mandatory license conditions would be included in the license.

Response: We acknowledge EPA's rating for the draft EIS and understand that mandatory conditions will be included in any license issued.

Comment G2: EPA comments that the EIS must disclose the need for the Clean Water Act (CWA) section 404 permit, explain how the extent of jurisdictional waters would be verified, and coordinate with the U.S. Army Corps of Engineers to ensure that the selected alternative would comply with section 404 permit requirements.

Similarly, the California Regional Water Quality Control Board, Central Valley Region (CVRWQCB) comments that the proposed project must be evaluated for presence of jurisdictional waters, including wetlands and other waters of California. CVRWQCB states that both the CWA section 404 permit and section 401 WQC must be obtained before site disturbance. Some wetlands and other waters are considered "geographically isolated" from navigable waters (e.g., isolated wetlands, vernal pools, or stream banks above the ordinary high water mark) and are not within CWA jurisdiction. Discharge of dredged or fill material to these waters may require either individual or general waste discharge requirements from CVRWQCB.

Response: Section 1.3, *Statutory and Regulatory Requirements*, of the draft EIS and final EIS discuss only those statutory and regulatory requirements that must be met before a FERC license can be issued for the project. A CWA section 404 permit and other state or local permits are not a prerequisite for the Commission's licensing determination; therefore, the EIS does not discuss jurisdictional issues of section 404 permits or other local permits. It is, however, the Commission's expectation that its licensees will comply with all other federal, state, and local permitting processes, as appropriate.

[132] An "LO" rating means that EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for applying mitigative measures that could be accomplished with no more than minor changes to the proposal.

Comment G3: Rugraw, LLC (Rugraw) states that figure 2-1 in the draft EIS shows an outdated diversion location and that exhibit F, sheets 5 and 6, filed on December 2, 2015, shows the current proposed diversion location.

Response: We have updated the final EIS to reflect Rugraw's latest proposal for the diversion structure location.

Comment G4: Rugraw and the California State Water Resources Control Board (Water Board) request that the final EIS evaluate the alternative transmission line route in the town of Manton, proposed in Rugraw's amended final license application, filed on December 2, 2015. During each of the January 3, 2018, draft EIS public meetings, local stakeholders also requested that the final EIS evaluate the transmission line route proposed in the amended final license application. At the draft EIS meeting, Mr. Richard Montarbo questioned whether the transmission line would cross his property.

Response: In Rugraw's final license application filed on April 21, 2014, it proposed to construct a new 12-mile-long, 60-kilovolt transmission line that would connect the project to a switchyard adjacent to Pacific Gas and Electric Company's existing 60-kilovolt Volta-South transmission line in the town of Manton, California. Specifically, that transmission line would traverse from the powerhouse in a northwesterly direction to a point on Hazen Road in Manton, approximately 500-feet east of the intersection with Rolling Hills Road and then run parallel with and on the south side of Hazen Road for approximately 1 mile to the intersection with Manton School Road, then turn north along Manton School Road. However, on December 2, 2015, Rugraw amended its final license application and modified the proposed transmission line route. As amended, the proposed transmission line would run parallel with and on the south side of Hazen Road for approximately 1.5 miles, past Manton School Road, to the intersection with South Powerhouse Road, then turn north and parallel South Powerhouse Road on the east side of the road for approximately 0.5 mile to the proposed switchyard, to be located just to the east of South Powerhouse Road.

In the draft EIS, we inadvertently described the originally proposed transmission line route along Manton School Road rather than the amended transmission line route along South Powerhouse Road. However, the analysis of vegetation and land use impacts described in the draft EIS did reflect the amended route. Section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, and section 3.3.6.2, *Land Use and Aesthetics, Environmental Effects*, of the final EIS describe and analyze Rugraw's proposed transmission line, as amended on December 2, 2015.

With regard to Mr. Montarbo's inquiry, the exhibit G drawings filed December 2, 2015, show that the proposed transmission line corridor would cross two parcels owned by Mr. Montarbo (Tehama County parcel numbers APN 13-17-24 and APN 13-17-25). The corridor would enter parcel number APN 13-17-25 from the northeast, heading in a southwesterly direction for about 200 feet, and then turn directly north, traversing about 500 feet of parcel number APN 13-17-25 and then about 1,000 feet of parcel number APN 13-17-24, exiting the northeast corner of parcel number APN 13-17-24. The proposed corridor would traverse a total of about 1,700 feet of Mr. Montarbo's property.[133]

Comment G5: The Water Board states that proposed measures that would ensure protection of aquatic resources should be included in the staff alternative, especially if they were developed collaboratively by resource agencies and the applicant. The Water Board says that FERC staff removed a number of proposed measures from its staff recommendations without proposing an alternative and should either: (1) propose an alternative measure that would be as protective as, or more protective than, the applicant's proposal; or (2) provide sufficient evidence that the proposed measure is unnecessary for the protection of beneficial uses.

Response: In deciding whether to issue a license for a hydroelectric project, the Commission must, pursuant to the Federal Power Act (FPA),[134] determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; the protection of recreational opportunities; and the preservation of other aspects of environmental quality, section 10(a)(1) also specifies that the Commission must give equal consideration to energy conservation and the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply). Our basis for not recommending specific measures, even if agreed to by the applicant and agencies, is described in section 5.0, *Conclusions and Recommendations*, of the final EIS.

Comment G6: The Water Board questions the assumption that recommended environmental measures will adequately protect aquatic resources, and states that monitoring is necessary to verify a lack of project impacts or the need for mitigation. The Water Board considers monitoring a critical element to the project to ensure environmental measures are effective and protective of water quality and beneficial uses. Such monitoring likely will be required as part of the requirements of the water quality certification, and adaptive management will likely also be necessary based on monitoring results.

Response: Monitoring can be used to verify compliance with specific license requirements or to evaluate ongoing project effects on a resource. Much of the requested and/or proposed monitoring that we do not recommend (e.g., benthic macroinvertebrate [BMI] monitoring) would not provide information that could be used to isolate or

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[133] The exhibit G drawings are available at: https://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14061697, (retrieved June 8, 2018).

[134] 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).

delineate project effects from non-project effects on the monitored resource. However, if the Water Board chooses to include a broader scope of environmental monitoring as part of the water quality certification, then that monitoring would become a requirement of any license issued.

Comment G7: The Water Board comments that there should be a rationale provided for designating an agency recommendation as outside the scope of the FPA. The Water Board requests an explanation of why FERC concludes that an environmental measure listed in table 5-1 is not considered within the scope of section 10(j) of the FPA. Without an explanation, some of the determinations seem contradictory (e.g., FERC concludes that designing fish passage according to the California Department of Fish and Wildlife (California DFW) standards ["compliance with agency standards"] is not a specific fish and wildlife measure, but also concludes that using a mix of California DFW-approved seeds for revegetation is a specific measure). For the Water Board staff to consider accepting FERC's determinations, rationale and explanation are required.

Response: Section 10(j) of the FPA provides that state and federal fish and wildlife agencies may make recommendations for measures to protect fish and wildlife resources. Although recommending a fishway, for example, is a measure for protecting fishery resources, recommending that a fishway conform to agency standards is an administrative matter relating to a fishway, not a measure in itself. In the case of revegetation using California DFW seed mixes, using those seed mixes is an integral part of the revegetation measure and ensuring that the plants cultivated from the seed is appropriate for the environment (e.g., native plants). We understand that it may be a "fine line" between calling a recommended measure within or outside the scope of section 10(j) of the FPA, but that call in itself is not the only basis for accepting or rejecting a recommended measure. Staff often adopts recommendations that are judged to be outside of the scope of section 10(j). For example, the staff-recommended alternative includes California DFW's recommendation for coordination on design of the diversion dam and fish screen, even though we determined it to be outside the scope of section 10(j).

Comment G8: The Water Board asks for more information about the design and operation of the proposed diversion facilities including design of the facilities and how they would operate under various flow conditions (i.e., less than 18 cubic feet per second [cfs], 18–105 cfs, and greater than 105 cfs). If using an inflatable dam, the parameters specifying when the project would operate (dam inflated) and when it would not operate (dam deflated), should be noted at the beginning of section 2.2.3, *Project Operation*, to give context to the operation details that follow.

Response: We revised section 2.2.1, *Project Facilities*, in the final EIS to provide more information about the proposed pneumatic gates in the diversion dam and revised section 2.2.3, *Project Operation*, to include more details on operation of the project over the range of expected flows (see table 2-1 of the final EIS).

Comment G9: The Water Board asks FERC to reconsider the proposed construction timeline and states that the timeline to complete construction within 5.5 months seems ambitious considering the need for baseline preconstruction monitoring and the potential for unforeseen events that could cause delays. As such, the Water Board asks for an analysis of the contingency that it could take Rugraw 5 months to a year to complete construction.

Response: The amended final license application (filed December 2, 2015), exhibit A, section 3.8, states that construction would begin on May 1, 2016, and that commercial operation would begin on October 15, 2016. However, exhibit A, section 3.7, also states: "Outdoor construction activities are proposed to commence in the spring and cease in late fall of each (emphasis added) year. Such activities are weather-dependent, with the general outdoor construction period being from April 15 through October 15. Unseasonably wet, dry, and cold (frozen) conditions can modify start and ending dates."

Although the applicant proposes an ambitious schedule and hopes to complete construction as soon as possible, the FPA only stipulates that the licensee must commence construction within 2 years of license issuance. Our analysis recognizes the applicant's proposed annual construction window of 5.5 months, but does not limit construction to a single construction season, and the applicant acknowledges that site conditions may prolong construction. Therefore, there is no need to consider a contingency where it could take Rugraw 5 months to a year to complete construction.

Comment G10: The Water Board asks that the EIS recommend measures for Rugraw to take (e.g., automatic project shut-down) if inflow to and outflow from the project reservoir are not approximately the same and then analyze the potential impacts of that action.

Response: Any license stipulating run-of-river operation would require the licensee to maintain outflows that approximate inflows on a near-instantaneous basis. Any license would also require the licensee to install the necessary equipment to monitor inflows and outflows at a sufficient frequency to monitor compliance with required project operations, as recommended in this final EIS (see section 5.0, *Conclusions and Recommendations*). If project operation is not compliant with license requirements, Rugraw would first be expected to return the project to a compliant operating condition, and second, report the non-compliance event. Any license issued would specify the operating conditions for the project (e.g., minimum flows, run-of-river, ramping rate). The staff recommendation in section 5.1.2, *Additional Measures Recommended by Staff*, of the final EIS would have Rugraw develop a project operation compliance monitoring and reporting plan that monitors the project's operational compliance with license conditions and provides for reporting of non-compliance events. As such, there is no need to consider alternative action(s) for Rugraw to take (e.g., automatic project shut-down) if the project operation is non-compliant with the operational conditions of the license.

NEED FOR POWER

Comment NP1: American Whitewater, California Sportfishing Protection Alliance, and Trout Unlimited (Conservation Groups) comment that the value for alternative power of $88/megawatt-hours (MWh) in the draft EIS is too high and cites values lower than that from other sources. As such, the Conservation Groups request that the Commission reevaluate its economic analysis for this project.

Response: The power value used in the draft EIS was based on a recently issued license for a project in northern California and used an average annual on-peak energy rate of $73.80/MWh and an average annual off-peak energy rate of $55.80/MWh, as well as a capacity value credit of $95,960/megawatt ($19.19/MWh) for the capacity the project offers. As a result, the composite power (energy plus capacity) value was $88/MWh. The values used in the draft EIS represented actual rates from a negotiated power contract for a project in the northern California and were used as a proxy for the Lassen Lodge Project. This represents one method used by the Commission to assign energy values to a project. However, in response to the comment, in the final EIS we now use the Energy Information Administration's Annual Energy Outlook (EIA Outlook) for 2017. The EIA Outlook provides modeled projections of domestic energy markets through 2050, and it includes cases with different assumptions regarding macroeconomic growth, world oil prices, technological progress, and energy policies. The EIA Outlook is another method used by the Commission to estimate energy rates as a proxy for projects without a negotiated contract. The EIA Outlook does not differentiate on-peak and off-peak energy rates and does not evaluate contract rates for energy. Using the EIA Outlook, the revised energy rate used in the final EIS is $30.35/MWh. The actual energy rate resulting from a power contract for the project may be higher than this value.

Comment NP2: The U.S. Department of the Interior (Interior) expresses concern that our cost analysis only put a monetary value on project power and not on environmental measures such as habitat restoration. Similarly, it states that the value of the project generation does not offset the value of critical fisheries habitat lost.

Response: The economic analysis that staff performs evaluates the cost to implement environmental measures and operate the project against the value of the power produced by the project. We do not attempt to place a monetary value on the potential environmental benefits. Typically, the dollar value of any current or future environmental benefit is not well defined, is unknown, or cannot be reliably estimated, based on available information. We base our conclusions on the merits of an environmental measure on our estimate of the dollar cost of that measure and our professional judgment as to the benefits that may occur from implementation (such as whether it would or would not improve the fish population).

Also, although the project would only produce a small amount of the projected energy shortfall in the region, the project would help to meet future energy needs with a renewable resource.

GEOLOGY AND SOILS

Comment GS1: The Water Board states that monitoring turbidity levels and how long turbidity persists in the bypassed reach after sediment sluicing, especially when sluicing during lower flows (i.e., <400 cfs), should be conducted to determine if sluicing effects are significant.

Response: In section 5.1.2, *Additional Measures Recommended by Staff*, of the draft EIS, we did not recommend any monitoring for sluicing events. Discussions in the March 15, 2018, 10(j) meeting led to a better understanding of agency recommendations for monitoring associated with the potential for sediment accumulation in the project impoundment and turbidity associated with sediment sluicing. In section 5.1.2, *Debris and Sediment Management Plan,* of the final EIS, we recommend monitoring these potential project effects to inform modifications to the debris and sediment management plan (DSMP), if needed, to limit long-term sediment accumulation in the impoundment and document any project-caused exceedance of the *Central Valley Regional Water Quality Control Board Basin Plan's* turbidity objective.

Comment GS2: The Water Board states that the details of the design of the diversion dam and sediment passage through the slot in the dam are unclear and must be explained. It requests that a detailed description of the slot be included in the final EIS, such as location in the dam; dimensions; elevation related to potential ponding during low flows; sediment sizes (gravel, cobble, boulder) that could pass through the slot; capability to pass woody debris or provide fish passage; and proposed operation (when open or closed). It also asks that the following items be addressed: (1) the likelihood that the impoundment would fill and require dredging, and how often; (2) how Rugraw would remove boulders from the impoundment if they do not move downstream on their own; and; (3) how and when would the dam be lowered to allow for large sediment passage.

Response: The exhibit F drawings (F-7 and F-8) in the revised application filed on December 2, 2015, show a 4-foot by 4-foot sediment sluice slide gate on each end of the diversion dam. There would also be three automated pneumatic gates in the center of the dam; each gate would have the dimension of 3 feet (depth) by 8 feet (height) by 8 feet (width). The gates would be installed on a concrete apron; the sill elevation of 4,302 feet mean sea level would be approximately the elevation of the existing streambed channel just upstream of the dam. When deflated, the bottom of the gate opening is expected to be at about elevation 4,302.5 feet mean sea level (due to the thickness of the deflated pneumatic gate material).

As proposed, when inflow is greater than the hydraulic capacity of the turbine, the excess flow would be spilled at the dam (see table 2-1 of the final EIS). If inflow exceeds 418 cfs, the project would go off-line, and all flow would be passed downstream at the dam. Rugraw proposes, and we recommend, lowering the pneumatic gates during high flows to re-mobilize bedload sediment that may accumulate in the reservoir. We also recommend sediment sluicing at flows less than 400 cfs, after consultations with resource agencies on the need for sluicing, and monitoring of turbidity associated with sediment sluicing events to document compliance with turbidity water quality objectives, along with periodically monitoring the project impoundment to determine whether long-term accumulation of sediment and/or woody material is occurring. Thus, long-term buildup of sediment behind the dam would be unlikely, considering the short length of the impoundment of only about 200 feet.

Boulders transported into the impoundment may require very high flows to move and thus may not be mobilized during each sluicing event. In addition, we assume that Rugraw would have sufficient access to the floor of the impoundment to allow for mechanical removal of large boulders with mechanical equipment (such as a boom crane), if required.

WATER RESOURCES

Comment WR1: The Water Board requests an analysis of the risk of fecal coliform contamination to the creek in response to the draft EIS stating that overflow from the Tehama County Sanitation District No. 1 ponds historically elevated fecal coliform concentrations. The Water Board requests documentation of the present levels of fecal coliform at these ponds and an assessment of the risk of the ponds overflowing and the consequential risk to the water quality in the project area.

Response: The Tehama County Sanitation District No. 1 ponds are located about 3 miles upstream of the project diversion dam site; therefore, the project would have no effect on those ponds. As a result, there would be no relationship between the proposed project and the Water Board's requested risk analysis; subsequently, the requested analysis has not been included in the final EIS.

Comment WR2: The Water Board states that, although flows are not anticipated to be high when the cofferdam is in place, the gradient of the channel and flashiness of the Battle Creek system could wash out a cofferdam, which could affect water quality. As a result, the Water Board asserts that the EIS should analyze cofferdam washout potential during project construction.

Response: The design of the cofferdams would be prepared as part of the final design phase prior to construction. The Commission's Division of Dam Safety and Inspections would oversee and approve the design of the cofferdams to ensure their adequacy and safety under potential flow conditions and prior to construction.

Comment WR3: The Water Board notes that its preliminary condition 6 for water quality monitoring would occur during project construction, operation, and maintenance activities, not just during construction, as was interpreted and analyzed in the draft EIS.

Response: We revised section 3.3.2.2, *Aquatic Resources, Environmental Effects*, and section 5.1.2, *Water Quality Monitoring Plan*, in the final EIS to clarify that this requirement would include operation and maintenance activities.

Comment WR4: The Water Board notes that the staff-recommended alternative for water quality monitoring is unclear and requests clarification on whether BMI, turbidity, flow, water surface level, pH, temperature, alkalinity, minerals, and/or conductivity would be included in the associated plan.

Response: Section 5.1.2, *Water Quality Monitoring Plan*, of the final EIS describes the staff-recommended water quality monitoring plan and specifies that the plan would include monitoring of pH, turbidity, and oily sheens during construction and turbidity during sediment sluicing events. In addition, in section 5.1.2, *Streamflow Monitoring*, of the final EIS we recommend monitoring of streamflow and/or water surface elevation at the project's impoundment and the bypassed reach just downstream of the diversion dam, and just upstream of Spring #4's influence for compliance with ramping rates, minimum instream flows (MIFs), and run-of-river operations. We also recommend monitoring water temperature at the project's diversion dam and just upstream of Spring #4. For reasons discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, of the draft and final EIS, however, we do not recommend monitoring BMI. Similarly, because it is not likely that the project would affect mineral content, conductivity, or alkalinity we do not recommend monitoring these constituents.

Comment WR5: The National Marine Fisheries Service (NMFS) states that the project would likely operate a greater percentage of the time from July through October than previously cited by Rugraw. Citing the applicant's hydrology report (Hydmet, 2012), NMFS says flows would be high enough for the project to operate at a minimum level of 5 cfs through the powerhouse (assuming a 13-cfs MIF) 70 percent of the time in July, 40 percent of the time in August, and 25 percent of the time in September and October, with the project reducing the natural flow by more than half during peak water temperature periods in late July and August. As a result, NMFS asks that the analysis of the project's effects on streamflows, water temperatures, aquatic habitat, and designated critical habitat be extended through the July and August periods. It notes that the project may also affect water temperature through reduced flows in other months (April, May, and June), which could adversely affect important anadromous fish life stages.

Response: In the draft EIS, we evaluated the project's effects on streamflows and water temperatures, including during July and August, in section 3.3.2.2, *Aquatic Resources, Operational Effects on Water Quantity and Water Quality*, and on aquatic habitat in sections 3.3.2.2, *Aquatic Resources, Operational Effects on Aquatic Habitat and Biota* and 3.3.4.2, *Threatened and Endangered Species, Effects of Project Construction and Operation on Listed Fish Species*.

We also respectfully disagree with the data cited by NMFS. We revised our analysis of this issue in the final EIS and demonstrate in revised table 3-6 the frequency at which the project could generate electricity under a MIF of 13 cfs, based on available flow information for a period of more than 88 years. This semi-monthly analysis indicates that, under a 13-cfs MIF, the project could generate electricity 62 percent of the time in early July, 43 percent of the time in late-July, from 18 to 29 percent of the time (semi-monthly range) in August, 6 to 8 percent of the time in September, and 9 to 16 percent of the time in October. We also evaluate project operation under an 8-cfs MIF and NMFS's requested alternative MIFs (35/30/25 cfs) and clarify the frequency of flows too low for generation (see table 3-6 in the final EIS).

Regarding NMFS's concern that project-reduced flows in the bypassed reach may contribute to warming in the bypassed reach in April, May, and June, as a result of our revised analysis in section 3.3.2.2, *Aquatic Resources, Environmental Effects,* we concur with NMFS's assessment. As a result, the staff recommendation described in section 5.1.2, *Additional Measures Recommended by Staff,* of the final EIS includes real-time water temperature monitoring and project shut-downs if the project causes warming above an average daily temperature of 20°C.

Comment WR6: The Water Board comments that the staff-recommended MIF of 13 cfs would provide little to no flow variability in the bypassed reach and that a constant steady-state MIF could harm aquatic resources. The Water Board notes that, under the staff-recommended MIF, there is little to no flow variability in the bypassed reach from December through April and June through July to support stream health. In contrast, the daily flow line for the natural hydrograph, shows significant flow variability during these periods. The Water Board suggests that a prescribed flow regime that mimics the variability of the natural hydrograph for each water year type would be more protective of aquatic resources. However, more hydrology data for the stream would help accurately analyze typical flow regimes during different water year types.

Response: It is true that under some flow years a MIF would reduce natural flow variability. However, whenever the project is shut down, the bypassed reach would revert to natural flows, as it would under high streamflows that exceed the hydraulic capacity of the project. In appendix C we provide an analysis of effects of a range of potential MIFs on the natural hydrograph for the period of April 15 to July 15, for five water year types. To further assess the effects of streamflow on project operation, and in turn on water temperature and aquatic habitat, we estimated when inflow would be sufficient for the project to operate while also releasing a minimum flow to the bypassed reach, and when the project would need to shut down because of insufficient streamflow. We used synthesized flow data from October 1928 through May 2017 and estimated the percent of time the project could operate at Rugraw's proposed 13-cfs minimum flow and the full range of Rugraw and agency-recommended minimum flows (see final EIS table 3-6). Our analysis in section 3.3.2.2, *Aquatic Resources, Effects of Streamflow on Project Operation*, found that the project would operate with sufficient inflow under a 13-cfs instream flow the majority of time from December 1 through July 15; infrequently (10 to 49 percent of the time) from July 16 through August 31 and October 16 through November 30; and rarely during September 1 through October 15 (see table 3-6). The other recommended minimum flows showed varying amount of operation, with the lowest amount of operation at the highest minimum flows recommended by the agencies. Whenever the project is not operating, natural flow variability would be restored to the bypassed reach, which would be the majority of the time from mid-July through November.[135]

Comment WR7: The Water Board states that flow monitoring downstream of the powerhouse, which staff did not recommend in the draft EIS, is necessary to quantify the amount, duration, and frequency of streamflow reduction that results from project operation (i.e., filling of the penstock) and its impact on water quality and biological resources in the affected downstream reaches.

Response: Project operation would primarily affect streamflows in the 2.4-mile-long bypassed reach between the diversion dam and the powerhouse. To accurately record project outflows at the dam and MIFs in the bypassed reach, we are recommending three recording gages to monitor operational effects of the project: (1) impoundment water surface level at the dam for run-of-river compliance, (2) water surface elevation just downstream of the dam for ramping rates, and (3) streamflow just upstream of the Spring #4 influence for MIFs. These gages, along with powerhouse discharge data may be used to conservatively quantify streamflow downstream of the project's tailrace (i.e., streamflow without any accretion flow from within the bypassed reach downstream of Spring #4. While project maintenance may require the penstock to be occasionally dewatered and refilled over the term of a license, as discussed in section 3.3.2.2, *Aquatic Resources, Operational Effects on Water Quantity and Water Quality*, of the final EIS, refilling the penstock would only use flows that are not needed for minimum flow requirements, and any ramping rate requirements would be met during the refilling of the penstock. Therefore, for the reasons discussed above and in section 5.1.2, *Streamflow Monitoring*, of the final EIS, a flow gage downstream of the powerhouse, as suggested by the Water Board, would not be warranted.

Comment WR8: The Water Board provides the following additional support for its recommended drought plan: (1) during a drought, Water Board staff are inundated with emergency variance requests and must act quickly on issues for multiple projects; and (2) impacts of a drought or multiple consecutive dry water years (super dry years) are hard to predict, but having a plan in place to guide a licensee's actions and support the decision-making process would be helpful.

Response: Under the recommended staff alternative, the project would be operated in a run-of-river mode, would not store water, and would not be operated when available streamflow is less than 18 cfs. Furthermore, as explained in section 5.1.2, *Temperature Thresholds and Monitoring*, our recommended water temperature monitoring, and application of a 20°C average daily temperature threshold as part of a project operation

[135] In addition, although the project could operate 84 percent of the time in December through February and 69 percent of the time in June and early-July, at a minimum flow of 13 cfs, the percent of time that project flows would vary from 13 cfs would range from 37 to 44 percent, indicating that flow variability would still occur, even during periods of project operation.

compliance monitoring and reporting plan would by default dictate project operations during a drought. In addition, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, of the final EIS, because the project would be a non-consumptive use of water, would not store flow in the reservoir, and would not exacerbate drought conditions, there is no need for a separate and specific drought plan.

Comment WR9: The Water Board notes that paragraph 2 on page 56 of the draft EIS regarding the number of days the project would shut down is confusing and asks for clarification. Specifically, the Water Board asks for clarification of the analysis of project shut-down days in wet water years. It notes that, on page 180, the draft EIS states that wetter water years result in lower temperatures; on page 56, however, the draft EIS concludes that there are more days the project shuts down during wet years at every proposed temperature threshold, which appears to be an inconsistency.

Response: Although more temperature-caused shut-downs in relatively wet years seems counterintuitive, it would occur because flow-caused shut-downs would be less frequent in higher flow years. For example, the number of flow-triggered shut down days in April through October for a 13-cfs MIF would be 199 in the critical year of 2015 but only 34 in the wet year of 2006; the number of temperature-triggered shut-down days for NMFS's and the U.S. Department of the Interior, Fish and Wildlife Service's (FWS's) 7-day average daily maximum (7DADM) criteria would be zero in the critical year (because the project would already be shut-down for a lack of flow) and 53 in the wet year, where streamflow is ample for project operation; and subsequently, water temperature becomes the primary driver for project shut-down. To clarify the number of days the project would be shut down to meet temperature and MIF targets in April through October, we have added a table (table 3-7) to the final EIS and revised text in section 3.3.2.2, *Aquatic Resources, Water Temperature*.

Comment WR10: The Water Board requests more information about the cooling effects of the diversion pipeline-penstock. It states that the EIS should explain how the pipeline-penstock would cool water that enters the pipeline at greater than 14°C.

Response: We revised section 3.3.2.2, *Aquatic Resources, Water Temperature*, to explain that temperature cooling (and warming) would result from the water's conduction with the wall of the pipeline-penstock.

Comment WR11: Interior points out an inconsistency between table 5-1 and section 5.1.2, *Additional Measures Recommended by Staff*, of the draft EIS and subsequently questions whether FERC staff recommends water temperature monitoring. Interior also notes that the limited water temperature data set includes data collected during the worst California drought in recorded history, and that sampling during drought years is likely to lead to biased results. As such, Interior recommends the analysis include all water year types. Interior also states that the need for temperature monitoring is evident by the limited data used in the final license application and FERC's analyses. Therefore, Interior recommends that water temperature monitoring occur over a 5-year period that includes at least one dry or critically dry water year.

Response: In the draft EIS, it was our intent to not recommend water temperature monitoring. The analysis in the draft EIS used measured water temperature data from critical, dry, and below normal water year types and modeled water temperature data from above normal and wet water year types. On March 13, 2018, after the draft EIS was issued, Rugraw filed additional water temperature data collected in 2015–2017, representing critical, below normal, and wet water year types. As a result, the data set used to analyze water temperature in the final EIS includes measured data for each water year type with the exception of the above normal water year type, which was represented solely with synthetic water temperature data. Although no measured water temperature data are available for an above normal water year type, the water year type data that are available are sufficient for our analysis because they include a broad range of water years ranging from critical to wet. Our analysis of this data set is available in section 3.3.2.2, *Aquatic Resources, Water Temperature*, of the final EIS.

Re-evaluation of the temperature information found that most of the temperature data that indicated a cooling trend between the proposed dam and Spring #4 were collected at flows of less than 18 cfs, which would be during periods in which the project would not operate under a 13-cfs MIF. As discussed in section 3.3.2.2, *Aquatic Resources, Water Temperature*, of the final EIS, our re-evaluation of data available for preparation of the draft EIS and evaluation of Rugraw's new 2015–2017 data, we now conclude that the cooling effect between the proposed dam and Spring #4 may not occur throughout all spring and summer periods. Therefore, we have revised our recommendation in section 5.1.2, *Temperature Thresholds and Monitoring*, of the final EIS to limit project-caused exceedances of 20ºC as a daily average temperature, and real-time water temperature monitoring to support this effort and document compliance.

Comment WR12: Interior states that models can be valuable tools during the design and planning phase of a facility and for making predictions regarding operation, as is done in the draft EIS. However, it also finds that, given model uncertainty, they should not be relied upon to measure compliance with water temperatures criteria during operation. As such, Interior recommends implementing a temperature monitoring plan to monitor project compliance with state and federal water quality criteria for temperature. If included with operating temperature thresholds, the project would be able to adjust operation, if necessary, to maintain its compliance with water quality criteria and provide suitable habitat for fish.

California DFW notes that FERC staff do not adopt the applicant's proposal to discontinue project operation when the average daily stream temperature exceeds 20°C in the bypassed reach, based on the applicant's temperature modeling that shows water temperatures in the bypassed reach would decrease when the project diverts up to 105 cfs, while maintaining a 13-cfs MIF. California DFW is concerned that the applicant's temperature model is not robust enough (validated with only 3 months of low-flow data) to conclude that the project's diversion of flows would result in the subsequent cooling of the bypassed reach. California DFW also requests, at a minimum, temperature monitoring at the three locations identified in the draft EIS for real-time streamflow monitoring[136] for 5 years (including at least one dry year or critically dry year) to demonstrate that the project indeed does cool water temperatures in the bypassed reach.

The Water Board states that dissolved oxygen (DO) is highly affected by temperature, and recommends the water temperature monitoring plan include DO monitoring at the diversion intake, below the bypassed reach where water is returned, and just above Spring #4. The Water Board also recommends monitoring water temperature and DO at these locations for a minimum of 5 years, followed by resource agency consultations to assess project impacts and identify appropriate actions.

Response: We acknowledge that models are tools with limitations, and that the Water Temperature Transaction Tool temperature model's relatively short validation period at low flows may limit confidence in its simulated temperatures for longer periods with natural streamflows greater than 20 cfs. However, our decision in the draft EIS to not recommend project shut-down when the average daily stream temperature exceeds 20 degrees Celsius (°C) at the dam was based on both Water Temperature Transaction Tool modeling and the existing cooling effect in the bypassed reach as described in section 3.3.2.2, *Aquatic Resources, Water Temperature*. As discussed in our response to comment WR11, in the final EIS we have added an analysis of newly available water temperature data for 2015–2017 and re-evaluated the water temperature data used in preparation of the draft EIS. These evaluations led us to conclude that the cooling effect between the proposed dam and Spring #4 may not occur in the project reach throughout all spring and summer periods. Therefore, in section 5.1.2, *Temperature Thresholds and Monitoring*, of the final EIS, we have revised our recommendation to limit project-caused exceedances of 20ºC as a daily average temperature, and incorporate monitoring and reporting details into an operation compliance monitoring and reporting plan. This recommended plan would include water temperature stations at the diversion dam (which is expected to be virtually the same as at the diversion intake) and upstream of Spring #4. We do not recommend monitoring temperature below the bypassed reach because, as discussed in section 3.3.2.2, *Aquatic Resources, Water Temperature*, of the final EIS, local average monthly air temperatures indicate water routed through the pipeline-penstock system is not expected to increase in temperature during critically warm periods and any warming in the bypassed reach would be attenuated by the powerhouse discharge.

We acknowledge that project operation may increase water temperature slightly during some periods; however, this would have negligible effects on DO. For example, increasing the temperature from 18ºC to 19ºC would only decrease DO at saturation by 0.2 milligram per liter (USGS, 2018). Therefore, we do not recommend monitoring DO.

Comment WR13: The Water Board comments that Rugraw should protect resident rainbow trout and the staff recommended alternative would cause temperatures to

[136] Upstream of the project impoundment, just downstream of the diversion dam, and in the bypassed reach just upstream of Spring #4 influence.

“occasionally [approach] the range where stress could occur,” which is not protective. The Water Board asserts that Rugraw should adopt a 20°C 7DADM temperature threshold for suspending project operation and mandatory stream temperature monitoring during project operation to protect beneficial uses outlined in the *Central Valley Regional Water Quality Control Board Basin Plan*.

Response: In the draft EIS, we did not recommend a temperature trigger for project shut-downs because our evaluation of data available at the time indicated a cooling effect between the proposed dam and Spring #4 in the spring and summer. Upon re-evaluation of these data and evaluation of Rugraw’s 2015–2017 water temperature and flow data filed on March 13, 2018, we now conclude that the cooling effect between the proposed dam and Spring #4 may not occur throughout all spring and summer periods. As a result, we now recommend in *Temperature Thresholds and Monitoring* of section 5.1.2 of the final EIS a water temperature trigger of an average daily temperature of 20°C for suspension of project operation.

Comment WR14: California DFW refers to a statement in the draft EIS that juvenile rainbow trout and steelhead could be exposed to chronically elevated water temperatures during summer residence in South Fork Battle Creek and provides the rainbow trout optimal growth temperature range of 15 to 18°C, and lethal temperature range of 24 to 27°C. California DFW states that it does not believe that temperatures in the bypassed reach are adequate if they reach the mortality range of 24 to 27°C.

Interior states that water temperature is the physical factor with the greatest influence on Central Valley salmonids. Interior notes that temperature directly affects the survival, growth rates, distribution, and development rates of salmonids and indirectly affects growth rates, disease incidence and predation, and long-term survival. Interior also notes that fish migration is linked to natural environmental temperature cycles, and a change in temperature can lead to early or late spawning. Given the importance of temperature to salmonids, Interior states that operating the project without a stream temperature threshold and adequate temperature monitoring creates unacceptable risk to fish resources in the bypassed reach. Without license requirements that provide for an adequate minimum flow and temperature threshold, Interior believes that the project could affect the primary constituent elements of the critical habitat and affect listed winter-run Chinook, listed spring-run Chinook, and listed steelhead in the bypassed reach. Interior states that FERC staff did not fully consider the benefits to natural resource services and the cost of lost restoration dollars to state and federal governments and private parties and that a fair valuation of the benefit that a temperature threshold would provide to natural resources must be made.

Response: We agree that water temperatures in the 24 to 27°C range would be stressful or lethal to resident rainbow trout and note the proposed project would not be operated during the warmest period of the year when flows in South Fork Battle Creek drop below 18 cfs. We also agree that water temperature is one of the most important factors affecting fish habitat availability in the proposed project’s bypassed reach. As a result of re-evaluating water temperature information and analyzing newly available 2015–2017 temperature and flow data, we modified section 3.3.2.2, *Aquatic Resources, Water Temperature*, of the final EIS and now recommend in *Temperature Thresholds and Monitoring* of section 5.1.2 of the final EIS, that Rugraw consult with resource agencies and develop a project operation compliance monitoring and reporting plan that includes an average daily water temperature criterion of 20°C. As a component of this plan, temperature-triggered shut-downs would occur only when the average daily water temperature just upstream of Spring #4 is warmer than at the dam and greater than 20ºC. As we state in our response to comment AQ15, we do not find that there would be a "loss of restoration dollars."

FISHERY RESOURCES

Comment AQ1: The Water Board is concerned about the use of the hydraulic geometry (HG) model rather than physical habitat simulation (PHABSIM) to evaluate fish habitat given that the HG model was based on just two data points at the low end of the flow range. Similarly, NMFS states that the applicant's use of the HG model would not provide the necessary information to assess the proposed project's impacts on salmonid resources for the following reasons:

- The HG model only predicts cross-sectionally averaged depths and velocities and assumptions are made that this one averaged depth and velocity is reflective of available habitat.

- The use of cross-sectionally averaged depths and velocities at the habitat-unit and micro-habitat unit scale is a fundamental flaw of the HG model, and the applicant's collection of data at only two flows, 13 and 34 cfs, does not provide sufficient resolution to have any reliability in the parameterization of the HG relationships.

- The use of the Jowett (1998) method to determine the appropriate instream flow in the bypassed reach appears to be a misapplication of Jowett's proposed method of a rapid, broad regional screening tool meant to understand when mean or modal depths or velocities are approaching a threshold that would trigger more detailed habitat survey and analysis.

- The applicant's HG relationships are dependent on the second extrapolated bankfull discharge point and that several assumptions made in the extrapolation of the bankfull discharge data point are too coarse and too unreliable to be the primary building block for the assessment to set the MIF.

- The HG method underestimates the volume/depth-stage at particular flows and does not account for variations in hydrology due to either wetter/cooler or drier/hotter water years.

Response: PHABSIM assessments are typically more robust than HG assessments; however, like Rugraw's relatively coarse HG study (and subsequent carrying capacity evaluation), the FWS's PHABSIM study was designed to estimate the amount of aquatic habitat (or weighted useable area [WUA], an index of habitat) that would exist in the bypassed reach at a range of controlled flows. As discussed in section 3.3.2.2, *Aquatic Resources, Effects of Flow Regulation on Aquatic Habitat* of the final EIS, neither approach accounts for variations in hydrology due to either wetter/cooler or drier/hotter water years and these approaches also ignore the fact that natural low flows coupled with high water temperatures are what limit the abundance of salmonids in the bypassed reach. Because these natural conditions occur during most years when the project would not be operating, the project would have no influence on these limiting factors. In addition, FWS's PHABSIM study relies on habitat suitability criteria for both steelhead and Chinook salmon. Although it can be reasoned that steelhead and resident rainbow trout (both of which are *O. mykiss*) have similar juvenile rearing habitat requirements, the agency's resulting section 10(j) minimum flow recommendation was based on an average of the combined maximum WUAs for both Chinook and steelhead.

As noted in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, of the final EIS, rearing habitat is extremely limited in the proposed project's bypassed reach even during existing conditions. Rugraw's proposed minimum flow of 13 cfs is higher than the natural minimum flow in this reach from July through January and higher than the mean flow in August and September (see table 3-2 of the EIS). As a result, and for reasons discussed in sections 3.3.2.2, *Aquatic Resources, Environmental Effects*, and 5.1.3, *Other Measures Not Recommended by Staff*, we again conclude that a 13-cfs minimum flow, coupled with natural flows in excess of the project's turbine capacity would be protective of rainbow trout in the project area.

Comment AQ2: NMFS states that the staff-recommended MIF of 13 cfs would not provide sufficient protection for salmonid resources, and that even the applicant's studies found that rearing habitat would limit ultimate production within the reach, based in part on the HG model. NMFS agrees that limited rearing habitat may already occur within this reach, but disagrees with considering rearing habitat in general as a limiting factor because fish will displace downstream (out of the bypassed reach) and find additional suitable habitat. Thus, NMFS states that basing the proposed MIF on 13 cfs because it would over-seed the available rearing habitat is not a valid means to determine a MIF.

Response: Given that rainbow trout spawning and rearing habitat is extremely limited in upper South Fork Battle Creek by low flows and high water temperatures, even under natural conditions, we agree that it is likely that juvenile rainbow trout occupying the bypassed reach would move downstream during these high flow events to reside in more suitable spring-fed habitats near Panther Grade. This net downstream movement would likely occur under any MIF scenario for the project.

Comment AQ3: NMFS states that the preferred alternative in the draft EIS does not adequately consider all of the information NMFS filed in its response to the notice of

Ready for Environmental Analysis (REA) to support its recommended year-round MIF of 35 cfs, and instead accepts the applicant's proposals even though their proposals are based on flawed data.[137] NMFS also states that the final license application notes that flows of 30 to 60 cfs would be sufficient for trout passage in the reach while a flow of 13 cfs would not be adequate, and the draft EIS does not consider this information.

Response: We reviewed the referenced PHABSIM data during preparation of the draft EIS and analyze the benefits of the agencies' recommended 35-cfs minimum flow on juvenile Chinook salmon and steelhead rearing WUA in section 3.3.2.2, *Aquatic Resources, Effects of Flow Regulation on Aquatic Habitat*. We have added more information describing the effects of the proposed 13-cfs minimum flow on trout passage to the final EIS. We have also added an analysis of the NMFS's alternative seasonal 35/30/25 cfs MIF on the availability of aquatic habitat (from the NMFS letter filed April 5, 2018), and Rugraw's recently suggested 8-cfs alternative MIF.

Comment AQ4: NMFS describes the importance of connectivity for pool and pocket water habitat and requests flows that would be sufficient to provide connectivity and prevent salmonid trapping and increased risk of predation. The Water Board requests analysis of the connectivity of pocket water habitats to the main stream channel in the bypassed reach.

Response: We understand the importance of habitat connectivity to prevent the trapping of salmonids and include a more robust analysis of this issue in section 3.3.2.2, *Aquatic Resources, Effects of Flow Regulation on Aquatic Habitat*, of the final EIS. We include an assessment of the amount of pocket water habitat in the proposed project's bypassed reach and update our analysis of the effects of flow on connectivity among these important summer rearing areas.

Comment AQ5: NMFS disagrees with a statement in the draft EIS that "providing habitat for a non-extant fish assemblage is not justified." NMFS states that, because the project area contains critical habitat for endangered salmonids, it must be protected and that final EIS should provide evidence that the staff-recommended instream flow would protect this critical habitat. Interior also comments that the draft EIS provides only a very brief summary of the analysis used to make the determination for effects on designated critical habitat but no information on how FERC staff analyzed the effects of the proposed project on the primary constituent elements of the designated critical habitat. When analyzing for effects on primary constituent elements, NMFS states that FERC staff should consult with NMFS and document whether or not these elements would be impacted by the proposed project and that information should be included in the draft

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[137] On June 21, 2016, NMFS filed a document that contains flow versus habitat (PHABSIM) modeling that FWS developed with data provided by Cramer Fish Sciences (FWS and CFS, personal communication, 2016), which shows that the maximum average habitat for Chinook and steelhead fry and juvenile life stages occurs at 35 cfs within the bypassed reach.

EIS. Similarly, the Water Board comments that federally and state-designated critical habitat for endangered species (Chinook and steelhead trout) must be protected.

Response: In response to this comment, we prepared a detailed analysis of the effects of our recommended alternative on the physical or biological features (PBFs) of designated Chinook and steelhead critical habitat currently found in the proposed project area (see appendix B). These PBFs include: freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas, and offshore marine areas.

The results of our PBF analysis found that, even if spring-run Chinook salmon are able to migrate past Panther Grade during the spring, existing spawning habitat conditions in upper South Fork Battle Creek are impaired and are unlikely to support a sustainable population of Chinook salmon. Existing velocities, depths, and areas of spawning gravel are poorly suited for Chinook in the project area when spawning activity would peak in September (Sellheim and Cramer, 2013). In addition, natural water temperatures during the late summer and fall (>22°C), when their eggs would be incubating, typically far exceed levels lethal to eggs for several weeks during that period. Juvenile rearing habitat is also naturally impaired in the project area because of natural low flows, shallow water depths, high water temperatures, and limited cover. Finally, adult spring-run Chinook are currently unable to volitionally migrate upstream past Coleman, Inskip, and South Diversion Dams, and they have not had access to the proposed project area since these barriers were put in place (i.e., freshwater migration corridors are not properly functioning under existing conditions).

Under the staff recommended alternative, the project would not operate when natural stream inflow is below 18 cfs or when water temperatures in the bypassed reach are >20°C during the late summer and fall because natural inflows would be too low to support power generation and thus would have no effect on natural flows or water temperatures during this period. As a result, the proposed project as recommended by staff is not expected to affect these already impaired PBFs in a manner likely to appreciably diminish or preclude the role of that habitat in the recovery of the Central Valley spring-run Chinook salmon pursuant to the Battle Creek Salmon and Steelhead Restoration Project (BCSSRP). The proposed project would have no effect on estuarine areas, nearshore marine areas, and offshore marine areas.

As is the case for spring-run Chinook salmon, anadromous steelhead are currently unable to access the proposed project area due to existing downstream barriers (i.e., this PBF is impaired under existing conditions). Even when passage is provided at all three downstream diversion dams, it is unclear if steelhead would be able to pass Panther Grade and enter the project area. However, adult steelhead would be more likely to enter the proposed project area than spring-run Chinook, based on their documented ability to pass complex, instream migration obstacles. Furthermore, the smaller gravel patch sizes that exist in that reach are more suitable for steelhead spawning than for larger bodied Chinook salmon. The timing of both the upstream migration and spawning for steelhead during the winter and spring would also dramatically reduce steelhead exposure to any high water temperatures (as compared to spring-run Chinook salmon) and would allow them to take full advantage of higher flows during the over-winter period.

Although flows in upper South Fork Battle Creek are favorable for *O. mykiss* spawning and early rearing in the spring and summer, fall low flows and associated high water temperatures are a major limiting factor upstream of Panther Grade. Even under natural conditions, the production potential of steelhead is far greater than the rearing habitat can support. Consequently, any juvenile steelhead produced in the project area, in excess of the reach's carrying capacity, would have to migrate downstream to more suitable spring-fed rearing habitats during peak flow events (flows in excess of turbine capacity) in the spring and fall. As discussed in section 3.3.2.2, *Aquatic Resources*, *Effects of Flow Regulation on Aquatic Habitat*, natural flows during the spring and fall would still occasionally exceed the project's turbine capacity, resulting in bypassed reach flows that are greater than 30 cfs. These peak flow events would likely maintain habitat connectivity and facilitate the downstream movement of salmonids prior to the summer low flow period.

Therefore, the proposed project as recommended by staff would not affect these already impaired spawning and rearing sites or improperly functioning migration corridor PBFs in a manner likely to appreciably diminish or preclude the role of that habitat in the recovery Central Valley steelhead.

We understand that part of the proposed project bypassed reach is designated as critical habitat for listed salmonids; however, those species do not occur in the reach, and it is unknown whether spring-run Chinook or steelhead would ever enter the project area in substantial numbers. Upstream-migrating salmonids would have to pass downstream dams (currently proposed to have fish passage by 2023), as well as natural impediments to migration such as Panther Grade, which likely blocks upstream migration at many flow levels.

Comment AQ6: NMFS states that the goal of an increased minimum flow is to support population growth of endangered/special-status species by maximizing habitat, not to decrease the ratio of spawning habitat to rearing habitat. NMFS believes FERC staff should not focus on the argument that spawning habitat exceeds rearing habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead because it ignores the purpose of minimum flows and is not protective of endangered aquatic resources. NMFS supports evaluation of higher alternative minimum flows if anadromous salmonids are discovered in the project area.

Response: We understand the importance of maintaining adequate habitat availability for listed steelhead and Chinook salmon and support the idea of Rugraw providing higher minimum flow releases for these species (if they gain access to the proposed project's bypassed reach). However, the Commission uses current conditions as its baseline for evaluating project effects and alternatives, which is the environment as it exists at the time of licensing. At this time, no anadromous fish are present in the proposed project area, and the presence in the reasonably foreseeable future is arguable. If Chinook or steelhead are eventually found in the project area (as a result of ongoing anadromous fish reintroduction measures in South Fork Battle Creek), NMFS could request that the Commission use the standard license reopener to assess the need for additional measures to protect anadromous fish habitat.

Comment AQ7: Interior notes that the draft EIS frequently makes the conditional statement "if passage is provided," and that this statement is inaccurate and renders the analysis incorrect. Interior asserts that passage will be provided with a new fish ladder at Inskip Dam, and the other two dams (Coleman and South) on South Fork Battle Creek will be removed by 2023. Interior argues that the likelihood that higher numbers of salmonids will be in South Fork Battle Creek is very high, upon completion of the BCSSRP. As such, Interior recommends that the applicant conduct anadromous fish monitoring to ensure that the proposed project is not having a detrimental impact on the BCSSRP and that the project is not "taking" listed species under the Endangered Species Act (ESA) or adversely modifying critical habitat.

California DFW similarly recommends that Rugraw conduct anadromous fish monitoring, noting that the proposed project would be located within the BCSSRP, the collaborative effort to restore 42 miles of habitat in Battle Creek and its tributaries for threatened and endangered salmon and steelhead. Once the BCSSRP is complete, California DFW anticipates anadromous salmonids returning to their historic habitat all the way to Angel Falls, and the proposed project could adversely affect listed salmon and steelhead. California DFW states that the purpose of anadromous fish monitoring would be to document when salmonids return to the project's bypassed reach, at which time it would request that the license be reopened, evaluated, and conditioned for the protection of listed salmonids.

The Water Board also states that fish habitat monitoring would verify a lack of project impacts or the need for mitigation, including for endangered spring-run Chinook salmon and steelhead trout critical habitat, and identify whether or not resource goals are being met. The Water Board also supports the salmonid monitoring plan detailed in the revised final license application and recommends, if spring-run Chinook salmon or steelhead trout are found in the project area, immediate consultation with resource agencies to determine the appropriate components of a salmonid habitat assessment plan. The Water Board further recommends development of a resident fish habitat assessment plan in consultation with resource agencies to inform and ensure that existing fish habitat is protected and that the project would not adversely impact resident fish species.

Response: As noted in section 3.3.2.2, *Aquatic Resources, Salmonid Monitoring Plan*, of the final EIS, the potential future success of the BCSSRP is currently unknown, would involve a number of downstream fish passage measures unrelated to the project, and would not guarantee that anadromous species would reach the project area. If anadromous salmonids access the project bypassed reach as a result of downstream actions, a project license could be re-opened to determine additional measures or requirements needed for the protection of listed salmonids. In the interim, however, it is expected that any license issued would be conditioned to ensure project operations are not resulting in a take of federally listed species. Further, it is not the licensee's responsibility to monitor the success of the BCSSRP and determine when listed species may attain passage over Panther Grade, as implied in the proposed salmonid monitoring plan. Such monitoring is typically the responsibility of state and federal fishery management agencies. If agency monitoring indicates that listed species are present in the project-affected stream reaches, it would be incumbent on the licensee to comply with the ESA and prevent take of the listed species. In addition, it is not clear how the Water Board's suggested resident fish habitat assessment plan would be used to address project effects on the resource or to inform changes in future project operation.

Comment AQ8: Interior states that the project, as proposed, would be constructed in critical habitat for two ESA-listed species, Central Valley spring-run Chinook and Central Valley steelhead trout, and modify primary constituent elements of both critical habitats. Interior notes that the proposed project bypassed reach would also be located within the project boundaries of the BCSSRP, an approximately $185 million, multi-party restoration project that is intended to extend anadromy to Angel Falls by 2023. Interior finds that the draft EIS fails to fully acknowledge that anadromous fish will return to the proposed project area, does not adequately analyze the project's impacts on Chinook salmon or steelhead trout, and does not demonstrate how Chinook salmon and steelhead trout will be protected by the staff-recommended measures. Interior notes that, if the project results in water temperatures over 18°C (7DADM), it is unclear how the effects of that warming would be mitigated to ensure success in restoring the watershed.

Response: Interior's information on the critical habitat for the two listed species, and the BCSSRP, is consistent with the information in the draft EIS. The draft EIS acknowledges that, although anadromous species may be provided access to the project reach, it is unknown if and when that access would be realized. Although all downstream man-made barriers to upstream migration may be removed by 2023, the date that fish actually enter the project reach would depend on fish population pressure from downstream (when will fish currently using habitat in lower Battle Creek have the need to seek upstream habitat) and if they are capable of surmounting natural impediments to migration such as Panther Grade. We have revised our analysis of the proposed project effects on anadromous species, including water temperature (see section 3.3.2.2, *Aquatic Resources, Water Temperature*), in the final EIS, based on receipt of new water temperature data from the applicant, and our revised recommendations include real-time water temperature monitoring and project shut-downs to avoid the project causing average daily temperatures to exceed 20°C in the bypassed reach. We also include an analysis of the effects of the proposed project on the primary constituent elements (now called PBFs) of the critical habitat for Central Valley spring-run Chinook and Central Valley steelhead trout (see appendix B).

Comment AQ9: FWS supports the no-action alternative for the project because the proposed project would impact trust resources that FWS and partners have gone to great effort to restore. FWS notes that, because the proposed project is located within the boundary of the BCSSRP, it is inconsistent with restoration plans of the BCSSRP in South Fork Battle Creek and the Salmon Resiliency Strategy (CNRA, 2017), and therefore the staff-recommended measures in the draft EIS cannot resolve its concerns. In contrast, the Bureau of Reclamation (Reclamation) supports federal and state resource agencies' environmental review to ensure that the proposed project does not have a detrimental impact on the BCSSRP.

Response: We acknowledge FWS's support for the no-action alternative but, consistent with Reclamation's approach, we find that the proposed project with the staff-recommended measures would not jeopardize the BCSSRP.

Comment AQ10: Interior states that the Battle Creek Jumpstart Project will release juvenile winter-run Chinook into Battle Creek beginning spring 2018 and that, with these releases, adult fish may return to Battle Creek within the next 2–3 years. Interior notes that the draft EIS does not mention this reintroduction project and implies that the final EIS should include a full analysis of the project's effects on winter-run Chinook salmon including the potential for winter-run Chinook to stray into the South Fork and access the project reach.

Response: We have revised section 3.3.4, *Threatened and Endangered Species* in the final EIS to include this information on the Battle Creek Winter-Run Chinook Salmon Reintroduction Program and analyzed the potential effects of the staff-recommended alternative on this Evolutionarily Significant Unit.

Comment AQ11: Interior comments that the real flow at which the Panther Grade partial barrier and other barriers within the project area are passable is unknown and that the selection of 400 cfs as the streamflow that may allow passage is arbitrary and undocumented. Interior suggests that a complete analysis of a range of flows (e.g., 180, 200, 250, 300, 350, 400 cfs) would allow for a thorough review of the effects of the proposed project.

Response: Rugraw believes that Panther Grade is a barrier to upstream fish migration when flows are less than approximately 400 cfs (the highest flow in which it can be safely surveyed). Although Interior finds the use of 400 cfs arbitrary, we note that any passage analysis would be based on professional opinion and could also be considered arbitrary. Therefore, and in response to this comment, we revised the appropriate sections in the final EIS to exclude any references to Panther Grade being passable at 400 cfs.

Comment AQ12: Interior states that the peak migration of spring-run Chinook occurs in May, and migration of steelhead occurs from August–March, when flows over Panther Grade would be highest. Interior, therefore, asserts that the last paragraph on page 42 in section 3.3.2.1, *Aquatic Resources, Aquatic Habitat*, of the draft EIS is factually incorrect as it states that salmon will not migrate when flows are high enough for the fish to overcome barriers on South Fork Battle Creek.

Response: We have modified section 3.3.2.1, *Aquatic Resources, Aquatic Habitat,* of the final EIS accordingly.

Comment AQ13: Interior states that the discussion in the draft EIS of effects of flow regulation lacks a full analysis of what effects flow regulation would have on BMI, amphibians, nutrient cycling, water quality and terrestrial ecosystems in the project area and downstream of the project.

Response: Section 3.3.2.2, *Aquatic Resources, Effects of Flow Regulation on Aquatic Habitat,* includes an analysis of proposed flow regulation on aquatic habitat, using quantitative data available in the project record. Based on the results of our analysis, we determined that our recommended flows, ramping rates, water temperature driven project shut-downs, and substrate and large woody material measures would protect BMI, amphibians, and nutrient cycling processes within the project affected stream reach.

Section 3.3.3.2, *Terrestrial Resources, Effects of Project Construction and Operation on Vegetation,* includes analysis of proposed flow alterations on vegetation structure and canopy cover. Section 3.3.3.2, *Terrestrial Resources, Effects on Special-status Wildlife Species* and section 3.3.4.2 *Threatened and Endangered Species, California Red-legged Frog,* include analysis of project effects on amphibians. Based on our analysis, we conclude the project, with our recommended measures, would provide flow pulses, sediment transport, and spring base flow recession rates in the bypassed reach similar to existing conditions. Therefore, we conclude that the project would not adversely affect terrestrial ecosystems or amphibians. Because the proposed project would operate in a run-of-river mode, our analysis concludes that there would likely be no effect of flow regulation downstream of the project.

Comment AQ14: Interior notes that the PHABSIM study included in its comments, and on which its recommended 35-cfs MIF is based, was conducted in 2016 by FWS staff using data collected by Cramer and Associates in the bypassed reach specifically for the Lassen Lodge Project and that the Thomas R. Payne & Associates citation stated in the draft EIS, page 58, is an error.

Response: We have corrected the citation error in the final EIS.

Comment AQ15: Interior finds that the draft EIS does not acknowledge the comprehensive effort to restore salmon habitat in the Battle Creek watershed. Interior asserts that anadromous fish will occupy the bypassed reach in the future and it provided information that shows adult migration, spawning, or rearing of winter-run, spring-run Chinook and steelhead could occur concurrently with project operation. In addition, in determining to not adopt Interior's 35-cfs recommendation, Interior notes that FERC staff did not fully consider the benefits to natural resource and the cost of lost restoration dollars to state and federal governments and private parties and that a fair valuation of the benefit that the 35-cfs flow would provide to natural resources would compare the value of the project against the implementation cost of the environmental measure.

Response: The draft EIS and final EIS describe the efforts to restore salmon and steelhead habitat in the Battle Creek watershed. Although Interior asserts that the restoration program will be fully successful, there is no assurance of this, as the extent to which Panther Grade may or may not be an obstruction to upstream migration is not fully known. For example, The Coleman National Fish Hatchery Adaptive Management Plan (Hymanson et al., 2016), estimates Chinook and steelhead passage success over "Unnamed #10" at RM 13.26 is 50 percent and estimated passage success over Panther Grade ("Panther Falls") would be 20 percent, resulting in a cumulative passage success over Panther Grade of only 10 percent; an indication that few fish, if any, would ever make it to the project area.

It is unclear why Interior believes that a failure to adopt the 35-cfs minimum flow would result in a "loss of restoration dollars." Funding for the BCSSRP has focused and will continue to focus on the removal of obstructions to fish migration in lower Battle Creek, well downstream of the proposed project area, and those efforts would be unaffected by the project on the upper South Fork Battle Creek at the potential upper limit of fish migration in the Battle Creek watershed.

Our analysis in section 3.3.2.2, *Aquatic Resources, Effects of Flow Regulation on Aquatic Habitat* of the draft and final EIS indicates that a MIF of 13 cfs would maintain an appropriate amount of aquatic habitat for resident rainbow trout and that a MIF of 35 cfs would maximize the amount of habitat for fry and juvenile Chinook and steelhead. In section 4.3, *Cost of Environmental Measures*, of the draft and final EISs we compare the costs of the recommend MIFs, and in section 5.1, *Comprehensive Development and Recommended Alternative*, we evaluate the costs and associated benefits of the recommended measures to environmental resources. Given the information provided in sections 3.3.2.2, *Aquatic Resources, Environmental Effects,* and 4.3 of the final EIS, in section 5.1, *Comprehensive Development and Recommended Alternative*, we find that providing Interior's recommended MIF of 35 cfs would likely maximize habitat for anadromous species; however, that habitat would also be significantly under-utilized. Therefore, providing a 35-cfs MIF is not justified when we consider the benefit to the resource to be protected and the cost to the power and developmental purposes of the proposed project.

Comment AQ16: The Water Board states that streamflows are prescribed to protect aquatic species by providing habitat for all life stages and that the goal of an increased MIF is to support population growth of endangered/special-status species by maximizing habitat, not to decrease the ratio of spawning habitat to rearing habitat. The Water Board notes that focusing on the argument that spawning habitat exceeds rearing habitat for spring-run Chinook salmon and steelhead trout ignores the purpose of MIFs and is not protective of endangered aquatic resources. The Water Board supports evaluation of alternative MIFs (i.e., high enough to support anadromous salmonids) for the reasonably foreseeable contingency that salmonids may enter the project area.

Response: While the Water Board comments that the goal of an increased MIF is to support population growth of endangered/special-status species by maximizing habitat, not to decrease the ratio of spawning habitat to rearing habitat, we determined that our recommended flows, ramping rates, water temperature driven project shut-downs, and substrate and large woody material measures would protect the existing fish, BMI, amphibians, and nutrient cycling processes within the project affected stream reach. Should the listed anadromous salmonids achieve passage to the project reach in the future, the reopener provision of any license issued could be used to adjust MIF's for these species, if required.

Comment AQ17: Interior comments that there is limited discussion in section 5.2, *Unavoidable Adverse Effects*, of the draft EIS on unavoidable adverse effects, and notes that the discussion should include: inundation at the diversion dam, reduction of flows in the bypassed reach, effects of fluctuating water levels on aquatic invertebrates, effects on invertebrates of siltation in the impoundment and scouring in the bypassed reach, blockage of upstream fish passage, alteration of stream and riparian habitats, changes in water quality, long-term changes in river hydrology, and establishment of bullfrogs.

Response: Section 5.2, *Unavoidable Adverse Effects*, of the EIS describes those effects that are unavoidable after implementation of all proposed and recommended environmental measures. Interior's list of unavoidable effects appears to be just a list of project effects, some of which are discussed as unavoidable, but many would be mitigated by measures recommended by staff and resource agencies. For example, inundation at the diversion dam is discussed in section 5.2, *Unavoidable Adverse Effects*, as an unavoidable effect, while reduction of flows and flow fluctuations are noted, but those effects would be mitigated by provision of instream flows and ramping rate restrictions, while proposed sluicing of gravels and fines at the dam would ensure that suitable substrates for aquatic invertebrates and fish are passed downstream into the bypassed reach. Impoundment siltation would also not be an unavoidable adverse effect because of the small size of the proposed impoundment and the recommendation for sluicing of gravels and fines from the impoundment. Project operation would not result in scouring in the bypassed reach; any scouring that may occur would be the result of natural high-flow events beyond the control of the project. While the proposed dam would be a blockage to upstream fish migration, any anadromous species that may enter the project reach in the future would not reach the dam because of the downstream blockages to migration at Angel Falls and Panther Grade. The dam would be a blockage to upstream movement of resident trout and that effect has been added to section 5.2, *Unavoidable Adverse Effects*, of the final EIS. The project would have minimal effects on stream and riparian habitats, water quality, and river hydrology, because of the small size of the project and the recommended instream flows that would be higher than current natural low flows during the summer months, and our recommendation to shut down the project whenever stream temperatures exceed 20°C, minimizing any effects of higher water temperatures. Establishment of bullfrogs is a potential effect of constructing the small project impoundment, but not unavoidable, as our recommended aquatic invasive species monitoring plan would monitor for bullfrogs and include control measures, should they be discovered.

Comment AQ18: Interior points out that table 5-1 in the draft EIS does not include Interior 10(j) recommendation 6: DSMP, and requests that it be included in the final EIS.

Response: While we erroneously omitted the DSMP from table 5-1, we note that the draft EIS did analyze that recommendation in section 3.3.2.2, *Aquatic Resources, Sediment and Woody Debris Management*, and the staff recommendation in section 5.1.1, *Measures Proposed by Rugraw*, supported the preparation of a DSMP. Section 5.1.1, *Measures Proposed by Rugraw*, of the final EIS, continues to recommend the development of a DSMP with agency consultations for sluicing sediment when flows are less than 400 cfs, turbidity monitoring during sluicing events, and monitoring of sediment and woody material accumulation in the impoundment. We have also added Interior's recommendation for a DSMP to table 5-1 of the final EIS.

Comment AQ19: In its comments on the draft EIS, Rugraw proposes to modify its proposed operating plan if anadromous species successfully migrate into the project reach as follows: (1) if from 1 to 11 anadromous fish (minimum length of 18 inches) reach the tailrace or above within the project reach, then, unless the resource agencies mutually agree to alternative measures, Rugraw would relocate these anadromous fish to more suitable habitat below Panther Grade; (2) if 12 or more anadromous fish arrive at the tailrace or above within the project reach, then Rugraw would release a pulse flow of at least 30 cfs into the bypassed reach for a minimum of 48 hours in each month that 12 or more anadromous fish are identified in the project reach to allow for better upstream migration and spawning opportunities within the project reach, unless resource agencies mutually agree to alternative measures; and (3) if 12 or more anadromous fish arrive at the tailrace or above within the project reach, then Rugraw would perform, in consultation with agencies, additional studies of the habitat within the project reach to better inform an appropriate adaptive management plan based on current site conditions.

Response: We acknowledge Rugraw's modified proposed operating plan to take certain actions depending on the number of anadromous fish that move into the project reach. However, we do not analyze the modified proposal in the final EIS because it lacks sufficient detail. In addition, anadromous fish are not expected to enter the project reach because of the substantial natural barriers to upstream migration. If federally listed anadromous fishes enter the project reach in the future, Rugraw would be expected to comply with the ESA to prevent take. If new or revised environmental measures are necessary to protect listed species for the duration of the license term, Rugraw and/or fish and wildlife agencies may petition the Commission to reopen the license for the protection of listed and unlisted fish and wildlife resources.

Comment AQ20: The Water Board finds that monitoring of BMI before (i.e., baseline monitoring) and during construction, and during operation and maintenance activities after the project is built, is necessary to determine project-related impacts on aquatic resources and ecosystem health. The Water Board further supports ongoing monitoring of BMI in the bypassed reach in keeping with its anti-degradation policy.[138] The Water Board argues that analysis of BMI community composition and structure can give early warning of ecosystem degradation and information on project impacts on water quality and ecological conditions during the term of a license.

Response: As stated in the draft EIS, BMI "are a good indicator of the biological health of streams and are a critical component of the food web in aquatic communities." Although we agree with the Water Board that analysis of BMI community composition and structure can alert resource managers of ecosystem degradation, we respectfully disagree that this analysis can articulate project specific impacts. As an indicator of aquatic ecosystem health, BMI can be affected by many factors within the watershed unrelated to the project, and BMI monitoring results cannot isolate project-specific effects on the resource. For this reason, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, we do not recommend monitoring BMI as requested by the Water Board.

Comment AQ21: Interior comments that section 3.1, *Description of the River Basin*, incorrectly identifies Panther Grade as the upper extent of the BCSSRP and presents documentation that Angel Falls is the upstream limit of the restoration project.

Response: We have modified the final EIS to indicate that Angel Falls is the upper extent of the BCSSRP.

Comment AQ22: The Water Board asks for an evaluation of a variety of hydropower turbines and fish screen designs and to select the options that are most protective of fishery resources. The Water Board requests an explanation of: (1) why the proposed Pelton turbine is appropriate for the project given a near 100 percent mortality rate for entrained fish; and (2) requests an evaluation of the effectiveness of the proposed fish screen based on past experience, and whether it would expose fish to potential impingement on the screen and related injury or mortality.

Response: The applicant typically selects the turbine unit based on site-specific engineering considerations. Certain turbine designs are appropriate only under some conditions, and a Pelton unit is most appropriate under high-head conditions and relatively small flow volumes, which are the conditions at the proposed project site. Rugraw's proposed fish screen is intended to prevent the entrainment of all life stages of resident rainbow trout into the project works and should eliminate turbine mortality. As discussed in section 3.3.2.2, *Aquatic Resources, Fish Passage,* developing the screen in

[138] State Water Resources Control Board Resolution 68-16 (Antidegradation Policy) protects surface and ground waters from degradation. It states that "waters having quality that is better than that established in effective policies shall be maintained unless any change will be consistent with the maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial uses, and will not result in water quality less than that prescribed in the policies."

consultation with California DFW, following the latest NMFS screening guidelines (NMFS, 1997), would also ensure that these screens reflect the latest screening technology intended to prevent entrainment and impingement and result in a high fish diversion efficiency and survival.

Comment AQ23: The Water Board comments that evaluation of the 35-cfs alternative MIF must include analysis of a full range of impacts. For the EIS to meet the needs of the Water Board's California Environmental Quality Act analysis and the National Environmental Policy Act, the Water Board states that the EIS must fully analyze all reasonable alternatives to the proposed project flow of 13 cfs. The Water Board notes that FERC limited the evaluation of the 35-cfs flow alternative in the draft EIS to economic feasibility, rearing habitat for salmonid parr life stages, and temperature. The Water Board requests that the final EIS include an analysis of the 35-cfs alternative for a full spectrum of impacts, including impacts on amphibians, BMI, sediment passage, and woody debris.

Response: In section 3.3.2.2, *Aquatic Resources, Environmental Effects*, section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, and section 3.3.3.2, *Terrestrial Resources, Effects on Special-status Wildlife Species*, of the final EIS, we provide a detailed analysis of the recommended 13 cfs and 35 cfs MIFs on aquatic habitat, fish populations, amphibians, BMI, sediment passage, and woody debris. We also evaluate the effects of NMFS's variable (25, 30, and 35 cfs) and Rugraw's suggested 8 cfs minimum flow alternatives on these same environmental attributes.

TERRESTRIAL RESOURCES

Comment T1: Interior, the Water Board, and California DFW state that, in addition to monitoring amphibians during construction, annual monitoring should also occur during project operation for an unspecified period to determine project-related impacts on state- and federally listed sensitive species (foothill yellow-legged frog [FYLF], California red-legged frog, and Cascades frog).

Response: Our analyses in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, indicates that the proposed project flows would continue to support existing FYLF habitat. The aquatic invasive species plan would include surveys for bullfrog and control measures if bullfrogs colonize the impoundment area. We modified our recommended aquatic invasive species plan to include protocols for decontaminating equipment used during instream work to prevent the spread of chytrid fungus. As recommended in section 5.1.2, *Additional Measures Recommended by Staff*, these measures would continue for the duration of the license. Regarding amphibian monitoring for the term of the license, the Water Board did not provide its reasoning for this recommendation; we typically do not recommend long-term biological monitoring of populations. As discussed in section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, species' populations may be affected by many factors within the watershed and respond to a multitude of environmental stressors that are not project related. Therefore, monitoring species' populations has little value when assessing project impacts. As such, in section

5.1.2, *Additional Measures Recommended by Staff*, we do not recommend post construction amphibian monitoring. Measures in the aquatic invasive species management plan, including surveys for bullfrog in the project impoundment, bullfrog control measures, and measures to prevent the spread of chytrid fungus, would provide protections for sensitive amphibians for the license term.

Comment T2: The Water Board and California DFW are concerned that the staff recommendation to relocate FYLF out of the construction area may result in the take of state-candidate FYLF and assert that the final EIS must address the potential effect of moving larval and juvenile frogs.[139] California DFW states if any life stage of FYLF is found during preconstruction surveys or during construction activities, all work should immediately stop, and California DFW and other agencies should be notified immediately.

Response: In section 5.1.2, *Additional Measures Recommended by Staff*, of the draft EIS, we recommended that Rugraw consult with California DFW if FYLF are observed during preconstruction surveys. However, in section 5.1.2 *Additional Measures Recommended by Staff* of the final EIS, we now recommend Rugraw consult with California DFW before construction to develop protocols for handling and relocating larval, juvenile, and adult FYLF, and notify California DFW if such relocation is necessary. Waiting until FYLF are observed during construction activities, stopping work, and then consulting to identify proper protocols would result in unnecessary delays in the construction schedule, which is already limited to 5.5 months annually due to climate conditions. We anticipate that the developed protocols would prevent stress to individuals and limit the potential for take associated with moving individuals out of harm's way during construction activities. Implementing this measure to develop protocols prior to construction would have the same result as intended by California DFW.

Comment T3: California DFW notes that unnatural flow pulses could occur during operation when the project trips offline, which could impact FYLF by scouring egg masses. Therefore, California DFW requests that the final EIS analyze the effects of potential flow pulses on downstream habitat for this species.

Response: If the project trips off line, there would be no pulse flow in the bypassed reach because flows would continue to pass through the penstock and powerhouse into the tailrace but would be directed away from the turbines. We have modified section 3.3.3.2, *Terrestrial Resources, Environmental Effects*, in the final EIS to clarify this operational contingency. If it were necessary to subsequently transition flows from the powerhouse to the bypassed reach, this transition would be subject to the staff

[139] The California Endangered Species Act defines take as to hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill.

recommended ramping rates, discussed in section 5.1.2, *Additional Measures Recommended by Staff*, to eliminate any pulse flow and potential for scour.

Comment T4: Interior states that the Executive Summary must provide more detail on measures to address migratory birds and references FWS guidelines on the migratory bird program website.[140]

Response: The Executive Summary does not have the full details that are included in other sections of the draft EIS on our analysis, recommendations, and conclusions. We modified section 5.1.2, *Additional Measures Recommended by Staff*, in the final EIS to clarify our recommendation that Rugraw develop an avian protection plan, in consultation with California DFW and Interior, prior to construction of the transmission line. We note, this consultation could include the incorporation of measures from FWS's guidelines on the migratory bird program website.

Comment T5: Interior recommends continuation of the noxious weed control beyond year 2 until a goal of less than 10 percent cover of noxious weeds is achieved. In addition, Interior recommends filing the noxious weed monitoring and revegetation monitoring reports with the Commission and distributing it to the project's Service List.

Response: In section 3.3.2.2, *Terrestrial Resources, Environmental Effects*, we analyze the benefits of Interior's recommended continuation of noxious weed control and conclude it would provide additional protection to terrestrial resources. We have modified section 5.1.2, *Additional Measures Recommended by Staff*, in the final EIS to include our recommendation that Rugraw modify the Noxious Weed and Revegetation Plan to include FWS's recommended success criteria and reporting, including circulation to appropriate agencies, including FWS, California DFW, the Water Board, and Tehama County.

Comment T6: The Water Board asks if the annual reporting component of the staff-recommended aquatic invasive species management plan would be done after construction is finished (i.e., during project operation).

Response: Our recommended aquatic invasive species management plan would apply to both construction and operation of the proposed project. Annual reporting would begin following the first year of construction and continue through the term of the license.

Comment T7: Interior comments that the statement in the sixth bullet on page 166 of the draft EIS mischaracterized its recommendation for transmission line design by only referencing FWS's Avian Protection Plan guidelines and not the Avian Power Line Interaction Committee (APLIC) guidelines. Interior notes it provided the APLIC Guidelines for powerline development as an attachment to its comments in response to the REA notice and continues to support their use on this project.

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[140] https://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php.

Response: We revised this bullet in the final EIS Executive Summary. In addition, in section 5.1.2, *Additional Measures Recommended by Staff*, we recommend that any avian protection measures that Rugraw implements should consider APLIC Guidelines.

Comment T8: California DFW comments that the FYLF is now a candidate species, as defined in Fish and Game Code section 2068, and it must be afforded the same protections under the California ESA as a threatened or endangered species.

Response: We have updated references to the status of this species in the appropriate sections of the final EIS.

Comment T9: California DFW states that the draft EIS did not fully analyze the effect of project operation and maintenance on FYLF by: (1) stranding or dewatering egg masses and tadpoles, and (2) affecting water temperatures potentially altering the timing of breeding and tadpole development. Interior recommended that spring flood recession rates should be less than a 1-foot drop in stage over a 3-week period to prevent the stranding of FYLF egg masses. During the March 15, 2018, 10(j) meeting, FWS clarified its intent that this recommendation be considered pursuant to section 10(j) of the FPA. FWS noted that this recession rate is needed to protect FYLF egg masses, which are deposited in approximately 1 foot of water and require up to 3 weeks to develop. FWS further clarified that the stated recession rate was not intended to apply to ramping rates associated with short-term storm events, but was related to the base flow between storms. FWS stated the starting point for evaluation should be at a point where the falling limb of the spring snow melt pulse flow begins to level out to base flow conditions.

Interior's comments on the draft EIS also state that low water temperatures during tadpole rearing periods can increase development time, reduce size at metamorphosis, and potentially result in poor or no recruitment. Interior notes that in field and laboratory experiments, tadpoles reared at sites with daily average temperatures of 16.5 to 20ºC in June through August resulted in the highest survival rate with very low survival below 16.5ºC. However, during the 10(j) meeting FWS articulated that meeting temperature criteria for salmonids was a greater priority than meeting temperature criteria for FYLF.

Response: In section 3.3.3.2, *Terrestrial Resources*, *Environmental Effects*, and appendix C of the final EIS we provide additional analysis to evaluate the potential for project operation to result in a spring base flow recession rate greater than 1 foot over 3 weeks. We conclude that, the spring flood recession rate would increase under project operation, and would exceed a 1-foot-per-3-week rate about once every 7 years. As a result, we found that though rare, these occurrences would likely result in some dewatering of egg masses and cause reduced reproduction success during those years and that such reductions would also affect second generation production. Therefore, in section 5.1.2, *Additional Measures Recommended by Staff*, we adopt the FWS recommendation and recommend Rugraw consult with California DFW and FWS to develop a plan to protect FYLF from spring base flow recessions greater than 1 foot over 3 weeks.

Regarding water temperature, as discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, we conclude that proposed project operation would not affect the suitability of water temperatures for FYLF in South Fork Battle Creek because there would be minimal reductions in water temperature in May, which would occur early in the breeding period and would not affect tadpoles. Under the staff alternative, as discussed in section 5.1.2, *Additional Measures Recommended by Staff*, as water temperatures warm, the project would be shut down to protect salmonids and prevent any project induced water temperature increases above the upper optimum limit of 20ºC for FYLF tadpole rearing.

THREATENED AND ENDANGERED SPECIES

Comment TE1: Interior comments that the draft EIS states the Northern spotted owl was overlooked and omitted from Interior's June 24, 2016, REA comment letter. Interior notes that, at that time, FWS concluded that the Northern spotted owl would not occur in the project area, because the project is outside of the range of the sub-species.

Response: We have modified section 1.3.3, *Endangered Species Act,* in the final EIS to reflect this information.

Comment TE2: Interior comments that endangered species surveys have an associated time limit, so a prior survey may no longer be valid, and that FERC should check with FWS regarding individual survey protocols for each listed species. For plants, Interior notes that inventories older than 3 years would likely need additional surveys.

Response: Rugraw proposes to conduct preconstruction surveys for sensitive plant species in areas of proposed disturbance. If federally listed plants are found, Rugraw would implement protection measures as listed in section 5.1.1, *Measures Proposed by Rugraw*. As discussed in section 5.1.2, *Additional Measures Recommended by Staff*, Rugraw would file a construction plan identifying all areas of disturbance and buffer areas to protect listed species.

CUMULATIVE EFFECTS

Comment CE1: The Water Board asks for re-evaluation of cumulative water temperature effects and requests that the EIS provide evidence that the project would not provide a considerable contribution to the cumulative effects on water temperature.

Response: As discussed in section 5.1.2, *Temperature Thresholds and Monitoring,* of the final EIS, we now recommend real-time water temperature monitoring and project shut-downs when average daily temperatures exceed 20°C. Our analysis in section 3.3.2.2, *Aquatic Resources, Water Temperature*, of the EIS finds that operating the project with a 13-cfs minimum flow would likely increase water temperature no more than 0.5ºC downstream of the project's powerhouse. We acknowledge that the project would have some cumulative effect on water temperature, albeit negligible. Therefore, we revised section 3.3.2.3, *Aquatic Resources, Cumulative Effects*, of the final EIS to indicate the project would have "negligible" adverse cumulative effects on water temperature in South Fork Battle Creek or lower Battle Creek in combination with warming that now occurs upstream of the project site in large meadows in the vicinity of the town of Mineral and the Pacific Gas and Electric Company's Battle Creek Project in lower Battle Creek.

Comment CE2: The Water Board states that it cannot be assumed that applicant-proposed environmental measures would adequately protect aquatic resources, and that monitoring is necessary to verify a lack of project impacts or the need for mitigation. The Water Board argues that anticipating the preservation of good aquatic habitat throughout a 30–50 year license term, and not proposing monitoring to validate or confirm this assumption, is not protective of aquatic resources. The Water Board notes that without monitoring Rugraw would not know if cumulative changes in fishery resources are a result of project operation.

The Water Board also notes that the draft EIS' analysis for fishery resources in section 3.3.2.3, *Aquatic Resources, Cumulative Effects*, which states that a salmonid monitoring plan would mitigate cumulative effects on fishery resources, is inconsistent with the FERC staff alternative that does not include a salmonid monitoring plan. As a result, the Water Board requests clarification of whether the staff recommends a salmonid monitoring plan and that if not, revise the analysis in section 3.3.2.3, *Aquatic Resources, Cumulative Effects*, to determine the cumulative impacts on fishery resources without a salmonid monitoring plan.

Response: Although we agree that long-term monitoring can often be a valuable tool in the management or recovery of fish populations, it is unclear how said monitoring would be able to distinguish a project effect from other natural and anthropogenic effects within the watershed. That said, the staff recommendation in section 5.1.2, *Additional Measures Recommended by Staff*, includes certain monitoring for the duration of the license term (e.g., water temperature, streamflow, and sediment accumulation in the impoundment) to ensure the project is operated in a manner consistent with the environmental measures included in its license and determined to be protective of the resources.

We have corrected section 3.3.2.3, *Aquatic Resources, Cumulative Effects*, in the final EIS to confirm that we are not recommending a salmonid monitoring plan.

COMPREHENSIVE DEVELOPMENT

Comment CD1: The California DFW disagrees with the conclusions in the draft EIS that Rugraw's proposed water temperature monitoring program, use of a 20°C water temperature criterion to shut down the project, upstream fish passage facilities at the diversion dam, and other proposed measures are inconsistent with the comprehensive planning standard of section 10(a) of the FPA, including the equal consideration provision of section 4(e) of the FPA. California DFW disagrees with staff's determination that the costs of the measures outweigh the expected benefits, and it states that the cost to implement these provisions would be minimal compared to the expected revenue generated from a 5.0-megawatt hydroelectric facility.

Response: Cost is not the only consideration in determining whether a measure is inconsistent with the comprehensive planning standard of section 10(a) of the FPA. The measure must also be directly tied to a specific effect of the project and have a reasonable chance of mitigating that effect. However, for reasons discussed in *Temperature Thresholds and Monitoring* of section 5.1.2 in the final EIS, as noted in our response to comment WR5, WR11, WR12, WR13, and WR14, we are now recommending water temperature monitoring and discontinuing project operation when the project warms average daily stream temperature to above 20°C.

Comment CD2: Interior questions how we establish the stated costs for implementing its recommended water temperature monitoring. California DFW disagrees with our estimated capital cost of $60,000 for the development of its recommended water temperature monitoring plan. Interior states that the cost for the Interior/NMFS-recommended temperature monitoring seems overly inflated, noting that temperature loggers typically have a one-time cost of about $100 compared to our estimated capital cost of $120,000.

Response: We strive to provide transparency throughout the entire National Environmental Policy Act process, including our cost estimates provided in table 4-3 of the draft and final EIS. The temperature loggers noted in Interior's comment are a cost-effective means of monitoring and recording water temperature for a prolonged period of time. However, temperature loggers would not support Interior's or NMFS's section 10(j) recommendation 2 to actively manage project operation based on monitored water temperature. Instead, real-time water temperature monitoring instrumentation, which is substantially more expensive to purchase, install, and maintain, would be needed to support the agencies' recommendation 2. Our cost estimate reported in the draft EIS was based on the equipment, installation, operation, and maintenance necessary to support and comply with the agencies' 10(j) recommendation 2. We added a discussion of the need for real-time temperature monitoring stations to actively manage project operation in *Water Temperature* of section 3.3.2.2 and in *Temperature Thresholds and Monitoring* of section 5.1.2 of the final EIS. In addition, based on comments and discussions at the March 15, 2018, 10(j) meeting, we revised our estimates of water temperature monitoring in table 4-3 of the final EIS to account for: (1) the apparent inclusion of the station at the dam in Rugraw's construction cost; (2) a reduced cost for installation of California DFW's recommended station on the project's penstock; and (3) use of loggers, instead of real-time stations, to monitor temperature at one station proposed by Rugraw, one station recommended by California DFW, and two stations recommended by Interior and

NMFS.[141] We provide our itemized cost estimates for all proposed and recommended water temperature monitoring programs in appendix D of the final EIS.

Comment CD3: California DFW asserts that upstream fish passage at the proposed diversion dam upstream should be provided and disagrees with the staff estimate of $300,000 for constructing upstream passage at the diversion dam (page 142 of the draft EIS). California DFW notes that the cost for upstream passage would only be the cost to build weirs in the canal for fish to ascend the 8-foot-high dam. California DFW further comments that page 67 of the draft EIS states that the only fish that would currently benefit from upstream passage at the diversion dam would be rainbow trout that reside in the 0.7 mile of stream between Angel Falls and the diversion dam. Interior supports the California DFW and argues that the South Fork Battle Creek is a class 1 stream with observations of rainbow trout in the project area. California DFW also notes that the Fish and Game Code requires the owner of a dam to provide a suitable fishway in consultation with California DFW when determined that the dam does not allow free passage for fish and that the code does not specify a minimum length of stream for fish passage to be required.

Response: 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 recreational opportunities; and (4) the preservation of other aspects of environmental quality. As such, we must evaluate the potential effects of a project on the affected environmental resources and determine whether the effects justify the need for environmental measures and at what cost. As discussed in section 3.3.2.2, *Aquatic Resources, Fish Passage,* in the draft and final EIS, providing upstream fish passage facilities for resident rainbow trout residing in the 0.7-mile reach between the proposed diversion and the crest of Angel Falls would provide minimal benefit to this fishery. If these resident trout exhibit anadromy, as suggested by some agencies, their primary behavioral response would be to migrate downstream to the ocean and not move upstream via the fishway. Fish production in the reach would

[141] We continue to estimate the cost for real-time stations at all proposed and recommended stations at the dam, within the bypassed reach, and at or just below the powerhouse discharge. However, we estimate the costs for using loggers to monitor temperature at all stations that we concluded would not be used for real-time management of project operations. This resulted in estimating costs for loggers, instead of real-time stations, at Rugraw's proposed station at Ponderosa Way Bridge, California DFW's recommended station just upstream of Panther Grade, and Interior's and NMFS's recommended stations downstream of Panther Grade and at the project's intake header box.

continue to be supported by natural spawning in the 0.7-mile reach or from seeding from upstream locations. We note that our recommended measures for MIFs, ramping rates, temperature thresholds, and project shut-downs are intended to maintain the habitat in this reach and protect the fish residing there. Therefore, as discussed in section 5.1.3, *Other Measures Not Recommended by Staff*, of the final EIS, the environmental benefit of constructing and operating an upstream fishway at the project diversion dam would not be worth the developmental cost.

As discussed during our 10(j) meeting in Sacramento, Rugraw concurs with our cost estimate, which is based on the costs of similar passage facilities located on the West Coast. These costs include the design and engineering of the facility, permitting, and construction.

APPENDIX B—EFFECTS OF PROPOSED PROJECT OPERATION ON DESIGNATED CENTRAL VALLEY SPRING-RUN CHINOOK SALMON AND CALIFORNIA CENTRAL VALLEY STEELHEAD CRITICAL HABITAT PHYSICAL OR BIOLOGICAL FEATURES

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1.0 CRITICAL HABITAT DESIGNATIONS

The National Marine Fisheries Service (NMFS) designated critical habitat for the Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) Evolutionarily Significant Unit on September 2, 2005 (70 Federal Register [FR] 52488). This designation includes the stream reaches of the Feather and Yuba Rivers; Big Chico, Butte, Deer, Mill, Battle, Antelope, and Clear Creeks; the Sacramento River; and portions of the northern Delta. In South Fork Battle Creek, critical habitat extends up to river mile (RM) 21.4, which is about 0.8 mile upstream of the proposed project's powerhouse site and 0.9 mile downstream of Angel Falls at RM 22.3, which is considered the upstream limit of fish migration in South Fork Battle Creek. Although spring-run Chinook do not currently have access to the proposed project area because of existing downstream barriers, the Battle Creek Salmon and Steelhead Restoration Project (BCSSRP) plans to remove the last man-made barrier to upstream passage in Battle Creek by approximately 2023.[142]

NMFS also designated critical habitat for the Central Valley steelhead (*O. mykiss*) on September 2, 2005 (70 FR 52488). This critical habitat includes all river reaches accessible to listed steelhead in the Sacramento and San Joaquin Rivers and their tributaries in California, including 1.7 miles of the proposed project's bypassed reach up to the base of Angel Falls at RM 22.3. As is the case for spring-run Chinook salmon, steelhead do not currently have access to the critical habitat designated in the proposed project area. However, the resident rainbow trout population currently found in the upper South Fork Battle Creek project area may have the ability to exhibit anadromy.[143]

Both of these critical habitat designations have generally used the term "primary constituent elements" (PCEs) to describe the physical or biological features that are essential to the conservation of these species. However, NMFS and the U.S. Department of the Interior, Fish and Wildlife Service (FWS) recently issued a final rule amending the regulations for designating critical habitat (81 FR 7414). This final rule replaced the term PCEs with physical or biological features (PBFs) but did not change the categories of such features (i.e., freshwater rearing habitat or freshwater migration corridors) or the approach used in conducting an effects analysis (which is the same regardless of whether the original designation identified PCEs or PBFs).

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142 The BCSSRP will reestablish approximately 42 miles of prime salmon and steelhead habitat on Battle Creek, plus an additional 6 miles on its tributaries. The target species include the Central Valley spring-run Chinook salmon (state- and federally listed as threatened), the Sacramento River winter-run Chinook salmon (state- and federally listed as endangered), and the Central Valley steelhead (federally listed as threatened).

143 Anadromy and/or residency appear to reflect interactions among genetics, individual condition, and environmental influences.

2.0 PHYSICAL OR BIOLOGICAL FEATURES OF CRITICAL HABITAT

NMFS, in another final rule (81 FR 7432), defines PBFs as ‘‘the features that support the life history needs of the species, including but not limited to water characteristics, soil type, geological features, sites, prey, vegetation, symbiotic species, or other features. A feature may be a single habitat characteristic or a more complex combination of habitat characteristics. Features may include habitat characteristics that support ephemeral or dynamic habitat conditions. Features may also be expressed in terms relating to principles of conservation biology, such as patch size, distribution distances, and connectivity.’’ The overall value of critical habitat for the conservation of a listed species is the sum of the quantity, quality, and availability of the PBFs. Therefore, reductions in the quantity, quality, or availability of one or more PBFs reduce the value of the PBF, which in turn reduces the function of the overall critical habitat.

The 2005 critical habitat designation (70 FR 52488) identified the following PBFs for both Central Valley spring-run Chinook salmon and California Central Valley steelhead critical habitat:

- **Freshwater spawning sites** with water quantity and quality conditions and substrate supporting spawning, incubation, and larval development.
- **Freshwater rearing sites** with water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; water quality and forage supporting juvenile development; and natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks.
- **Freshwater migration corridors** free of obstruction with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.
- **Estuarine areas** free of obstruction with water quality, water quantity, and salinity conditions supporting juvenile and adult physiological transitions between fresh- and saltwater; natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels; and juvenile and adult forage, including aquatic invertebrates and fishes, supporting growth and maturation.
- **Nearshore marine areas** free of obstruction with water quality and quantity conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation; and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, and side channels.

- **Offshore marine areas** with water quality conditions and forage, including aquatic invertebrates and fishes, supporting growth and maturation.

In the following sections, we summarize the existing conditions and analyze the effects of proposed project operation on these PBFs in South Fork Battle Creek. Effects on designated critical habitat are evaluated with respect to whether they impair properly functioning habitat, appreciably reduce the functioning of already impaired habitat, or retard the long-term progress of the impaired habitat toward properly functioning conditions (64 FR 50394). Unless otherwise cited, our description of existing conditions at the Evolutionarily Significant Unit/Distinct Population Segment level is derived from NMFS (2009a). More specific information pertaining to Battle Creek and South Fork Battle Creek was obtained from the applicant's final license application; other sources in the project record; and/or reasonably accessible, publicly available information.

3.0 EFFECTS OF PROJECT OPERATION ON CENTRAL VALLEY SPRING-RUN CHINOOK SALMON PBFs

3.1 Freshwater Spawning Sites

Freshwater spawning sites are areas with appropriate water quantity, water quality, and substrate for successful spawning, egg incubation, and larval development. Under existing conditions, spring-run Chinook salmon have been reported to spawn in the mainstem Sacramento River between Red Bluff Diversion Dam (RBDD) and Keswick Dam, although little spawning activity has been reported in recent years. Spring-run Chinook salmon primarily spawn in Sacramento River tributaries such as Mill, Deer, and Butte Creeks. Operations of Shasta and Keswick Dams on the mainstem Sacramento River are constrained by the need to provide water of suitable temperature for adult winter-run Chinook salmon migration, holding, spawning, and incubation, as well as for spring-run Chinook salmon embryo incubation in the mainstem Sacramento River.

In South Fork Battle Creek, spring-run Chinook salmon are currently unable to access the project area (action area) because of existing downstream barriers. The most upstream of these is the South Diversion Dam on South Fork Battle Creek, approximately 6 RM downstream of the proposed project area. Although all of these barriers are scheduled for removal by 2023, it is not known if spring-run Chinook salmon will be able to pass Panther Grade (RM 18.9) and several other natural barriers and/or obstacles to upstream migration upstream of Panther Grade. The proposed powerhouse site is at RM 20.6, about 1.7 miles upstream of Panther Grade.

As described in our final environmental impact statement (EIS), adult Central Valley spring-run Chinook salmon enter the Sacramento River from late March to July, over-summer in coldwater habitats, and then spawn from mid-August through early October. Incubation occurs from mid-August to mid-March, with rearing and emigration occurring from mid-August through April. Adult Chinook salmon require cold, freshwater streams with suitable gravel for reproduction. For maximum survival of incubating eggs and larvae, water temperatures must be between 5 degrees Celsius (°C) and 13°C (Moyle, 2002). After emerging between November and March, Chinook salmon fry tend to seek shallow, nearshore habitat with slow water velocities and move to progressively deeper, faster water as they grow. Spring-run juveniles frequently reside in freshwater habitat for 12 to 16 months.

Even if spring-run Chinook salmon are able to migrate past Panther Grade during the spring, the analysis of current habitat conditions in upper South Fork Battle Creek provided in the final EIS indicates that natural production of spring-run Chinook salmon is likely unsustainable in the reach that would be affected by the proposed project. The existing velocities, depths, and areas of spawning gravel are poorly suited for spring-run Chinook salmon when spawning activity would peak in September (Sellheim and Cramer, 2013). In addition, natural water temperatures during the late summer and fall (>22°C), when their eggs would be incubating, typically far exceed levels lethal to eggs for several weeks during that period.

Under the staff alternative defined in the final EIS, the project would not operate when natural stream inflow is below 18 cubic feet per second (cfs) or when water temperatures in the bypassed reach are >20°C, and thus would have no effect on natural flows or water temperatures during this period. If spring-run Chinook salmon surmount the numerous passage obstacles in South Fork Battle Creek and reach the project area, they would face high risk of pre-spawning mortality because of the unsuitable water temperatures (>22°C) found in the project reach under current conditions and uninfluenced by project operation during the summer holding period.

As such, the Freshwater Spawning Sites PBF is impaired under existing conditions. Based on the findings above and in the final EIS, operation of the proposed project would not substantially alter the existing impaired condition of this PBF. In addition, it would not affect this PBF in a manner likely to appreciably diminish or preclude the role of that habitat in the recovery of the Central Valley spring-run Chinook salmon pursuant to the BCSSRP.

3.2 Freshwater Rearing Habitat

Freshwater rearing sites are areas with: (1) water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility; (2) water quality and forage supporting juvenile development; and (3) habitat complexity characterized by natural cover such as shade, submerged and overhanging large woody material, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks. Both spawning areas and migratory corridors comprise rearing habitat for juveniles, which feed and grow before and during their outmigration. Rearing habitat condition is strongly affected by habitat complexity, food supply, and the presence of predators of juvenile salmonids. The channelized, leveed, and riprapped river reaches and sloughs that are common in the Sacramento River system typically have low habitat complexity, relatively low production of food organisms, and offer little protection from either fish or avian predators. However, some complex, productive habitats with floodplains remain in the system (e.g., Sacramento River reaches with setback levees (primarily located upstream of the City of Colusa) and flood bypasses (Yolo and Sutter bypasses)). Juvenile life stages of salmonids are dependent on the function of this habitat for successful survival and recruitment.

Spring-run Chinook salmon are currently unable to access the project area because of existing downstream barriers. When passage is provided at these structures, it is not known if spring-run Chinook are capable of passing Panther Grade to enter the project area. If they do enter the project area, the existing high water temperatures (>22°C) and very low flows during the summer/fall months would limit habitat connectivity and likely cause significant mortality and stress for holding adults. Furthermore, existing substrate and gravel patch sizes are less than optimum for Chinook salmon spawning, as are water velocities during their typical spawning period. As discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, of the final EIS, juvenile rearing habitat is also naturally limited in the project area by low flows, shallow water depths, high water temperatures, and limited cover.

As discussed above, salmonid rearing capacity is naturally limited in the proposed project area during the annual low flow period (due to reduced habitat area, high water temperatures, and limited instream cover) under current conditions. The staff-recommended 13-cfs minimum flow would decrease the amount of flow in the bypassed reach and subsequently the amount of available habitat during the spring and fall seasons. However, the amount of habitat area is not the only limiting factor in this reach (e.g., high summer water temperatures also limit rearing habitat). Furthermore, as discussed in section 3.3.2.2, *Aquatic Resources, Environmental Effects*, of the final EIS, under the staff alternative the proposed project would not divert water during much of the summer low flow period because of insufficient natural flow to support power generation. Thus, project operation would not further restrict this rearing capacity during this time. Consequently, the **Freshwater Rearing Habitat** PBF is impaired under existing conditions, and the proposed project with the staff-recommended minimum instream flows would not substantially alter the existing impaired condition of this PBF. As a result, the proposed project as recommended by staff is not expected to affect this PBF in a manner likely to appreciably diminish or preclude the role of that habitat in the recovery of the Central Valley spring-run Chinook salmon pursuant to the BCSSRP.

3.3 Freshwater Migration Corridors

Freshwater migration corridors provide upstream passage for adults to spawning areas and downstream passage of outmigrant juveniles to estuarine and marine areas. Migratory corridors are downstream of the spawning areas and include the lower reaches of the spawning tributaries, the mainstem of the Sacramento River, and the Delta. Migratory habitat condition is strongly affected by the presence of obstacles or barriers, which can include dams (i.e., hydropower, flood control, and irrigation flashboard dams);

unscreened or poorly screened diversions; degraded water quality; or behavioral impediments to migration.

The RBDD is located at RM 243 on the Sacramento River, approximately 31 RM downstream of the Battle Creek confluence, and it was completed in 1964. It features a series of 11 gates that, when lowered, provided for gravity diversion of irrigation water from the Sacramento River into the Tehama-Colusa and Corning Canals for potential delivery to the Sacramento Valley National Wildlife Refuge and to approximately 140,000 acres of irrigable lands along the Interstate 5 corridor between Red Bluff and Dunnigan, California. The RBDD was an impediment to upstream and downstream fish migration, and a barrier preventing access to upstream Sacramento River spawning habitat for Chinook salmon and steelhead available upstream of the dam. Until recently, the RBDD created an upstream migratory barrier in the mainstem Sacramento River during its May 15 through September 15 "gates in" configuration. In response to a NMFS Biological Opinion, the Red Bluff Fish Passage Improvement Project (TCCA, 2012) was established, and the RBDD gates were permanently raised in September 2011 to improve fish passage conditions at the RBDD (NMFS, 2009b).

Sacramento River flow, along with many juvenile spring-run Chinook salmon, enters the Delta Cross Channel and Georgiana Slough, and subsequently the central Delta, especially during periods of increased water export pumping from the Delta (Reclamation, 2017). Mortality of juvenile salmon entering the central Delta is higher than for those continuing downstream in the Sacramento River. This difference in mortality could be caused by a combination of factors, including: (1) the longer migration route through the central Delta to the western Delta; (2) higher water temperatures; (3) higher predation rates; (4) exposure to seasonal agricultural diversions; (5) water quality impairments due to agricultural and municipal discharges; and (6) a more complex channel configuration that makes it more difficult for salmon to successfully migrate to the western Delta and the ocean. In addition, the state and federal pumps and associated fish facilities increase mortality of juvenile spring-run Chinook salmon through various means, including entrainment into the state and federal canals, and salvage operations.

In South Fork Battle Creek, adult spring-run Chinook salmon are currently unable to migrate upstream past Coleman, Inskip, and South Diversion Dams, and they have not had access to the proposed project area since these barriers were put in place. Downstream passage is also impaired at Inskip Diversion Dam. Although upstream passage is planned at these three downstream dams by 2023, spring-run Chinook salmon would still need to migrate past Panther Grade to access the project area. Measurements of jumping heights and jumping-pool depths at seven potential barriers within the project reach indicate the barriers are impassable to upstream migrating anadromous fish at a survey flow of 31 cfs because of inadequate jumping-pool depths (Cramer et al., 2015). The largest barrier was Powerhouse Falls, located immediately downstream of the proposed powerhouse location. At a 31-cfs flow, fish ascending this barrier would require a 7.5-foot vertical jump, and the pool at its base is only about 1.6 feet deep, which is insufficient for a fish to make a 7.5-foot vertical jump. This waterfall was also measured at 180 cfs in December 2002 and found to be impassible at that flow (Cramer et al., 2015).

Information included in the Coleman National Fish Hatchery Adaptive Management Plan (Hymanson et al., 2016), estimated that Chinook and steelhead passage success over "Unnamed #10" at RM 13.26 is 50 percent, and estimated passage success over Panther Grade ("Panther Falls") is 20 percent. If we multiply 50 percent (0.5) by 20 percent (0.2), that results in a cumulative passage success over Panther Grade of only 10 percent, which is another indication that few fish, if any, would ever make it to the project area.

Although flows in excess of 180 cfs are conceivable during the spring-run Chinook migration period, flows of this magnitude are unlikely to occur at frequencies that would be required to consistently sustain an anadromous fish population.[144] This combination of factors makes it likely that the natural upper limit of anadromy in South Fork Battle Creek is functionally at Panther Grade.

Given these existing upstream and downstream fish passage issues in South Fork Battle Creek, and at other sites located downstream of the proposed project area, it is clear that the Freshwater Migration Corridors PBF is currently not properly functioning, and the proposed project with staff-recommended measures would not exacerbate the existing not properly functioning condition of this PBF.

3.4 Estuarine Habitat Areas

Current conditions of the estuarine habitat in the Sacramento River Delta are substantially degraded from historic conditions. More than 90 percent of the fresh, brackish, and salt marshes have been lost because of human activities, reducing the availability of forage species and eliminating the cycling of nutrients from marsh vegetation into the waterways. In addition, the channels of the Delta have been modified by the raising of levees and armoring of the levee banks with riprap, which has decreased habitat complexity by reducing the incorporation of woody material and vegetative material into the nearshore area, minimizing and reducing local variations in water depth and velocities, and simplifying the community structure of the nearshore environment. Heavy urbanization and industrial actions have also lowered water quality and introduced persistent contaminants to the sediments surrounding points of discharge (e.g., refineries in Suisun and San Pablo Bays and creosote factories in Stockton). In addition to these impacts, Delta hydraulics have been modified as a result of Central Valley Project and State Water Project actions, and the resulting changes in the salinity transition zone have contributed to reductions in the phytoplankton and zooplankton populations in the Delta, as well as to alterations in nutrient cycling within the Delta ecosystem. Because the

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144 Flows more than 180 cfs are extremely rare during the Chinook migration period.

proposed project area would be limited to South Fork Battle Creek upstream of RM 20.6, it would have no effect on the estuarine habitat PBF.

3.5 Nearshore Coastal Marine and Offshore Marine Areas

Oceanic and climate conditions such as sea surface temperatures, air temperatures, strength of upwelling, El Niño events, salinity, ocean currents, wind speed, and primary and secondary productivity affect all facets of the physical, biological, and chemical processes in the marine environment. However, the proposed project area would be limited to South Fork Battle Creek upstream of RM 20.6, and it would have no effect on the nearshore coastal marine or offshore marine PBF.

4.0 EFFECTS OF PROJECT OPERATION ON CALIFORNIA CENTRAL VALLEY STEELHEAD PBFs

4.1 Freshwater Spawning Sites

According to NMFS (2009a), steelhead in the Sacramento River spawn primarily between Keswick Dam and the RBDD during the winter and spring. The highest density spawning area is likely in the vicinity of the City of Redding, although detailed surveys of steelhead spawning in the mainstem Sacramento River are not available. Most Sacramento River steelhead probably spawn in the tributary streams.

Central Valley steelhead adult migration occurs from July through February. Spawning occurs from December through April and, possibly in May, in most years in streams with cool, year-round, well-oxygenated water (Reclamation et al., 2006). Incubation generally occurs from December through April. Following emergence, fry live in small schools in shallow water along streambanks. Unlike Chinook salmon, steelhead typically rear in freshwater for 1 to 2 years before migrating to the Pacific Ocean. Steelhead may spawn more than once and return to the Pacific Ocean between spawning.

As is the case for spring-run Chinook salmon, anadromous steelhead are currently unable to access the proposed project area because of existing downstream barriers. Even when passage is provided at all three downstream diversion dams, it is not known if steelhead would be able pass Panther Grade and enter the project area. However, adult steelhead would be more likely to enter the proposed project area than spring-run Chinook, based on their documented ability to pass complex, instream migration obstacles. Furthermore, the smaller gravel patch sizes that exist in that reach are more suitable for steelhead spawning than for larger bodied Chinook salmon. The timing of both the upstream migration and spawning for steelhead during the winter and spring would also dramatically reduce steelhead exposure to any high water temperatures (as compared to spring-run Chinook salmon) and would allow them to take full advantage of higher flows during the over-winter period. Therefore, under existing conditions this PBF is properly functioning.

Under the staff alternative, the amount of flow in the proposed bypassed reach would decrease as a result of project operation, although Rugraw would maintain a continuous 13-cfs minimum flow in the reach to protect aquatic resources. Based on the results of Interior's physical habitat simulation (PHABSIM) study performed in the bypassed reach, this 13-cfs flow would provide habitat for steelhead fry and juveniles equal to 50.4 and 82.8 percent respectively, of the maximum possible weighted useable area for the two life stages. Consequently, this recommended minimum flow would be protective of critical rearing habitat in a stream that has experienced periods of no flow under natural conditions. Interior's PHABSIM study, however, did not evaluate steelhead spawning habitat availability at various flows. As a result, it is not known if this recommended minimum flow would adversely affect the quality and quantity of available *O. mykiss* spawning habitat, given the limited amount of spawning gravel in the reach. Consequently, the effects of the proposed project on this steelhead PBF are unknown. If steelhead are eventually found in the project area (because of ongoing anadromous fish reintroduction measures implemented in South Fork Battle Creek), NMFS could use the Commission's standard license reopener to address anadromous fish habitat needs.

4.2 Freshwater Rearing Habitat

Juvenile steelhead reside in freshwater for a year or more, so they are more dependent on freshwater rearing habitat than are the ocean-type Chinook salmon in the Central Valley. In the Sacramento River Basin, steelhead rearing occurs primarily in the upstream reaches of the rivers where channel gradients tend to be higher and, during the warm weather months, where temperatures are maintained at more suitable levels for rearing. The Sacramento River contains a long reach with suitable water temperatures even during the summer due to upstream hypolimnetic dam releases. Steelhead rearing in the Sacramento River occurs mostly between Keswick Dam (RM 302) and Butte City (RM 169) with the highest densities likely to be upstream of the RBDD.

Both resident and anadromous *O. mykiss* are present in the lower reaches of South Fork Battle Creek, and, once passage is provided at all downstream diversion dams, anadromous *O. mykiss* have the potential to enter the proposed project area. Under existing conditions, only resident rainbow trout are present in the proposed project area. Although flows in upper South Fork Battle Creek are favorable for *O. mykiss* spawning and early rearing in the spring and summer, fall low flows and associated high water temperatures are a major limiting factor upstream of Panther Grade. Even under natural conditions, the production potential of steelhead is far greater than the rearing habitat can support. Consequently, any juvenile steelhead produced in the project area, in excess of the reach's carrying capacity, would need to migrate downstream to more suitable spring-fed rearing habitats. Therefore, under existing conditions, this PBF is functioning under an impaired condition.

As is the case for spring-run Chinook salmon, project operation would not divert water from South Fork Battle Creek during the lowest flow periods that naturally restrict

O. mykiss rearing capacity; as noted above, the PHABSIM analysis found that the proposed minimum flow of 13 cfs would provide 50.4 and 82.8 percent of the maximum possible weighted usable area for steelhead fry and juveniles. However, project operation would reduce aquatic habitat connectivity in the bypassed reach during the spring and fall/winter "shoulder seasons." According to Cramer and Ceder (2013), flows of 30 to 50 cfs (and possibly less) would be sufficient to enable passage between all channel units within the bypassed reach. Based on our analysis, Rugraw's proposed and our recommended 13-cfs minimum flow would reduce the percentage of time that 30-cfs or greater flows would occur in the bypassed reach from March 1 through June 30 from 89 percent of the time (under natural conditions) to 25 percent of the time. From November 30 through February 28, a 13-cfs minimum flow would reduce the percentage of time that 30-cfs or greater flows would occur in the bypassed from 48 percent of the time to 9 percent of the time. Consequently, Rugraw's proposed minimum flow would reduce but not eliminate habitat connectivity during the peak juvenile movement period. Based on these findings, the proposed project would not substantially alter the existing impaired condition of this PBF.

4.3 Freshwater Migration Corridors

In the Sacramento River Basin, adult steelhead migrate upstream from the ocean to their spawning grounds primarily during the fall and winter months, and, like spring-run Chinook salmon, they must negotiate numerous upstream migration obstacles including the RBDD. Out-migrating steelhead smolts are also forced to pass through the mainstem Sacramento River, Georgiana Slough, and central Delta, where they are subject to water diversions, degraded water quality, predation, and numerous other stressors.

In South Fork Battle Creek, adult steelhead are unable to volitionally migrate upstream past Coleman, Inskip, and South Diversion Dams and have not had access to the proposed project area since these barriers were put in place. Therefore, under existing conditions this PBF is not properly functioning. However, resident rainbow trout residing in and upstream of the proposed project area have the potential to migrate downstream and exhibit anadromy.

Although anadromous steelhead would be more likely to enter the proposed project area than spring-run Chinook due to their smaller size and greater leaping ability, it is not known if they will ever enter the proposed project area. Even after passage is provided at Coleman, Inskip, and South Dams, information included in the Coleman National Fish Hatchery Adaptive Management Plan (Hymanson et al., 2016), estimates Chinook and steelhead passage success over "Unnamed #10" at RM 13.26 is 50 percent, and estimated passage success over Panther Grade ("Panther Falls") is 20 percent. That results in a cumulative passage success over Panther Grade of only 10 percent, which is another indication that few fish, if any, would ever make it to the project area. Based on these findings, the proposed project would not change the existing not properly functioning condition of the PBF. If steelhead are eventually found in the project area (as a result of ongoing anadromous fish reintroduction measures implemented in South Fork

Battle Creek), NMFS could use the Commission's standard license reopener to address anadromous fish habitat needs.

4.4 Estuarine Habitat Areas

Steelhead use the San Francisco estuary as a rearing area and migration corridor between their upstream rearing habitat and the ocean. The San Francisco Bay estuarine system includes the waters of San Francisco Bay, San Pablo Bay, Grizzly Bay, Suisun Bay, and Honker Bay, and it can extend as far upstream as Sherman Island[145] during dry periods. At times, steelhead likely remain for extended periods in areas of suitable habitat quality where food such as young herring, salmon, and other fish and invertebrates is available. Because the proposed project would be located on the upper South Fork Battle Creek, which is approximately 274 miles upstream of the San Francisco Bay estuary, it would have no effect on the estuarine habitat PBF.

4.5 Nearshore Coastal Marine and Offshore Marine Areas

The most recent discussion of PBFs for the Central Valley steelhead Distinct Population Segment (NMFS, 2009a) did not include the PBFs of nearshore coastal marine and offshore marine areas. Although relatively little is known about steelhead utilization of nearshore coastal marine and offshore marine areas, it is reasonable to assume that the discussion of these PBFs previously provided for spring-run Chinook salmon applies to steelhead. Because the proposed project would be located on the upper South Fork Battle Creek, about 300 river/estuary miles from the Pacific Ocean, it would have no effect on the nearshore coastal marine and offshore marine PBF.

5.0 REFERENCES

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[145] Sherman Island is located at the confluence of the Sacramento and San Joaquin Rivers.

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APPENDIX C—SPRING RECESSION FLOWS ANALYSIS

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Following issuance of the draft environmental impact statement (EIS), the U.S. Department of the Interior, Fish and Wildlife Service (FWS) revised its 10(j) recommendations to include a measure that specifies that baseflow recession rates following the spring snowmelt flood pulse should not exceed a 1-foot drop in stage over a 3-week period to protect the foothill yellow-legged frog (FYLF). FWS noted that the intent of these criteria is not to control short-term ramping rates associated with rain events. Rather, the intent is to identify the point at which the spring flood pulse associated with snowmelt begins to level out to groundwater-dependent flows and thereafter, prevent a drop in river stage of more than 1 foot over the course of the following 3-week period. FWS bases this recommendation on observed FYLF behavior that includes initiation of the breeding season at the end of the snowmelt-driven flood pulse, depth of egg masses (typically 0.7 to 1.6 feet), and egg development time (typically 2 to 3 weeks).

To analyze project effects on baseflow recession rates, staff developed graphs of river stage over time from April 15 to July 15 for 30 recent years (1987 to 2016). We used the existing stage-discharge curve for the Above Old Highway 36 Bridge station.[146] We then graphed the slope associated with a 1 foot over 3-week reduction in stage and superimposed this slope line on the figure in red, using our best judgment to identify the appropriate starting point for the flow recession, based on FWS's description provided during the 10(j) meeting. Each of the following figures contain two red slope lines, the upper one associated with the blue, "no project conditions stage" line and the lower one associated with the river stage resulting from staff's recommended 13-cubic feet per second (cfs) minimum instream flow. To avoid cluttering the graphs, we did not add slope lines for each minimum flow alternative analyzed in the final EIS; however, the graphs also include the NMFS and Interior recommended 35-cfs minimum flow, NMFS Alternative 1,[147] and Rugraw's 8-cfs minimum flow alternative.

In years where the end of the snowmelt-driven flood pulse was less obvious, or seemed to occur later in the year than typical, we oriented the red slope line to be more conservative. For example, in 1998, it is not clear whether flow pulses in late May and mid-June are associated with snowmelt or rainfall. However, we selected the mid-June point for our slope analysis because it shows a greater potential effect than a point around mid-May. As such, we consider 1998 a year when the recommended recession rate would not have been met under the 8-cfs minimum instream flow or 13-cfs minimum instream flow project scenarios. The following figures in this appendix show the results of our analysis for each year and demonstrate that project operation, as recommended by staff, would typically provide stable minimum instream flows that prevent stage

[146] The Above Old Highway 36 Bridge station is located about 0.5-mile downstream of the diversion dam site and 1.9 miles upstream of the powerhouse site.

[147] NMFS Alternative 1 minimum instream flow schedule is: 35-cfs November 1–March 1, 30-cfs March 2–May 31, and 25-cfs June 1–October 31.

reductions that could affect FYLF egg masses and that the project may result in base flow recession rates in the bypassed reach that exceed the recommended rate roughly once every 7 years on average. We summarize these results and provide our analysis in section 3.3.2.2 of the final EIS. Our conclusions related to FWS's 10(j) recommendation for baseflow recession rates is provided in sections 5.1.2 and 5.3 of the final EIS.

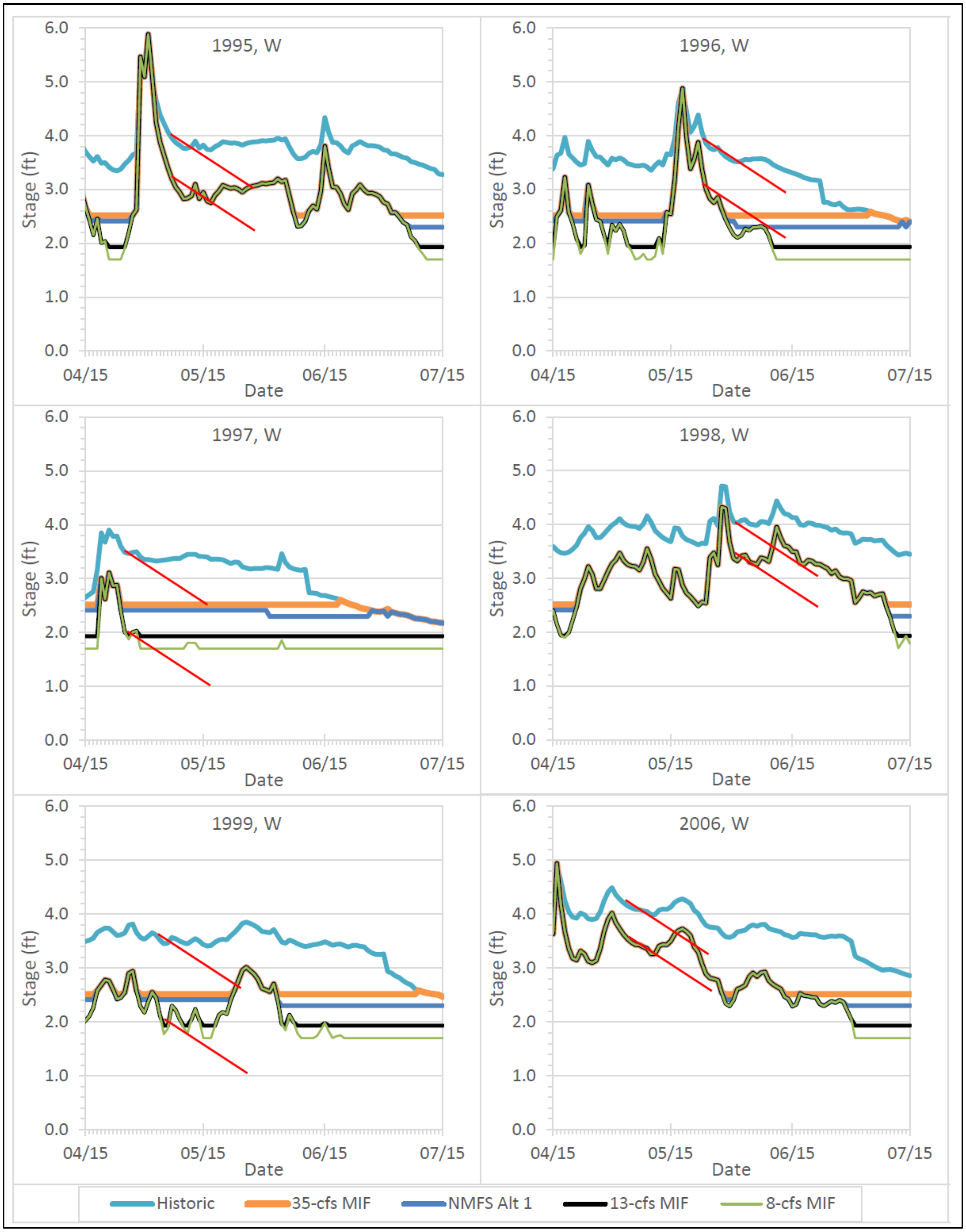

Figure C-1a. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of wet years during the 30-year period of 1987–2016. Wet years account for 23.3% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

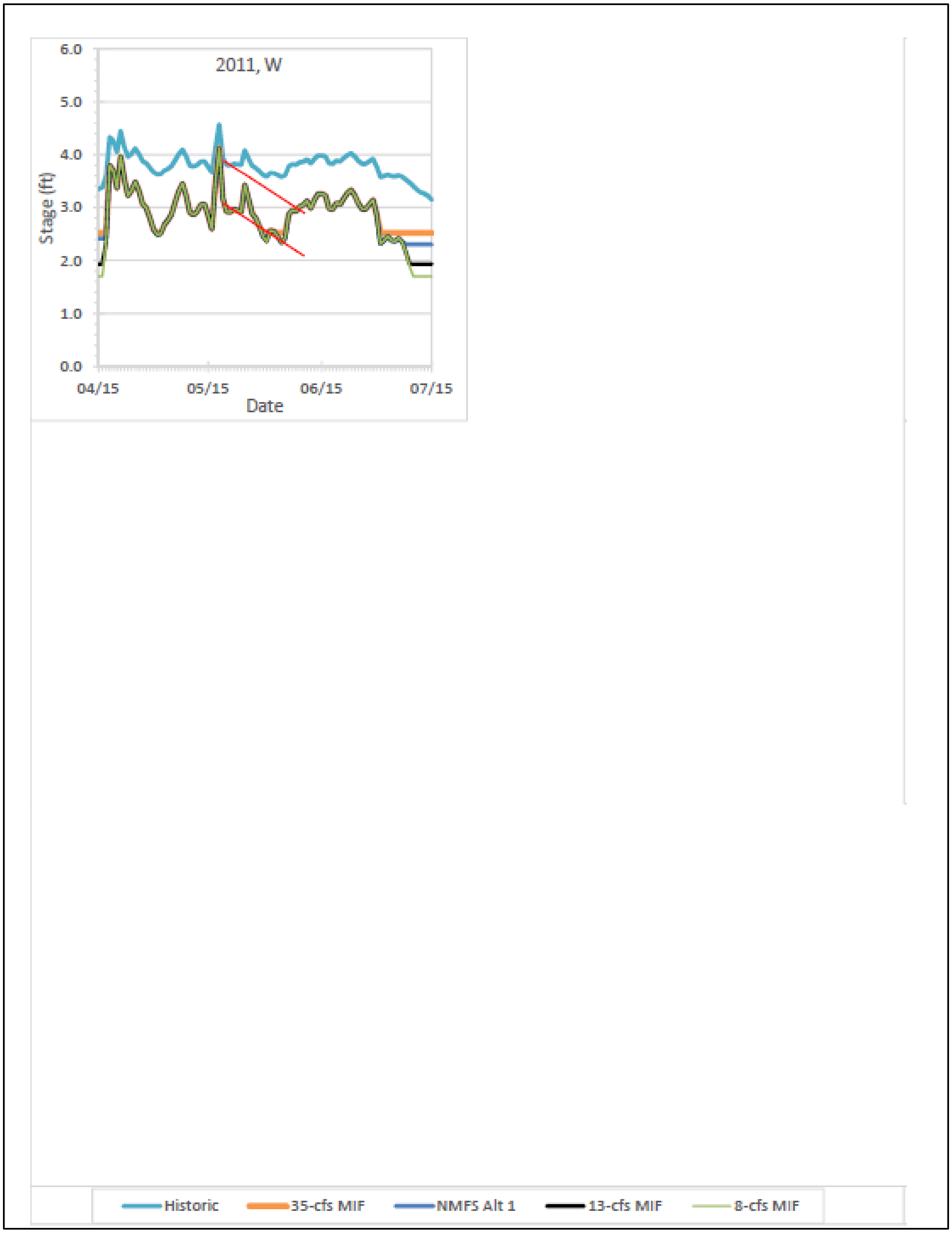

Figure C-1b. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of wet years during the 30-year period of 1987–2016. Wet years account for 23.3% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

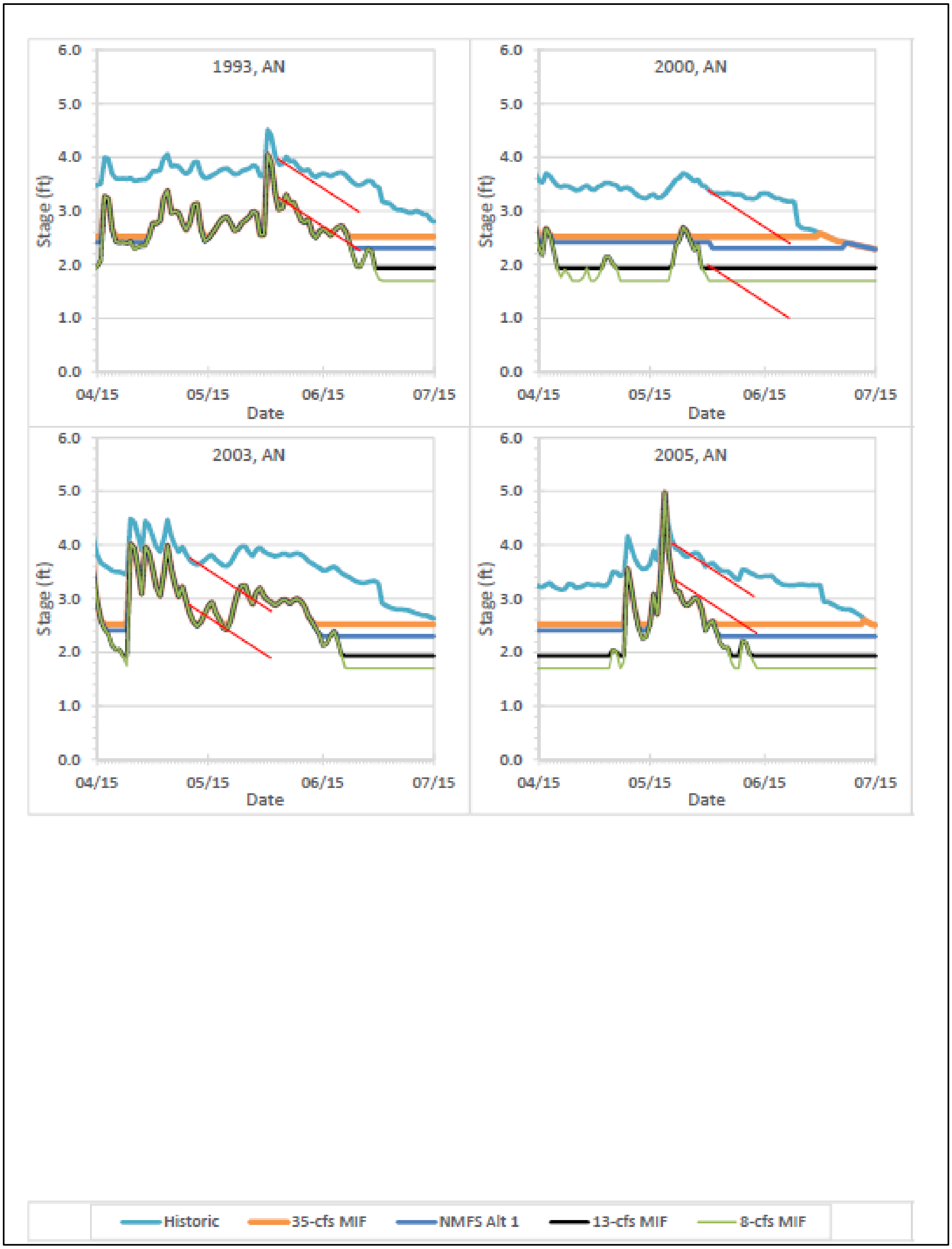

Figure C-2. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of Above Normal years during the 30-year period of 1987–2016. Above Normal years account for 13.3% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

Figure C-3. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of Below Normal years during the 30-year period of 1987–2016. Below Normal years account for 13.3% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

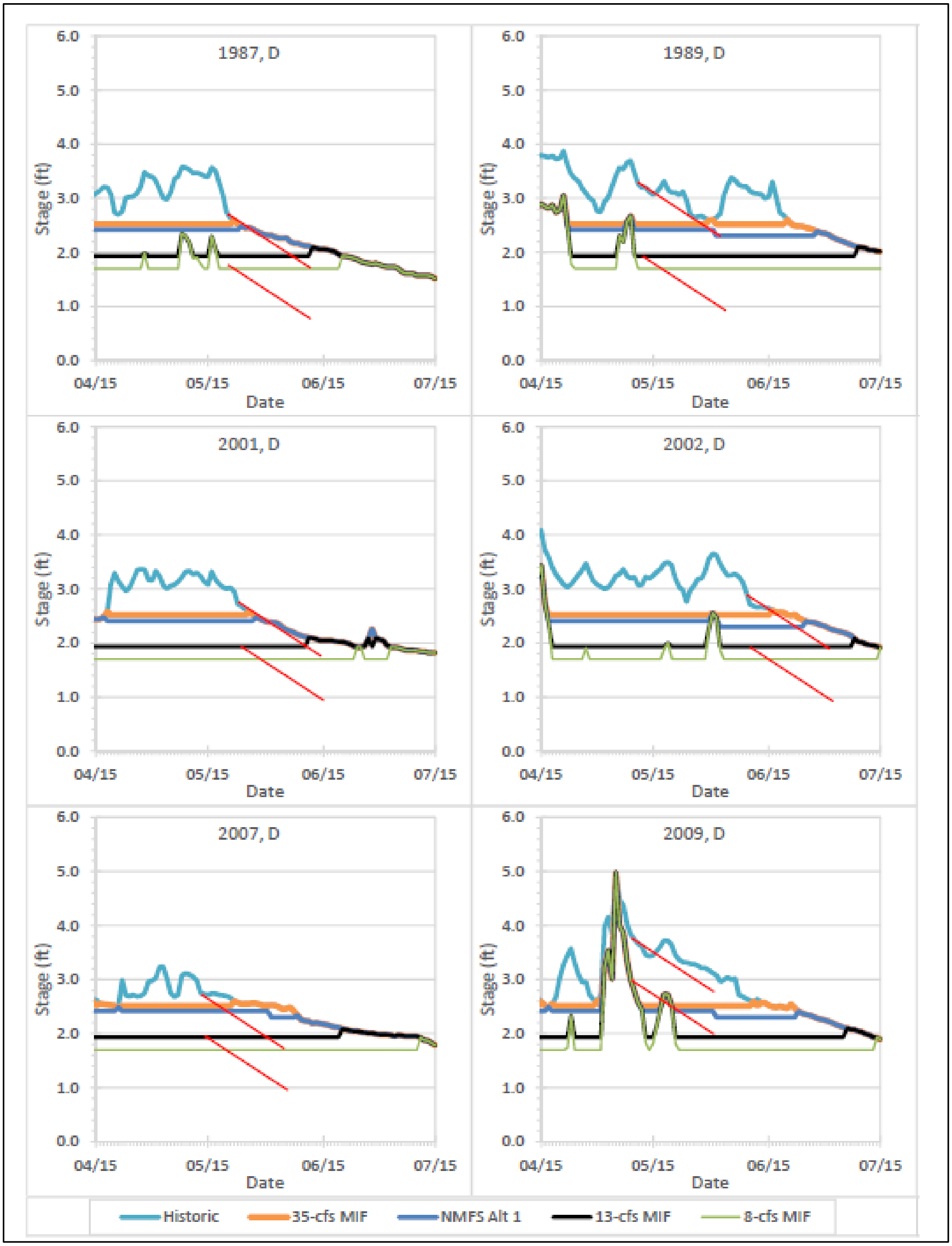

Figure C-4a. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of Dry years during the 30-year period of 1987–2016. Dry years account for 23.3% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

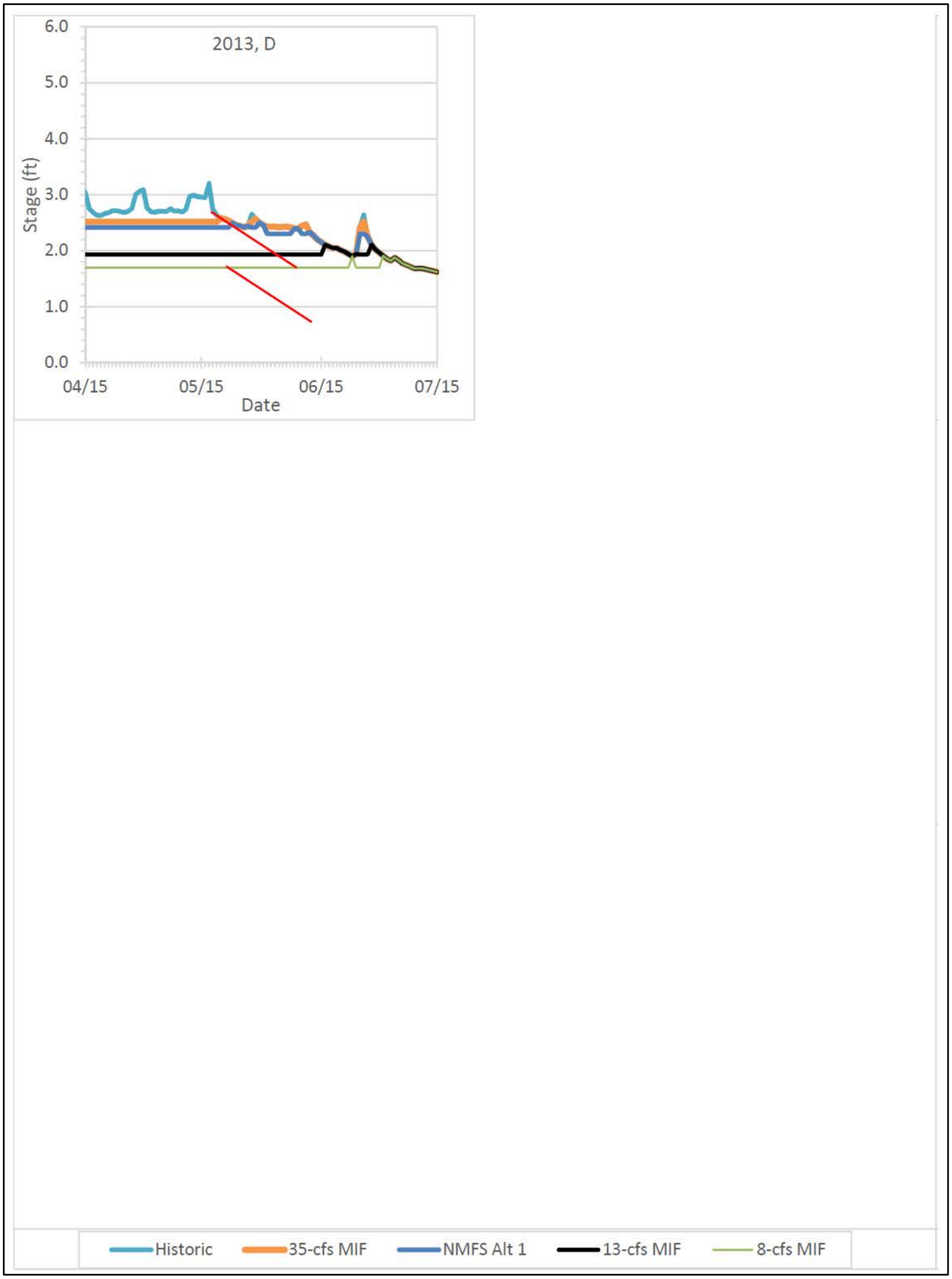

Figure C-4b. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of Dry years during the 30-year period of 1987–2016. Dry years account for 23.3% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

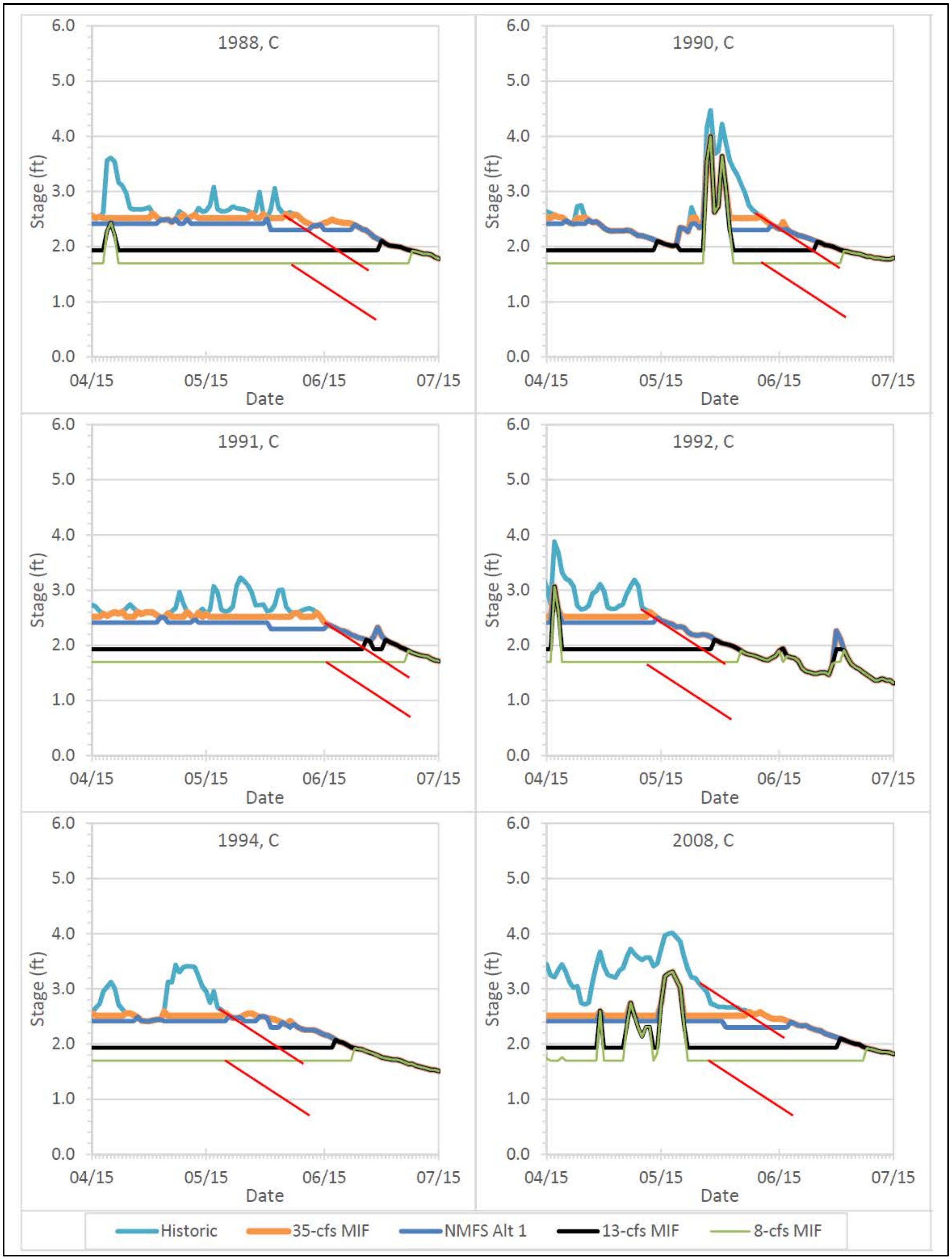

Figure C-5a. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of Critical years during the 30-year period of 1987–2016. Critical years account for 26.6% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

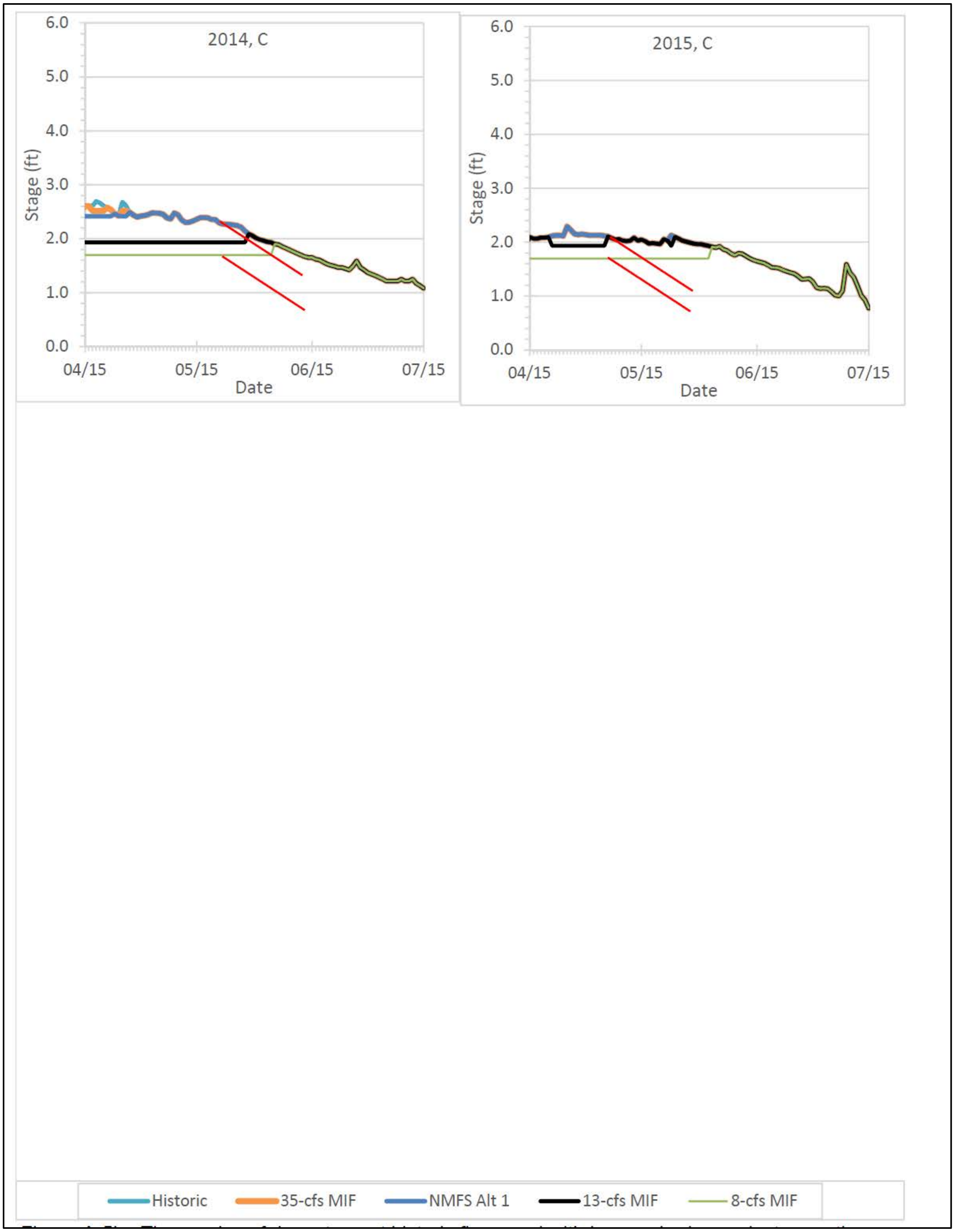

Figure C-5b. Time series of river stage at historic flows and with project operation at proposed alternative minimum flows Above Old Highway 36 Bridge Station (ABS) for April 15 to July 15 of Critical years during the 30-year period of 1987–2016. Critical years account for 26.6% of the 30-year period (Source: Rugraw, 2014, Cramer et al., 2015, as modified by staff).

APPENDIX D—STAFF COST ESTIMATES FOR WATER TEMPERATURE MONITORING

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Rugraw Water Temperature Monitoring Plan

Develop a water temperature monitoring plan with six monitoring stations. Rugraw proposes water temperature monitoring stations at: 1) the diversion/intake structure; 2) Old Highway 36 Bridge; 3) within the bypassed reach, just upstream of the tailrace; 4) the powerhouse tailrace; 5) downstream of the powerhouse, in mixed flows from the bypassed reach and powerhouse tailrace; and 6) Ponderosa Way Bridge downstream of Panther Grade.

Values represent cost in **each of the years** listed.

Total	**Cost is provided at the least $100-interval greater than or equal to the sum of detailed costs.**				**$50,500**	**$0**	**$0**	**$37,200**	**$0**	**$36,800**
					Year 1		**Year 2**		**Years 3 - 30**	
Description	**Unit Cost**	**No.**	**Cost**	**Comments**	**Capital**	**Annual**	**Capital**	**Annual**	**Capital**	**Annual**
Sr. Scientist	$125	80	$10,000	Develop plan	$10,000					
Real-Time water temperature monitoring station installation	$10,000	0	$0	Install WT stn #1, the diversion/intake structure; we conclude this cost is included in construction cost	$0					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #2, above Old Hwy 36 Bridge	$10,000					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #3, just upstream of tailrace (powerhouse)	$10,000					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #4, powerhouse tailrace	$10,000					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #5, in mixed flows downstream of the powerhouse tailrace	$10,000					
Real-Time water temperature monitoring station servicing	$5,000	5	$25,000	Service 5 real-time WT stns.				$25,000		$25,000
Temperature loggers	$140	3	$420	Loggers at stn #6, Ponderosa Way Bridge (3 = 2 + 1 backup)	$420					
Temperature loggers	$140	1	$140	Logger replacement every 3 years						$140
Scientist	$85	6	$510	Install loggers at 1 stn				$510		
Technician	$50	8	$400	Install loggers at 1 stn				$400		
Technician	$50	24	$1,200	Service loggers & manage data for 3 quarterly downloads at 1 stn with 2 technicians				$1,200		
Technician	$50	32	$1,600	Service loggers & manage data for 4 quarterly downloads at 1 stn with 2 technicians						$1,600
Sr. Scientist	$125	80	$10,000	Annual report and consultation				$10,000		$10,000

Water Board preliminary condition

Develop a water temperature monitoring plan with three monitoring locations and DO monitoring, with at least five years of monitoring at the diversion intake, just upstream of Spring #4, and at the powerhouse discharge.

Values represent cost in **each of the years** listed.

Total	**Cost is provided at the least $100-interval greater than or equal to the sum of detailed costs.**				**$35,000**	**$0**	**$0**	**$34,000**
					Year 1		**Years 2 - 6**	
Description	**Unit Cost**	**No.**	**Cost**	**Comments**	**Capital**	**Annual**	**Capital**	**Annual**
Sr. Scientist	$125	80	$10,000	Development of plan	$10,000			
Real-Time water temperature monitoring station installation	$10,000	0	$0	Install WT stn #1, the diversion/intake structure; we conclude this cost is included in construction cost	$0			
Real-Time water temperature monitoring station installation	$10,000	1.5	$15,000	Install WT stn #2, upstream of Spring #4; higher cost than typical because of location in remote canyon	$15,000			
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #3, powerhouse discharge	$10,000			
Real-Time water temperature monitoring station servicing	$5,000	3	$15,000	Service 3 real-time WT stns				$15,000
Monthly rental of multi-parameter water quality instrument	$1,450	6	$8,700	DO monitoring at 3 stns for 2 months				$8,700
Scientist	$85	8	$680	Install water quality loggers				$680
Technician	$50	58	$2,900	Install and service water quality loggers				$2,900
Technician	$50	48	$2,400	Semi-monthly service of water quality loggers				$2,400
Scientist	$85	50	$4,250	Annual report and consultation				$4,250

California DFW recommendation 3

Develop a water temperature monitoring plan with six monitoring stations. California DFW recommends water temperature stations: (1) upstream of the diversion dam; (2) just upstream of Angel Falls; (3) upstream of Spring #4; (4) in the penstock; (5) at the powerhouse tailrace; and (6) just upstream of Panther Grade.

Values represent cost in **each of the years** listed.

Total	**Cost is provided at the least $100-interval greater than or equal to the sum of detailed costs.**				**$50,500**	**$0**	**$0**	**$37,200**	**$0**	**$36,800**
					Year 1		**Year 3**		**Years 3 - 30**	
Description	**Unit Cost**	**No.**	**Cost**	**Comments**	**Capital**	**Annual**	**Capital**	**Annual**	**Capital**	**Annual**
Sr. Scientist	$125	80	$10,000	Develop plan	$10,000					
Real-Time water temperature monitoring station installation	$10,000	0	$0	Install WT stn #1, upstream of the diversion/intake structure; we conclude this cost is included in construction cost	$0					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #2, just upstream of Angel Falls	$10,000					
Real-Time water temperature monitoring station installation	$10,000	1.5	$15,000	Install WT stn #3, upstream of Spring #4; higher cost than typical because of location in remote canyon	$15,000					
Real-Time water temperature monitoring station installation	$10,000	0.5	$5,000	Install WT stn #4, in the penstock; lower than typical cost because of proximity to project facilities	$5,000					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #5, powerhouse tailrace	$10,000					
Real-Time water temperature monitoring station servicing	$5,000	5	$25,000	Service 5 real-time WT stns.				$25,000		$25,000
Temperature loggers	$140	3	$420	Loggers at stn #6, just upstream of Panther Grade (3 = 2 + 1 backup)	$420					
Temperature loggers	$140	1	$140	Logger replacement every 3 years						$140
Scientist	$85	6	$510	Install loggers at 1 stn				$510		
Technician	$50	8	$400	Install loggers at 1 stn				$400		
Technician	$50	24	$1,200	Service loggers & manage data for 3 quarterly downloads at 1 stn with 2 technicians				$1,200		
Technician	$50	32	$1,600	Service loggers & manage data for 4 quarterly downloads at 1 stn with 2 technicians						$1,600
Sr. Scientist	$125	80	$10,000	Annual report and consultation				$10,000		$10,000

Interior and NMFS 10(j) recommendation 2

Develop a water temperature monitoring plan with seven monitoring gages. Recommended monitoring stations are: 1) just upstream of the Diversion Dam, 2) at the intake's header box, recording what is being diverted into pipeline, 3) just upstream of Angel Falls, 4) upstream of Powerhouse Spring Number 4, just downstream of Angel Falls (between Angel Falls and Powerhouse Spring No. 4), 5) at the Powerhouse discharge (what the powerhouse is discharging), 6) just downstream of the Powerhouse (or just upstream of Panther Grade), and 7) just downstream of Panther Grade.

Values represent cost in **each of the years** listed.

Description	**Unit Cost**	**No.**	**Cost**	**Comments**	**Year 1 Capital**	**Year 1 Annual**	**Year 2 Capital**	**Year 2 Annual**	**Years 3 - 30 Capital**	**Years 3 - 30 Annual**
Total				**Cost is provided at the least $100-interval greater than or equal to the sum of detailed costs.**	**$55,900**	**$0**	**$0**	**$38,700**	**$0**	**$38,500**
Sr. Scientist	$125	80	$10,000	Development of plan	$10,000					
Real-Time water temperature monitoring station installation	$10,000	0	$0	Install WT stn #1, just upstream of the diversion dam; we conclude this cost is included in construction cost	$0					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #3, just upstream of Angel Falls	$10,000					
Real-Time water temperature monitoring station installation	$10,000	1.5	$15,000	Install WT stn #4, upstream of Spring #4; higher cost than typical because of location in remote canyon	$15,000					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #5, powerhouse tailrace	$10,000					
Real-Time water temperature monitoring station installation	$10,000	1	$10,000	Install WT stn #6, just downstream of powerhouse or just upstream of Panther Grade	$10,000					
Real-Time water temperature monitoring station servicing	$5,000	5	$25,000	Service 5 real-time WT stns.				$25,000		$25,000
Temperature loggers	$140	3	$420	Loggers at WT stn #2, at the intake's header box. (3 = 2 + 1 backup)	$420					
Temperature loggers	$140	3	$420	Loggers at WT stn #7, just downstream of Panther Grade (3 = 2 + 1 backup)	$420					
Temperature loggers	$140	2	$280	Logger replacement every 3 years						$280
Scientist	$85	8	$680	Install loggers at 2 stns				$680		
Technician	$50	12	$600	Install loggers at 2 stns				$600		
Technician	$50	48	$2,400	Service loggers & manage data for 3 quarterly downloads at 2 stns with 2 technicians				$2,400		
Technician	$50	64	$3,200	Service loggers & manage data for 4 quarterly downloads at 2 stns with 2 technicians						$3,200
Sr. Scientist	$125	80	$10,000	Annual report and consultation				$10,000		$10,000

Staff Water Temperature Monitoring Plan

Develop a water temperature monitoring plan with real-time temperature monitoring at the diversion dam intake and upstream of the influence of Spring #4.

Values represent cost in **each of the years** listed.

Total	**Cost is provided at the least $100-interval greater than or equal to the sum of detailed costs.**				**$25,000**	**$0**	**$0**	**$13,400**
					Year 1		**Years 2 - 30**	
Description	**Unit Cost**	**No.**	**Cost**	**Comments**	**Capital**	**Annual**	**Capital**	**Annual**
Sr. Scientist	$125	80	$10,000	Develop plan	$10,000			
Real-Time water temperature monitoring station installation	$10,000	0	$0	Install WT stn at the diversion dam; we conclude this cost is included in construction cost	$0			
Real-Time water temperature monitoring station installation	$10,000	1.5	$15,000	Install WT stn upstream of Spring #4; higher cost than typical because of location in remote canyon	$15,000			
Real-Time water temperature monitoring station servicing	$5,000	2	$10,000	Service 2 real-time WT stns				$10,000
Scientist	$85	40	$3,400	Annual report and consultation				$3,400